An investigation of residents' relationships with street trees in southwest England

John Flannigan

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Birmingham Institute of Arts and Design
School of Architecture
Birmingham City University

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Abstract

This thesis considers the ways in which residents interact with street trees being placed within the context that street trees form the most significant 'everyday natural street features' in local urban landscapes. Three specific facets are explored to identify the nature and importance of the 'street tree/resident relationships' namely; the relationship a resident may have when regarding the overall street scene; the relationship a resident may have when in their house or carrying out house related activities; the relationship a resident may have with street trees in a visual simulation situation. Accordingly, research describes the different spheres of contact between residents and street trees ranging from a more general interaction with them throughout the neighbourhood to the tree closest to the home. The methodology was developed in the context of the lack of any clear theory about residents' perceptions of street trees, especially in a UK situation. In particular, it acknowledges the need to combine quantitative and qualitative techniques, to ensure that areas lacking knowledge are addressed, while allowing for a deeper understanding of residents' perceptions. Appropriate methodologies are critically assessed through initial trials of householder questionnaire surveys and visual simulation techniques in order to ascertain whether methods utilised elsewhere, particularly the USA, are appropriate in the UK including a critique of other visual simulation methods to introduce robust visual simulation survey techniques. These exploited digital photography to develop realistic images, to apply tree scenarios to real street backgrounds and to control variables. Residents in a carefully selected case study area were subsequently engaged in a householder postal questionnaire, face-to-face interviews and a visual simulation survey with each approach intended to meet specific needs of the research. Using these approaches the study integrated findings to gain an in-depth understanding of residents' perceptions. Findings reveal; that a complex, generally positive, relationship exists between urban residents, the road in which they live and the street trees growing within it; that residents express strong opinions about street trees demonstrating a relationship that is both complex and profound; such describes how street trees are considered as significant territorial symbols of residents' home life offering a wide ranging list of benefits meeting their spiritual, aesthetic and practical needs. In the context of current UK arboricultural practice the findings are revelatory for the arboricultural mindset which, in the UK, has tended to focus on the environmental, biological, legal and maintenance issues of street trees rather than the needs of the people who live alongside them. It is anticipated that findings will help to better equip urban tree managers and allied professionals to establish policies that are mutually beneficial for trees and citizens; raise awareness of potential conflicts; and contribute towards clear strategic direction for street tree planting and maintenance.

Introduction

Current arboricultural practice in the UK concentrates on trees rather than the people who live alongside them. Research sets out to challenge this position by considering residents' interactions with street trees, which are significant natural features in urban landscapes, in and around people's homes. Three specific relationships have been identified for exploration namely:

- The relationship a resident may have when regarding the overall street scene.
- The relationship a resident may have when in their house or carrying out house related activities.
- The relationship a resident may have with street trees in a visual simulation situation.

Such relationships describe different spheres of contact between residents and street trees ranging from a more general interaction with them throughout the neighbourhood to the tree closest to the home. Integrating findings from these two relationships with the results from a visual simulation survey will enable the opportunity to gain an in-depth understanding of residents' perceptions.

Such relationships are considered to be components of residents' complex interaction with street trees, heavily influenced by the proximity of individuals to street trees at any particular time. In this evaluation consideration will also be given to how much the physical size of street trees and their spatial relationship with houses contributes to individual's perceptions in each of these relationships.

A significant issue affecting this area of research is the paucity of knowledge about UK residents' attitudes to street trees despite the fact that street tree management is a significant area of work for urban tree managers due to the complex issues associated with their care. Considerable efforts are required to grow trees in the biologically hostile street environment; ongoing maintenance is difficult and costly due to the proximity of the highway and nearby properties; and communities appear to hold strong opinions about street trees.

Effective street tree management therefore requires an approach that successfully addresses all these distinct issues yet UK arborists have tended to focus only on two factors namely biological and maintenance matters. Such has been the focus of the arboricultural industry on these areas that until research related to this thesis was published (Flannigan, 2005) there have been no UK based papers describing residents' perceptions of living alongside street trees.

It is proposed that understanding residents' relationships with street trees will better equip urban tree managers to establish policies that are mutually beneficial for trees and citizens; raise awareness of potential conflicts; and contribute towards clear strategic direction for street tree planting and maintenance. Such outcomes are rising in importance as it becomes recognised that street trees will have a positive role helping residents adapt to climate change and that further tree planting in urban areas, close to people's homes, is inevitable (Gill *et al,* 2007).

Lack of knowledge is not the only significant problem facing UK researchers in this field and research will also address other issues that limit current understanding of residents' perceptions of street trees.

Although there has been research elsewhere (e.g. Sommer *et al,* 1989) it has tended to be quantitative in nature contributing to an ongoing lack of understanding of deeper values held by residents. Research will address this by adopting qualitative methods such as open-ended questions in the householder survey directly linked to face-to-face interviews to gain more in-depth understanding of residents' perceptions.

Thus the lack of any clear theory about residents' perceptions of street trees, combined with a lack of UK knowledge, determines that the methodology describes an approach combining quantitative and qualitative techniques. The former ensured that areas lacking knowledge were addressed whilst the latter allowed for a deeper understanding of residents' perceptions.

Research aims were therefore to:

- Further knowledge regarding the factors that affect residents' perceptions of street trees.
- Consider the positive and negative relationships that exist between residents and trees in the context of the street and the nature of the value system underpinning these relationships.
- Review and utilise a range of current approaches used to determine residents' values and perceptions of street trees in relation to specific case studies of street tree populations and local street communities.
- Evaluate the impact of tree size and proximity on residents' perceptions of nearby street trees.

Whilst researchers have identified how effective information can only be obtained from residents using a range of techniques (such as householder surveys; visual simulation surveys and interviews) such methods have yet to be adequately integrated. Thus, conclusions have subsequently been linked between separate studies suggesting that residents' relationships with street trees are broadly consistent irrespective of the residents' relationship with street trees or the method of enquiry. Such assumptions are addressed in this thesis by using a case study approach ensuring the same residents responded to each of the three different survey methods.

A particular feature of this type of research is that it has to be carried out in the field because it is addressing residents' actual relationships with street trees and this cannot be adequately replicated elsewhere. Research therefore focussed on a case study area and adjusted, insofar as was practicable, the variable 'tree size'. The selected neighbourhood therefore contained four streets each of which were dominated by trees of a particular size class, based on mean height. A full inventory of the street tree population was also made allowing residents' responses in each of the surveys to be cross-referenced with the physical and spatial qualities of their local street trees.

Whilst the tree size variable was the key feature in selecting the streets for the case study it was necessary to limit other variables as much as possible. Hence, the case study area covered a small area of four streets so that demographic factors were relatively consistent as were the spatial features of the street layout and the style of housing.

Research in the case study area was developed following separate trials of householder questionnaire surveys (Flannigan, 2005) and visual simulation surveys. Such pilot studies were required in order to check whether methods utilised elsewhere (e.g. Sommer *et al,* 1989) were appropriate in the UK; and to introduce more robust visual simulation survey techniques by exploiting digital photography to minimise variability in the images. Images for the visual simulation survey used the case study streets as background scenes and by using digitally enhanced images it was possible to only vary tree shape and size.

Residents were engaged in a householder postal questionnaire, face-to-face interviews and a visual simulation survey with each approach intended to meet specific needs of the research. The householder survey was designed to increase knowledge about UK residents' perceptions of street tree attributes but also included open ended sections to understand more in-depth feelings towards street trees. Semi-structured interviews were subsequently carried out to enable more detailed understanding of the depth of residents' perceptions and finally interviewees completed a visual simulation survey to enable their visual responses to be cross-referenced with their verbal opinions of actual trees.

Thus the thesis has been organised to address the key points. The arboricultural literature was reviewed to understand residents' attitudes to street trees and the influence of tree size. Special consideration is given to the lack of UK knowledge and the preponderance of USA based studies and the implications of this to the research. Further review of the methodologies used and recognition of their limitations is also carried out. Street trees are also considered as part of the wider urban forest and considered as features of 'urban nature' and the influence of these factors on perceptions is also addressed. Visual simulations are a key part of this

thesis and a full review of the arboricultural research around survey techniques, scene presentation and limitations is carried out.

The methodology describes how two pilot studies were implemented. The first was to develop a survey method to increase knowledge about UK residents' attitudes to street trees and to place this in context with the international literature. Secondly, visual simulation methods were developed that took advantage of digital imaging techniques to maintain control over the variables. Images were shown separately to residents to enable them to choose their street trees and to professionals to gain insights about image presentation.

Studies have indicated that a variety of approaches using householder surveys, interviews and visual simulations enable the most effective collection of data. Thus qualitative methods were integrated into the investigation to sit alongside the householder survey developed from the pilot studies to enable a deeper understanding of residents' perceptions. These included open ended questions in the householder survey and a semi-structured interview with residents in the case study area. Interviewees also undertook a visual simulation survey developed from the pilot studies.

Analysis of the results from these three surveys follows. It looks in detail at the three relationships separately considering how residents perceive streets in their neighbourhood and individual trees closest to their home. Analysis of the visual simulation survey follows. Finally four vignettes representing interviewees living in close proximity to each other from each of the streets are presented which integrate all surveys and present an in-depth review of key issues for these individuals. All analysis considers the spatial context of the street trees and residents' proximity to them.

By integrating the methodologies, within an area of known tree population, research seeks to increase knowledge of UK residents' relationships with street trees. Furthermore, research addresses wider methodological issues by developing an approach that integrates the key techniques with known street tree populations to achieve an in-depth understanding of residents' perceptions of street trees.

Literature Review

Introduction

Street trees are significant natural features in some urban landscapes but it is only relatively recently that researchers have sought to investigate people's relationship with them; where the focus has been on isolating factors that influence perception including species characteristics, tree size and tree proximity.

Relationships between people and street trees have been investigated in various places including retail centres, suburban streets, industrial estates and transport links and several methods have been used including visual simulation surveys, householder questionnaires and interviews, expert opinion and physical inspections of growing trees.

The very existence of street trees, combined with ongoing, costly maintenance provides strong evidence that such trees have value; which is a message generally endorsed by participants in the results of the research outlined above.

However, most of the literature originates from North America and evaluating its relevance to the UK is problematic because researchers have tended to agree that their conclusions should not be inferred elsewhere due to likely differences between populations in climate, geography and culture.

Associated with this are two other significant factors that limit deeper understanding of the relationship between residents and street trees and this relates to the way in which the various methodologies have not been integrated alongside a focus towards quantitative techniques.

These issues are explored in more depth below.

Values and attitudes

Most research in this field has sought to understand attitudes to street trees (e.g. Sommer *et al*, 1990; Schroeder & Ruffolo, 1996; Heimlich, 2008) rather than more deeply held values. In contrast an understanding of the issue of human values has been actively sought for woodlands and forests where opinions have been largely positive and deeply held (O'Brien, 2003; McDonough, 2003; Vining & Tyler, 1999).

Policy makers in forestry have accorded importance to understanding values because there has been a strong desire to ensure that local and national government policies reflect citizens' concerns *and* that the public is fully engaged in decision making (Dwyer *et al,* 1991; O'Brien, 2003; Wolf, 2004).

Whilst 'attitudes' relates to learned tendencies for reacting favourably or unfavourably to a situation (Bright *et al,* 2003) values are a much more complex concept as O'Brien (2003) has described,

"Values are an enduring concept of worth; they are formed out of a social process of dialogue and debate and influenced by the social, cultural, historical and geographical relationships between society and the individual. They are constructed between individuals and institutions and are informed by ethical and moral judgements and by creating priorities in ideas and belief systems."

Dwyer *et al* (1991) described how values held about trees cannot be,

"...conveyed by a high correlation between 'tree size' and 'preference'"

Values are therefore complex but there is little understanding of them in relation to people's perceptions of street trees. One cause of this has been proposed by McLean *et al* (2007) who have criticised how the emphasis on quantitative research has meant that there is currently little in-depth understanding of residents' perceptions of street trees.

The street context

Whilst research concentrates on residents' perceptions of street trees it is necessary to consider the role of the street in the way that residents perceive their overall external environment.

Appleyard & Lintell (1982) have described how more trafficked streets are less attractive to residents because of factors such as noise and reductions in social interaction. Residents in lighter used streets were much more likely to use the street for activities including children's play and socialisation and were subsequently much more aware of the street environment than residents in busier roads. This component of street life has not been taken into account in the street tree research literature where it is possible that residents in busier streets will have different opinions of street trees than those in quieter locations because of their setting.

Arboriculturists tend to focus on tree attributes when evaluating their place in the highway (e.g. Helliwell, 2004) but a wider understanding of the position of street trees within residents' sense of place and their experiences of that place would be beneficial for communities. Thwaites & Simkins (2007) have described how the experiential landscape, *"a holistic relationship of outdoor open space and a range of human experience"*, can help understanding of the ways in which people relate to their surroundings and such a method appears to offer opportunity for increasing knowledge about street tree perceptions. For example, this approach could provide an insight into perceptions of street trees as people move away from one 'centre', such as their home, to another at their place of work. Wider collaboration with other disciplines, not least landscape architecture, would enable a more complete understanding of the role of street trees in residential streets.

Elmendorf (2008) further describes how,

"Community is just not a place; it is a place-oriented process. In this process, the physical characteristics and qualities of place, or environment, are recognised as playing important roles in the health, interaction and capacity of community."

People's perceptions of their streets is an area of complexity and the role that street trees play in that is little understood; although it appears that residents in roads with a stronger sense of community are more likely to value the benefits of street trees than residents in less sociable areas. The role of street trees within this complex area needs further exploration and is a topic where future research appears to be critical to move the debate on from a tree-centric approach (e.g. Sommer *et al,* 1990) that currently dominates thinking (McLean *et al,* 2007) to one that focuses on people.

What is a street tree?

When reviewing the literature about street trees it is important to be mindful that although the street tree is distinctive in its own right it is also considered as a component of seemingly interchangeable descriptions such as the 'urban forest' and 'urban nature'. It is therefore important when reviewing the street tree literature to decide whether the issues under analysis actually relates to street trees or are more relevant to different types of landscapes described as the 'natural environment' (see page 11 below).

The 'urban forest' is an important concept in urban tree care management although there are differences in meaning within the literature.

In the USA, for example, which has led research into urban trees and therefore makes up the majority of the literature review in this study, urban forestry is the standard definition of all trees in urban areas (Nowak & Dwyer, 2007).

It is not so clear cut in the UK, although Hibberd's (1989) Forestry Commission funded work concurs with the USA definition when he states that the urban forest,

"... embraces trees grown in and close to urban areas for their value in the landscape, for recreation, and including trees in streets, avenues, urban parks ... as well as those in urban woodlands and gardens."

Conversely, Bradshaw *et al* (1995) propose that there is a clear difference between trees grown for amenity purposes, such as those in streets, gardens or parks and those in the urban forest.

"Recently some people have taken urban forestry to cover all trees grown in, and close to, urban areas... It is perhaps most sensible then to think that what can be called an urban forest should have a minimum size of 0.5 acre."

Such a definition reflected Konijnendijk's (1997) early European perspective,

"The focus of European urban forestry is more on forests than on urban green space at large."

although street and park trees are now commonly considered to be part of the urban forest (Konijnendijk *et al,* 2005).

It is therefore important to recognise the various terms within the literature when addressing street tree research.

Notwithstanding these anomalies, the literature is consistent about identifying the specific place occupied by street trees within the landscape. Miller (1988) describes street trees as those,

"...planted in the public right of way."

Both Koller & Dirr (1979) and Hodge (1989) describe in more detail the range of street tree locations including grass verges between the path and the road; in the pavement at either its front or back edge; in median strips between traffic lanes; and sometimes between the path and neighbouring private property.

Whilst the literature has a strong focus on street trees in residential areas (e.g. Sommer *et al*, 1989, Schroeder & Ruffolo, 1996), particularly residents' responses to such trees, there have also been limited investigations of attitudes in other urban neighbourhoods.

Poracsky & Scott (1999) analysed street tree populations and species diversity in industrial areas although they did not address how workers responded to these trees. Wolf (2005) investigated the effects of street trees in retail areas finding that well landscaped streets improved the shopper's experience thereby benefiting the retail outlets; whilst Ellis *et al* (2006) found that tree and shrub cover moderated and mediated the negative effects of retail on neighbourhood satisfaction in nearby residential streets.

Street trees as part of the 'natural environment'

Researchers have linked studies relating people's perceptions of the natural environment and landscape to street trees and this is explored in more depth below.

Street trees are described as a key component of the plants that band together in urbanised settings to form what researchers have variously called the 'natural environment' (Kaplan *et al*, 1998), 'urban nature' (Kaplan, 1983), 'civic nature' (Wolf, 2005), 'urban greening' (Westphal, 1999) and the 'urban forest' (Hibberd, 1989; Dwyer *et al*, 1991). These terms all appear to have the following in common,

"The settings ... are not the wild and awesome, distant and dramatic, lush and splendid. Rather, the emphasis is on the everyday, often unspectacular, natural environment that is, or ideally would be, nearby. That includes parks and open spaces, street trees, vacant lots, and backyard gardens, as well as fields and forests." (Kaplan *et al*, 1998)

Perceptions of street trees have become associated with the values and attitudes associated with experiences of the natural environment (Kaplan, 1983). It is not uncommon, for example, for researchers to assign benefits to street trees that have only be explained for wilderness experiences (e.g. Hitchmough & Bonugli, 1997; Zhang *et al*, 2007) or to promote urban trees based on such findings (e.g. National Urban Forestry Unit, 2005).

Translating residents' responses to street trees from research about the natural environment and wider landscape appears to be a significant step. However, Kaplan & Kaplan (1989) have described how people's relationship with their environment is

interactive and that perception is determined by a range of personal and environmental factors described by the concept of 'compatibility',

"Compatibility is established by an environment that is conducive to meeting your personal goals; that is, in a compatible environment, what you want to do and are inclined to attempt are needed and feasible".

It is therefore reasonable to accept that people balance, consciously and sub-consciously, aspects of their urban life, including the effects of living near street trees, when creating or seeking a 'compatible' environment to set up home as similarly as they would if considering a rural or wilderness landscape.

Evidence describes how residents are affected both physically and psychologically by street trees around their home and regularly mention how street trees provide a link to 'nature' and 'wildlife' (Schroeder & Ruffolo, 1996). These factors combined suggest that such a link between landscape perception models (e.g. Kaplan & Kaplan, 1989) and urban street trees is reasonable particularly due to the importance of 'compatibility' as part of residents' perceptive reasoning.

Landscape perception models that seem to relate most to street trees are those associated with the 'subjective' approach which is derived from people's interaction with the landscape compared to the 'objective' approach which describes how the landscape is viewed in terms of objective and observable means (Lothian, 1999).

The 'subjective approach' identifies how the individual constructs their own perception of the landscape based on their experiences and emotions (e.g. Kaplan & Kaplan, 1989) and the evidence supports an interactive relationship between residents and neighbourhood street trees. It is not so clear cut in their interactions with street trees in visual simulation surveys (e.g. Kalmbach & Kielbaso, 1979) where a lack of control over the variables (Schroeder & Ruffolo, 1996) or lack of realism (Sheets & Manzer, 1991) hinder objectivity. Further research is needed in this field to evaluate these theories against the street tree/resident relationship.

Thus, the field of research that appears to have most relevance to this thesis is dominated by environmental psychologists (e.g. Kaplan & Kaplan, 1989) and

evolutionists (Heerwagen & Orians, 1993) who describe responses to the landscape in terms of people's preferences, itself founded on experience and needs.

Darwin (1958) initially proposed *'habitat theory'*, which is the ability of a place or object to satisfy the biological needs of human beings. Although this theory has not been directly applied to residents' relationships with street trees it supports the evidence that the physical and sensory issues faced by people living near trees are important. In other words, do street trees suit a positive home life? Are they a compatible feature of the residential landscape?

Support for this position is found with Gibson (1979) who introduced the concept of 'affordance' which he defined as,

'The affordances of the environment are what it offers for the animal or human being and what it provides or drives towards good or ill'.

Gibson further described that objects have instantly recognisable features, being perceived in terms of what they offer the person, rather than their feature or qualities and are therefore relative to the individual. Interactions with the object are therefore dependent on their capabilities. For instance, a low branch one metre above the ground does not afford the act of climbing if the person is a crawling infant but would for an able adult.

According to Gibson, the three relationships investigated in this research would each offer a potentially vast number of possibilities because each individual will have slightly different expectations dependent on their needs and their vantage point. Thus, the existence of an affordance requires harmony between the individual and the environment but the factors that cause accord are wide ranging and diverse.

As Gibson (1979) describes,

"*The meaning or value of a thing consists of what it affords ...What a thing affords a particular observer (or species of observer) points to the organism, the* ***subject****. The shape and size and composition and rigidity of a thing, however, point to its physical existence, the* ***object****. But these determine what it affords the observer. The*

affordance points both ways. What a thing is and what it ***means*** *are not separate, the former being physical and the latter mental as we are accustomed to believe."*

Gibson's theory appears to have some resonance with people's perceptions of street trees which can be important in meeting people's needs of urban living although more research is necessary to support this suggestion.

Appleton's (1975) prospect-refuge theory is based on habitat theory, stating that the ability to see (prospect) but not be seen (refuge) is basic to many biological needs. According to Appleton, the ability to see without being seen increases perceived safety which in turn increases the appeal of an area which manifests itself as aesthetic pleasure experienced in the environment.

There appears to be no studies directly related to this theory in the street tree literature but further work could examine more deeply the possibility that residents' perceptions of street trees include balancing the amount of privacy (refuge) they receive against the degree to which their outward view (prospect) is obscured.

Heerwagen & Orians (1993) and Balling & Falk (1992) have proposed that the habitat and savannah theories explain support for trees which are considered to meet the basic human need for shelter,

"...humans evaluate environments, not necessarily consciously, in terms of the opportunities they provide for pursuing activities that contribute positively to survival and reproductive success." (Heerwagen & Orians, 1993).

There is thus a strong implication that humans perceive their environment in functional terms and this has significance when looking to understand residents' perceptions of street trees (Gibson, 1979; Kaplan & Kaplan, 1989; Appleton, 1975; Heerwagen & Orians, 1993; Balling & Falk, 1992). Lynch (1960) offers an urban approach classifying trees as 'landmarks' although such a passive term now seems inadequate to describe residents' relationships with nearby street trees; although it is probable that they might relate to that concept when away from their home, seeking direction. There appears to be no research to consider Lynch's work in

relation to residents' perceptions of neighbourhood street trees to evaluate whether the physical and sensory attributes of trees complement this type of categorisation.

Further evidence to support this theory has been revealed in experiments testing preferred tree shape. A suite of experiments (Heerwagen & Orians, 1993; Orians & Heerwagen, 1992; Orians, 1986) found that preference for tree shape reflected those found in productive savannah habitats i.e. acacia like in appearance being more broad than tall, having canopies more wide than deep, possessing small compound leaves and have trunks that are short relative to tree height.

It is not known whether these seemingly instinctive preferences are overridden by the practical issues of urban living. Balling & Falk (1982) suggest that this may be true postulating a developmental pattern of perception, with innately programmed responses that are later modified by experience in particular settings. Further research would be useful in a street setting to test this theory.

The argument has therefore developed that responses to trees are a remnant of human's evolutionary past showing a predisposition for positive responses to specific landscapes and vegetation because they contributed to the survival chances of early humans.

Supporting this position are Sommer & Summit (1995, 1996), Summit & Sommer (1999), and Sommer (1997) who found similar preferences across diverse international college communities (Australia, Brazil, Canada, Israel, Japan, and the United States) for tree shapes resembling those on the African savannah. They also found that participants strongly favoured tree shapes that resembled trees common to their experience of their setting. For example, Australian students favoured trees that resembled eucalyptus species.

Further support for these theories has been provided by Lohr & Pearson-Mims (2006) who documented that people exhibit emotional responses when looking at scenes containing trees and the scenes with the spreading tree were the most preferred.

Orians & Heerwagen (1992) suggested that the condition of the vegetation in an area could signal an area's long-term survival potential and subsequently Kaufman & Lohr (2004) developed a survey using preference ratings to examine responses to a range of hues and intensities to investigate whether tree canopy colour influenced emotions. They found through measuring subjects' physiological responses that all tree colours were calming, but the green that would most closely approximate a healthy tree was most calming concluding that the 'right' green colour, which is associated with healthy plants with good nutrient qualities, could be an important landscape cue for people.

Kaufman & Lohr's (2004) study is limited in scope, having only interviewed nine people, but it provides a useful starting point to increase knowledge about this neglected topic of the importance of tree colour.

Tree condition also appears to affect aesthetic quality and this has been explored in various studies. Sommer *et al* (1993b) found that participants' opinion of storm damaged species was significantly lower than for non-stormed damaged trees. Nelson *et al* (2001) investigated deciduous tree canopy in relation to perception of fecundity and visual attractiveness using computer simulation techniques of tree crowns. They found support for their three hypotheses namely that trees with the most complete canopies were the most attractive and that trees in bare branch were less attractive than trees in leaf. They found partial support that the attractiveness of a tree in leaf depended upon the amount of leaf in relation to amount of branch. Supplementary analysis indicated that leaf accounted for more variance than branch.

Nelson *et al* (2001) concluded that,

"...perception of the fecundity and visual attractiveness of a tree reflects the completeness of its canopy. The Gestalt principle of closure was linked to prospect-refuge theory and suggested to be a vestige of evolutionary development and germane to the notion of Biophilia."

Furthermore, Heerwagen & Orians (1993) noted that analysis of the trees in their visual simulation survey showed that several of the least attractive trees had broken branches, deformed trunks and highly asymmetrical canopies;

"Despite our efforts to make the tree sample uniform with respect to tree condition, subjects readily perceived the imperfections."

Another component of this area of research is around the emotional effect of vegetation. Urban nature, including the presence of trees, causes measurable outcomes which tend to be positive including increased recovery speed from surgery (Ulrich, 1984), less violent neighbourhoods (Kuo & Sullivan, 2001), improved concentration when learning (Lohr & Pearson-Mims, 2006) and less stress (Kaplan, 2001). Kaplan & Kaplan (1989) have argued that the natural environment helps people to minimise "directed attention fatigue" and the distractibility and irritability that accompany it.

Kaplan (2001) evaluated responses to views of the natural environment from house windows which is a common perspective that residents have of street trees. What Kaplan found, further supporting their theories (Kaplan & Kaplan, 1989) and relating them directly to street trees, was that,

"...having natural elements of settings in the view from the window contributes substantially to residents' satisfaction with their neighbourhood and with diverse aspects of their sense of well-being."

Kaplan (2001) also included an element in her research to ascertain whether,

"...being in the environment plays a significant role as opposed to the effect of witnessing the environment from a window."

She found that residents with little control over their environment, such as apartment dwellers, reacted differently than those that have control. This has important consideration for street trees which are generally not 'controlled' by residents and further research into this particular issue would be useful particularly to evaluate whether residents perceive their own trees differently to street trees.

Hull & Harvey (1989) described how park visitor's emotional pleasure increased as tree numbers and understorey vegetation increased. Subsequently, Sheets & Manzer (1991) examined the breadth of people's reactions to vegetation specifically evaluating the affective response to altered scenes of urban streets and found that,

"Positive affective responses to vegetated settings appear to be independent of the settings' land use."

Although limited to one study, such research provides a link between urban street trees and the wider environmental type research which has tended to focus on other vegetation types (e.g. Kaplan & Kaplan, 1989). Furthermore, Sheets & Manzer (1991) reported that vegetation influenced their respondents' expectations of the quality of life of the urban setting; such a response being attributed either to an evolutionary model where vegetation indicates a resource rich area or it is consistent with social knowledge where well kept landscapes tend to be more affluent.

Research which has focused on the much broader concept of human relationships with the natural environment does appear to relate to people when they interact with street trees but more direct research using street trees as the variable would provide more confidence that the links between these two quite separate entities are justifiable.

Learned responses to vegetation

Researchers have also recognised that responses to places with vegetation occur through experience (Kaplan, 1983) and from cultural values (Tuan, 1990; Fraser & Kenney, 2000). For example, individuals may have had positive experiences of vegetation when younger such as tree climbing or learned through storytelling. Culturally valued aspects of rural life such as independence or harmony with nature also influence people and such attributes are frequently described by residents when describing perceptions of street trees (e.g. Gorman, 2004; Flannigan, 2005).

Fraser & Kenney (2000) reported wide variation in responses to urban trees from participants from four different ethnic backgrounds, which they attributed to the historical landscapes of their cultural origin. Hitchmough & Bonugli (1997) concluded that there was a cultural bias against street tree planting from the Scottish respondents to their survey. Williams (2002) noted that few surveys about attitudes to street trees exist outside North America and found that Melbourne residents preferred smaller, globular trees, at odds with North American results.

Schroeder *et al* (2006) unearthed interesting similarities when comparing Chicago residents' responses to street trees with those from south west England. Whilst tree species, road layouts, property alignment and climatic differences clearly existed between the two survey areas residents generally had an overall high opinion of the tree outside their home and rated the top most benefit as 'pleasing to the eye'. There were however significant differences in attitudes to all annoyances with UK residents more irritated by tree attributes than USA residents.

The concerns of researchers (e.g. Sommer *et al,* 1989; Schroeder & Ruffolo, 1996) about interpreting results away from the loci of the study appear well founded.

Preferences for vegetation may be based on cultural values which in turn may be a consequence of their historical utility for human survival. Ulrich (1983) supports this position suggesting a model for environmental preference that includes both components.

It is not yet possible, for example, to evaluate the relative importance of evolutionary or cultural factors described above primarily because related research has focussed on people's preferences, rather than 'affect' (Sheets & Manzer, 1991). What is clear is that residents' relationships with street trees are based on a complex array of factors that has yet to be fully explored.

North American bias

Although street tree planting has become an established tradition in most urban areas (e.g. *The Times*, 1856; Arnold, 1993; McBride & Mossadegh, 2000) a

significant feature of the literature is that the majority of research into perceptions of street trees originates from the USA, specifically associated with funding and objectives described in The Cooperative Forestry Assistance Act (1978) and more latterly the Food, Agriculture, Conservation, and Trade Act, 1990 (United States Department of Agriculture, 2005).

This legislation provided funding for urban forestry research and most of the subsequent research from the USA about people's relationships with urban trees has benefited from this (e.g. Sommer *et al,* 1989, 1990, 1993; Dwyer *et al,* 1991; Schroeder & Cannon, 1983; Schroeder & Ruffolo, 1996; Heimlich *et al,* 2008) as has other related research in the field of environmental benefits (e.g. Maco and McPherson, 2002, 2003; Nowak *et al,* 2006).

The emphasis on people's relationships with urban trees in the USA was founded on very practical issues. Firstly was the obvious lack of knowledge. Brush & Moore (1976) stated that the chief research question for behavioural scientists interested in the place of nature in the city was to find out what attributes of city vegetation urban residents considered to be desirable. A consequence of this lack of knowledge was noted by Sommer *et al* (1990) that,

"At present, city agencies concerned with public responses must rely on spontaneous comments that often come in the form of complaints whose representativeness is unknown".

Indeed, the stimulus for Sommer *et al's* (1989) paper derived from a dispute in Sacramento, California where City officials started a programme of street tree felling instigated by residents who were dissatisfied with the mess created by the elm leaf beetle. Opposition from tree supporters then terminated the programme leaving a stalemate. They noted that,

"It was hoped that the survey, by identifying the opinions of those individuals most directly affected by the elms would help the city resolve the controversy."

Alongside this desire to increase knowledge was also the perceived need to justify the cost to municipalities of ongoing urban tree management as Getz *et al* (1982) describe,

"The scarcity of municipal resources poses significant challenges for the management of urban trees. Tightening budgets and rapidly rising operating costs put strains on existing programs and necessitate a careful re-evaluation of current efforts."

Sommer & Sommer (1989) linked these two issues describing why it was important to understand residents' needs,

"If there is to be a major increase in street trees, it is important that the varieties selected maximize householder satisfaction and minimize public maintenance costs."

No such organisation with an equivalent dedicated purpose appears to be in place outside the USA. In Europe, attention is given to the concept of urban forestry but it has been applied more to forests under a strong urban influence than to urban green space at large (Konijnendijk, 1997). In the UK there is very little research about people's relationships with individually grown urban trees instead there is more focus on people and forests (e.g. O'Brien & Claridge, 2002) or their relationship with urban woodlands (Simson & Ryan, 2002; Coles & Caserio, 2004).

Arboricultural research in the UK has tended to focus on biological factors such as disease (Strouts & Winter, 1994), risk management (Lonsdale, 1999), tree biology (Mattheck & Breloer, 1994; Roberts *et al*, 2006) or tree populations (Land Use Consultants, 1993; Britt & Johnson, 2008).

The evidence that underpins much of what we know about people's attitudes to urban trees therefore originates from the USA and is replicated without any obvious concerns in the UK (e.g. National Urban Forestry Unit, 2005) despite frequently expressed concerns by authors about extrapolating results beyond their point of origin.

Issues about inferring results away from the point of origin

This issue has serious implications for research outside the USA because researchers have consistently stated that their results should not be extrapolated elsewhere because differences in climate, geography and culture would render comparisons meaningless. For example, Sommer *et al* (1993a) express caution about differences that may exist in people's perceptions of tree aesthetics,

"Ratings of visual attractiveness, for example, may differ in the desert communities in the American southwest, small villages in the French countryside, and major cities of Southeast Asia. This is not an argument against visual assessment; so much as it is a plea for replication of studies in different regions."

Schroeder & Ruffolo (1996) were also concerned by the inevitable variability of each surveyed area,

"Caution should be exercised in generalizing these results to other neighborhoods and communities, since the responses to this survey may have been influenced by factors specific to these particular neighborhoods at the time of the survey. In particular, the results of individual species must be interpreted relative to the age and size of the existing trees in these neighborhoods."

Such variability is illustrated in Plate 1 from Schroeder *et al's* (2006) comparison of residents' attitudes to street trees in southwest England and Chicago. These images show that it is not just the variability of the trees that is important but also the layout of the streets. In this example the North American street, on the left of Plate 1, has larger front gardens meaning the street trees are further way from the property and therefore less likely to cause an annoyance. The trees are also growing in a grass verge leaving the pavement free of obstruction unlike in the English scene.

Hitchmough & Bonugli (1997) proposed that climatic differences affect preferences because the functional role of street trees in casting shade is of little importance in cooler, less sunny areas; a point recognised by Schroeder *et al* (2006) who found shade to be a greater annoyance for the UK residents compared to the Chicago based participants.

Plate 1 – a demonstration of the variability between the lay out of different neighbourhoods which appears to influence residents' relationship with street trees (images from Schroeder *et al*, 2006).

Although Hitchmough & Bonugli's (1997) study focussed on tree-less streets, in contrast to all other related research, it found relatively low support for street trees, supporting the theory that cultural factors might influence opinions about street trees. Notwithstanding, Fraser & Kenny (2000) noted that the British participants were very positive about trees and had the most trees on their property.

Such issues pose a particular problem when attempting to understand residents' perceptions of nearby street trees in England. For example, how cautious should UK researchers be of the North American findings? Would they be relevant to a UK based study?

"I love trees but ..."

There is a profound lack of knowledge in the UK about residents' attitudes to urban trees near houses yet arboricultural texts have tended to echo Hitchmough & Bonugli's (1997) results describing an overall negative perception of trees. However, this perspective, illustrated in more detail below, might be explained by a failure to engage with the whole population and only dealing with the subset of residents that find trees to be annoying.

Prominent UK arborists have described the "I love trees but..." phenomenon. Biddle (Clouston & Stansfield, 1981), for example, has stated that,

"Perhaps one of the most commonly heard cries is 'I like trees, but not in front of my house'."

Annett (Baker, 1984) adds,

'How often have we heard 'I do not like trees because ...',

whilst Patch (*Horticulture Week,* 1994) has described how,

"Street trees are often unloved by the public....".

Dobson & Patch (1997) developed this theme further, characterising the public's attitude as,

"*I love trees, but ... **not-in-my-back-yard.***"

Solihull Metropolitan Borough Council's (2003) Tree Strategy expresses the equally negative view that,

"Those very same trees that make Solihull a pleasant town to live and work are, for many residents, a source of frustration".

After someone had secretly, and without permission, planted trees in residents' front gardens, a local authority Tree Officer was quoted in a national newspaper as saying,

"It's refreshing to see someone planting trees rather than what we all too often see, which is people wanting to take them out" (*Daily Mirror,* 2004).

Such views appear to have been long held by professionals in the UK as this 40 year old article states,

"Let it be recognised that many urban trees are too large for their positions... many, often cause inconvenience to those against whose property they are situated" (Riseley, 1969).

Most recently Britt & Johnston (2008) reported that

"Many tree officers are concerned that urban trees are now being viewed increasingly as a liability by the general public."

However, despite these assertions the results from more systematic surveys (e.g. Flannigan, 2005; Booth, 2005, 2006) offers a perspective analogous to the international literature with residents rating urban trees positively although variability was found in the relative importance of tree attributes. Evidence for this is supplied by Schroeder *et al* (2006) who concluded that,

"...respondents from all three communities [two UK locations and one USA location] *had equally positive overall opinions of their street trees."*

The relative importance of tree attributes reported by Schroeder *et al* (2006) does support Hitchmough & Bonugli's (1997) position relating to climate for example. As Schroeder *et al* (2006) acknowledge,

"Arborists in both the United Kingdom and the United States should be aware that local conditions of climate and spatial layout of streets and homes may affect the impact that various benefits and annoyances have on some owners and should take this into account when selecting species and locations for planting trees."

Despite its narrow focus Schroeder *et al's* (2006) paper presents a fundamentally important point that North American based street tree research has relevance to the UK particularly in its methodological approach, described later, and, raising for the first time, a common and positive perception of street trees.

Methodologies used to evaluate residents' perceptions of street trees

Researchers generally agree about the key factors that relate to people's perceptions of urban trees which can be distilled into areas associated with ecosystem services (Wolf, 2006; McLean *et al,* 2007; Nowak & Dwyer, 2007).

Figure 1 illustrates the range and complexity of interactions between people and trees and the concepts described by Schroeder & Westphal (2008) apply equally to urban trees.

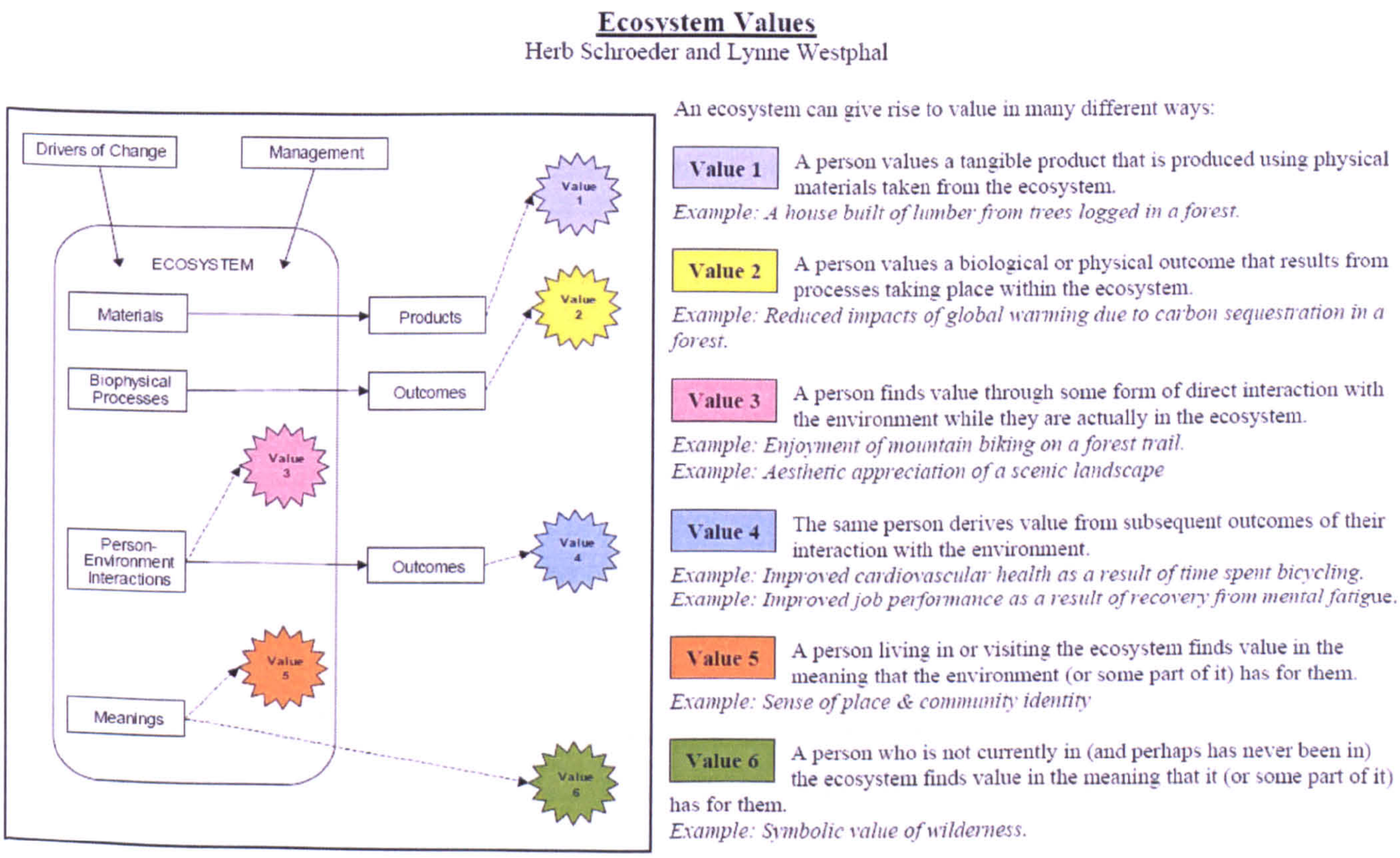


Figure 1 - Example of the range and complexity of interactions between people and trees

Individual and community benefits tend to cross cut and include; aesthetics where street trees enhance the visual quality of the street (Kalmbach & Kielbaso, 1979) as well as being beautiful in their own right (Schroeder & Ruffolo, 1996); a medium to express spiritual and emotional experiences that are important to people's lives (Chenoweth & Gobster, 1990; Schroeder, 2002); and involvement in tree planting activities (Westphal, 1999); or inventory projects (Bloniarz & Ryan, 1996).

Researchers have investigated the factors related to residents' perceptions of street trees by seeking to itemise factors and to analyse results primarily from the demographic information of the residents and the street trees rather than addressing the issue from a theoretical basis.

Factors that influence street tree preferences dominate the literature and researchers have focused on specific methods to achieve this objective namely visual simulation surveys, householder questionnaires, field based analysis and expert opinion (Sommer *et al,* 1993a) resulting in research that has tended to be limited to a practical understanding of the subject. As Dwyer *et al* (1991) explained,

"Much of our initial work focused on predicting people's preferences for urban forest management changes, for example, planting new trees along a street, increasing density of tree cover in a park, or designing changes in a landscape alongside a bicycle trail.

Although as they conducted this work,

"... it became increasingly clear... that the values of trees and forests in urban areas involved more than simple pleasures in the attractive environments they provide."

Despite this understanding of the presence of deeper values theoretical explanations for behaviour in relation to street trees is rare (McLean *et al,* 2007).

Sommer *et al's* (1993a) overview of the four standard methods for street tree evaluation has been described in Table 1 which also outlines their advantages and disadvantages, realised through their application across four related pieces of research (Sommer *et al*, 1990; Sommer & Cecchettini, 1992; Sommer *et al*, 1993a, 1993b).

Each of these methodologies is explored in more detail below. Underlying this piecemeal review of each of these methods is Sommer *et al's* (1993a) assertion that,

"Paralleling the belief that there is no such entity as a perfect street tree for all locations, we believe that there is no single assessment procedure that is suitable for all purposes. Each procedure can add useful information to the assessment process, but also has certain limitations."

Survey procedure	Advantages	Disadvantages
Householder survey	• Effective for assessing public response to trees planted in their area. • Provides detailed information missing from surveys carried out by professionals • Useful for assessing municipal maintenance practices	• Time, expertise and cost of conducting the surveys • Closed nature of questioning may mean important factors are overlooked
Professional survey	• Efficient way of obtaining expert ratings of species appropriate for a geographic area • Ratings of Arborists and landscape architects can be combined	• Likelihood that tree characteristics important to the public will be overlooked
Slide presentation	• Easiest and quickest method for rating street tree characteristics	• Collecting slides in an unbiased manner • Ineffective for rating of individual species
Physical inspection	• Can be carried out quickly and reliably by trained observer	• Results affected by inconsistency of repair policies and location of tree in the street • May overlook factors that are important to non-professionals

Table 1 - Sommer *et al's* (1993a) summary of the four types of methods used to increase understanding of residents' perceptions of street trees

Sommer *et al* (1993a) recognised flaws in this approach caused mainly by failures to draw together the information from the different methods,

- *"On a practical level differences between public responses and lists compiled by professionals can lead to end user dissatisfaction with the type of tree planted and professionals remain in the dark about the attributes valued by the public.*
- *On a heuristic level, when different researchers ask different questions among different groups of respondents there is almost no way of pulling together the findings into a coherent set of recommendations to guide policy."*

However, Sommer *et al* (1993a) did not tackle the reliance on quantitative techniques rather than qualitative approaches which would tackle, in more depth, the reasons behind people's preferences (McLean *et al,* 2007).

Notwithstanding, Sommer *et al* (1990) did derive their householder surveys from a more intensive programme of face-to-face interviews but which proved too costly to implement,

"The contact procedure for the door-to-door interviews was labor intensive and time consuming in terms of finding people at home. Writing down answers to the open-ended questions was awkward and time consuming. The procedure required a trained interviewer to ask the open-ended questions and a trained research assistant to code the responses. Problems in transcription and coding suggested the use of multiple choice responses. These were gradually introduced into the interview schedule, so that by the third survey the response format was largely multiple choice."

Householder survey

The rationale for on-going research has been fairly limited by funders whose focus has been on developing a tool to understand residents' preferences that could be easily used by non-scientists across the whole of the USA; hence the dominance of quantitative type householder surveys (Getz *et al,* 1982; Sommer *et al*, 1989, 1990; Schroeder & Ruffolo, 1996; Gorman, 2004; Heimlich *et al,* 2008). The approach has assisted the growth in knowledge about residents' preferences and has developed logically since the early work by Kalmbach & Kielbaso (1979) who, faced by the fact that they were unaware of any specific attempts to

"...obtain the thoughts of the public",

and had the limited objective of developing a survey

"...that would begin to sketch the meaning that trees held for people in urban environments with emphasis on streets and focusing on the variable of size".

Getz *et al* (1982) are attributed by Sommer *et al* (1989, 1990) as forming the basis of survey methodologies that have been used subsequently particularly around tree benefits and annoyances. Subsequent survey development work by Sommer *et al* (1989, 1990, 1993a) was derived with the specific objective of producing,

"an instrument that city agencies could use at a local level".

Schroeder & Ruffolo (1996) opined that survey questionnaire methods obtain more detailed knowledge of householders' perceptions of and preferences for the trees in front of their own homes than visual simulation surveys which can only present a fixed moment in time and cannot portray non-visual benefits. A point further developed by McLean *et al*, (2007) who argue that the emphasis on quantitative methods limits a deeper understanding of residents' perceptions.

Uncertainty also exists about the generalisibilty of the results because personality traits, previous experiences of trees, distance of home from the tree, physical ability to clear up debris, even lop-sided crowns might all play a part in how individuals respond to the tree outside their home. For example, Sommer & Cecchettini (1992) found a complex response from residents about the location of trees in the street and related root damage concluding that kerbside locations were favoured for street tree planting locations despite the fact that this caused annoyance for the majority of participants. Generalising the results from such surveys is therefore an issue.

Professional survey and physical inspection

These two methods, which have been rarely used, rely on professional judgement to provide a summary of important issues (e.g. Sommer & Cecchettini, 1992) and provide practical information for street tree managers. However, Sommer *et al's* (1993a) concerns whether these expert professional opinions match those of novice residents have been recognised elsewhere (e.g. Kaplan & Kaplan, 1989).

Research by geographers describes how experts categorised trees, and tree size, differently from non-professionals. Experts tended to use 'ideal' dimensions of height and purposefulness to categorise trees whereas the novices described what was familiar to them (Lynch *et al,* 2000). Expertise ratings also appear to be further influenced by *'local coverage'* (Proffitt *et al*, 2000),

> *"...we have shown that experts use considerable domain-specific causal knowledge when solving induction problems in their domain of expertise. We have also shown that local coverage predicts patterns of inductive reasoning about trees and hypothetical diseases for tree experts better than does global coverage or overall central tendency."*

Research relying on professionals' opinions therefore appears to be doubtful as an approach for gaining deeper insight of residents' perceptions of street trees.

Visual simulations

Visual simulation surveys have been frequently used as a tool for understanding people's perceptions of the natural environment (e.g. Kaplan & Kaplan, 1989) and this approach has been applied specifically to street trees.

Different visual simulation methods have been used to evaluate perceptions of street trees including line drawings (Sheets & Manzer, 1991; Summit & Sommer, 1999); photographs (Kalmbach & Kielbaso, 1979; Schroeder & Cannon, 1983); digitally enhanced photographs (Orland *et al,* 1992); and changes to the landscape (Sheets & Manzer, 1991).

Such research has described information relating to people's perceptions of house prices (Orland *et al,* 1992), psychological responses to urban trees (Sheets & Manzer, 1991) and tree size and planting frequency preferences (Kalmbach & Kielbaso, 1979; Schroeder & Cannon, 1983; Summit & Sommer, 1999).

Kalmbach & Kielbaso (1979) justified the use of visual simulation surveys on earlier work by Shafer and Richards (1974) supported more recently by Daniel and Vining (1983),

"...if a slide or photograph accurately depicts a scene, then a person viewing the picture or slide is likely to react to the scene as if he were there, as indicated by responses to adjective pairs used in semantic differential scaling."

Kalmbach & Kielbaso's (1979) survey is important to this research because it appears to be the only study where existing street tree preference is compared with preferences for photographs depicting scenes. Their focus was whether tree size affected the visual attractiveness of the scene; although it ignored factors that might contribute to the formation of these preferences such as street layout. Importantly Kalmbach & Kielbaso (1979) reported that personal preference for images of streets appears to generally favour those containing larger trees irrespective of the personal circumstances of the respondents; providing the first suggestion that these types of survey do not reflect all the aspects of living with street trees indicating that the 'compatibility' requirements for choosing preferred images are different to those for living beside street trees.

This factor has not been followed up in the literature with researchers using a whole range of different participants to judge scenes (e.g. Schroeder & Cannon, 1983; Sommer *et al,* 1993b; Williams, 2002) but not appearing to take into account their personal or spatial relationships with street trees.

Kalmbach & Kielbaso (1979) and Schroeder & Cannon (1983) describe a theme from North American visual simulation research which shows a preference for larger trees. However, this is not a consistent result of these types of surveys. In relation to house value study Orland *et al* (1992) found that larger trees tended to reduce perceived house price value whilst Williams' (2002) survey of street tree preferences in Melbourne, Australia found that the medium sized tree was preferred. In contrast to these generalist tree size perceptions, in an experiment using line drawings, which provided control over the variables yet lost realism Summit & Sommer (1999) reported that tree size preference was influenced by the context of the scene.

A number of flaws exist in the methodological approaches described in the visual simulation experiments above. For example, the early surveys (Kalmbach & Kielbaso, 1979; Schroeder & Cannon, 1983) were limited by the photographic medium available at that time which allowed little control over the variables. Kalmbach & Kielbaso admitted the difficulty of controlling image content,

"Trees were matched as nearly as possible in qualities other than tree size of trees. Difficulties were experienced in obtaining perfect matches."

Picture quality has also been a factor. Enabling participants to view images where the variables are controlled, such as maintaining identical lighting and weather conditions has proved problematic (Sommer *et al,* 1993). Orland *et al* (1992), who introduced the use of digital photography to street tree research, suggested that,

"...uncertainty [exists] whether the chosen variable causes an effect or is merely associated through its correlation with another, and the inability to use all possible variables for reasons of economy, could diminish the validity of conclusions from these studies."

Even before and after photographs of changed landscapes, where vegetation was added as part of a landscaping scheme, such as that used by Sheets & Manzer (1991) cannot be certain of controlling the variables. Lighting conditions, traffic and litter could all change in the intervening period thereby affecting how the viewer would perceive each scene.

Moreover the lack of control within street tree visual simulation studies, alongside the difficulties of translating the physical impact of trees, is well expressed in Sommer's own criticism of elements of this research (Summit & Sommer, 1999),

"Although these studies [Sommer et al 1989, 1990, 1992] were high on realism (people rating trees in an environmental context), they were low on control, because so many extraneous variables, including neighbourhood characteristics, house value, lawn size and condition, pruning procedures, tree droppings, root problems, and pests could influence respondents' attitudes towards actual trees."

Schroeder & Ruffolo (1996) offered their own critique of visual simulation surveys. They recognised that visual simulation surveys provided useful information for managing vegetation in streets but they presented four significant limitations:

1. Viewpoint; the images represent a view looking along the street rather than from houses, gardens or the pavement
2. Realism; images are incapable of depicting fine visual details of trees nor non-visual benefits and annoyances
3. Timing; the photographs depict a particular time of the year and cannot therefore capture seasonal changes
4. Distance; evaluations of street tree images are normally undertaken by people who do not live in the street under scrutiny.

Despite these issues the first such visual simulation surveys undertaken to address street tree perceptions (Kalmbach & Kielbaso, 1979; Schroeder & Cannon, 1983) continue to underpin understanding of attitudes to street trees. North American residents' preferences for larger street trees continues to be accepted (e.g. Williams, 2002) as does Schroeder & Cannon's (1983) conclusion that street trees are an important factor in the attractiveness of residential streets (e.g. Nowak and Dwyer, 2007).

Orland *et al* (1992) noted that visual simulation surveys could help to provide more specific information about the impact of street trees on house property value. This, they argue is more useful when compared to preceding research such as that by Anderson and Cordell (1988) and Morales (1980) which described increases in property value related to nearby vegetation but not about specific and identifiable trees such as these in the highway outside a property.

Further criticism is levelled by Orland *et al* (1992) that the stimuli used have rarely been evaluated for their validity as environmental surrogates. They use the example of Sheets & Manzer (1991) who whilst fortunate to find a quickly changing landscape for before and after photographs had to rely on artist's sketches of 'low realism' for another part of the study.

Orland *et al's* study aimed to address these shortcomings by the use of computer video simulations,

"The relative ease of use of this tool [microcomputer-based image editing] *has made it possible to create data sets in which numerous original images have been subjected to a variety of treatments, enabling researchers to increase the validity of their findings vis-à-vis study variables, and to demonstrate generalizability of their findings to a broader range of settings."* (Orland *et al,* 1992)

In order to address this problem and to test propositions derived from theories of landscape aesthetics Sommer & Summit (1995),

"...moved the research into the laboratory using line drawings of trees whose features could be systematically varied and evaluated. We recognise the loss of realism in using line drawings of trees as stimuli. However, line drawings are commonly used in landscape textbooks, manuals, nursery catalogs, and plans, and we felt the need to increase control relative to what was possible in earlier studies rating actual trees."

Researchers have therefore made specific attempts to address the problems of controlling the variables in this area of street tree research but have not yet fully utilised digital photography which enables detailed manipulation of images ensuring strict control of these variables whilst providing a high degree of realism. There has also been insufficient integration of people's street tree experiences with their responses to visual simulation surveys to evaluate whether outcomes accurately reflect real-life situations.

People's perceptions of street trees

The development of these methodologies described above has revealed how residents' perceptions of street trees are generally positive and it appears possible to link this with human's wider appreciation of the natural environment described earlier. Outcomes tend to relate to a combination of tangible and intangible features that can be considered as responses to compatibility, aesthetics or associations of individual importance which are explored in more detail below.

Understanding the extent of practical issues, related to residents' preferences have dominated the street tree literature. The majority of researchers have thus been more focused on investigating whether street tree perceptions are influenced by species factors (Sommer *et al,* 1990), size (Heimlich *et al,* 2008) and location (Gorman, 2004). It is these physical and spatial attributes of street trees that directly affect people's lives although deeper understanding of the causes behind such perceptions have yet to be adequately identified (McLean *et al,* 2007).

Presence of street trees

Irrespective of whether participants live in tree-lined streets or not the overall perception of the presence of street trees tends to be positive. Getz *et al's* (1982) participants were drawn from across the city of Detroit, for example, and trees in streets were rated as the most important location for urban trees; Lohr *et al* (2004) found that people were able to recognise a number of reasons why street trees were important; and the most favoured images in visual simulation surveys (e.g. Schroder and Cannon, 1983) included street trees; as did real-life changed landscapes where trees were added (Sheets & Manzer, 1991). However, there is some evidence that residents in tree-less streets can oppose the presence of street trees although research in this area is limited (Hitchmough & Bonugli, 1997).

Tree attributes

Researchers have identified attributes of trees that residents consider to be beneficial and annoying. Such attributes tend to be divided between positive and intangible features, such as visual appeal, and negative tangible factors such as raking leaves away in autumn. Table 2 summarises residents' responses to householder questionnaires highlighting their 'overall opinion' of nearby street trees and the three most prominent benefits and annoyances. Table 2 demonstrates that residents have, overall, a highly positive opinion about the presence of street trees. 'Pleasing to the eye' is consistently the highest ranked benefit and leaf and other debris the most frequent annoyance. However, Table 2 also reveals a range of prominent benefits and annoyances but the nuances of these differences are not investigated in any depth.

However, responses to this line of questioning are limited to the suggestions made in the survey. For example, Lohr *et al's* (2004) participants ranked tree shading as the most important attribute of urban trees but were not given the opportunity to rank visual attractiveness. They also rated allergies as the most important annoyance but were not given the opportunity to describe autumn leaf raking.

The relative importance of tree attributes is inconsistent, further supporting the view that local circumstances are critical for influencing tree perception. In respect of annoyances the raking of leaves is featured highly in some cases (Schroeder & Ruffolo, 1996; Flannigan, 2005) but is relatively insignificant in others (e.g. Heimlich *et al*, 2008). Sommer *et al* (1989) found that insects were the most significant annoyance but their research was specifically targeted to understand this known problem and elsewhere in the literature insects tend to be of minor annoyance (e.g. Schroeder & Ruffolo, 1996).

Table 2 emphasises how the visual attractiveness of street trees is a consistently highly rated benefit across all related research (e.g. Williams, 2002; Heimlich *et al*, 2008) yet local importance to other tree benefits exists. In USA based studies tree shade is important (e.g. Sommer *et al*, 1989) but was of minor importance in the UK (Flannigan, 2005). Such evidence further supports the idea that local circumstances are important in influencing people's perceptions of street trees.

Comparing Sommer & Sommer's (1989) factor analysis of residents' perceptions of benefits and annoyances with that carried out by Schroeder *et al* (2006) it is important to note that the former found that benefits clustered together and annoyances grouped under related headings whereas the latter described a different outcome with annoyances clustering. Such results add more weight to conclusions that support the opinion that local circumstances, whatever the causes, are significant factors that influence residents' behaviour and attitudes.

Study citation and location	Overall opinion of tree		Highest benefit	Highest annoyance
Sommer et al (1989) – California, USA	Elm trees	Positive opinions outweighed negative opinions by a ratio of 3 to 1.	▪ Gives shade ▪ Pleasing to the eye ▪ Marks season's change	▪ Insects in tree ▪ Diseases in tree ▪ Fallen leaves in autumn
	Plane trees	90% rated it from good to excellent	▪ Gives shade ▪ Pleasing to the eye ▪ Increase property values	▪ Fallen leaves in autumn ▪ Falling limbs ▪ Root damage
Schroeder & Ruffolo (1996) – Chicago, USA	Six of eight evaluated species had average ratings between good and very good.		▪ Pleasing to the eye ▪ Enhances neighbourhood ▪ Brings nature closer	▪ Fallen leaves in autumn ▪ General debris ▪ Epicormic growth
Gorman (2004) – Pennsylvania, USA	Tree outside home	92.8% rated street trees as a great benefit	▪ Pleasing to the eye ▪ Neighbourhood more liveable ▪ Improve environment	▪ Sidewalk damage ▪ Leaf fall ▪ Branches fall
	No tree outside home	85.8% rated street trees as a great benefit	▪ Pleasing to the eye ▪ Improve environment ▪ Fall colour	▪ Leaf fall ▪ Break power lines ▪ Branches fall
Flannigan (2005) – North Somerset, UK (pollarded trees)	Slightly higher than 'good'*		▪ Pleasing to the eye ▪ Brings nature closer ▪ Enhances look of garden and home	▪ Fallen leaves in autumn ▪ Root damage ▪ General debris
Flannigan (2005) – Torbay, UK (pollarded trees)	Slightly higher than 'very good'*		▪ Pleasing to the eye ▪ Autumn colour ▪ Brings nature closer	▪ Fallen leaves in autumn ▪ General debris ▪ Root damage

*A mean score was calculated from the overall evaluation of all trees where 1 = poor; 5 = excellent

Table 2 – Summary of results from householder questionnaires across a range of locations in North America and southwest England. These results highlight overall opinion and the three most prominent annoyances and benefits of the street tree closest to people's homes.

Such positive responses also reflect the findings of other research relating to urban trees. Wolf (2005) found that such trees enhance shopping and driving experiences. Coley *et al* (1997) noted that urban trees increased social benefits. Dwyer *et al* (1991) and Kaplan (1983) describe how people experience spiritual and aesthetic values whilst Dwyer *et al* (1992) and Nowak & Dwyer (2007) have described economic benefits.

Residents' perceptions of street trees therefore appear to be strongly influenced by each individual's needs in respect of a compatible environment. Annoyances and benefits are therefore reported but at different levels depending on the individual and their location e.g. residents in hotter climates value tree shade more than residents in cooler areas and taller trees are therefore compatible with the desire of the former to keep cool.

Human health

Another feature of the urban forest, which appears to be a component of the influence of natural environment factors, is its effect on individual human health. Nature has been found to contribute positively to human physical and mental health (Kaplan & Kaplan, 1989; Kellert & Wilson, 1993) and the urban forest plays an important role affecting how humans enjoy their lives both individually and as a community.

Ulrich (1984) noted that patients with a view of nature recovered faster from surgery, and needed less pain medication, than those with a view of buildings. Roads that pass through and by green areas, including trees, reduces driver stress as measured by blood pressure, heart rate and sympathetic nervous system changes (Parsons *et al*, 1998). Well landscaped areas such as parks and other parts of the urban forest are also more attractive place to walk and take other forms of exercise with subsequent improvements in reducing obesity and improving cardiovascular health (Department of Health, 2004)

Views of the urban forest have also been found to reduce physiological stress and buffer the negative impact of job stress on intention to quit (Leather *et al*, 1998; Kaplan & Kaplan, 1989). Workers with views of nature had higher levels of job satisfaction, and that such views helped to restore cognitive capacities needed for basic functioning.

The urban forest also contributes positively to mental functioning. Kaplan & Kaplan (1989) have undertaken extensive research in this area and report consistent findings that nature provides a 'restorative experience' enabling people to overcome the mental fatigue that occurs when living in urban areas. Views of urban nature have also been shown to help children be more disciplined (Taylor *et al*, 2002).

Individual health benefits can therefore be found through passive and active involvement with the urban forest although it would appear that only Kaplan (2001) has addressed this from the perspective of residents living alongside street trees where,

"Nature in the window view was a strong factor in well-being and residential satisfaction."

Further research is needed to extend this area of research into the street tree arena.

Tree species

Researchers in the USA have been particularly interested in finding out if different responses to tree species existed in order that future planting would reflect the community's preferences. Species rating appears to have been affected by a 'nuisance factor' with Schroeder & Ruffolo (1996) noting lower overall opinion for the Kentucky coffee bean tree attributed to its propensity to drop litter, whilst the compact form and spring flowers of the 'Chanticleer' pear was more appreciated. Sommer *et al* (1990) support this finding describing that some species were more highly favoured because they dropped less debris, such as seeds.

Such knowledge is unavailable in the UK where research has not been organised to collect this data (e.g. Flannigan, 2005; Booth, 2005, 2006).

Tree size and location

Tree size is clearly something that residents are capable of understanding (e.g. Kalmbach & Kielbaso, 1979; Schroeder *et al,* 2006) although there appears to be no current universal definition of dimensions that categorise 'tree size'.

The literature has thus described different ways to evaluate residents' opinions of tree size including trunk diameter (Schroeder & Cannon, 1983), and tree height (Kalmbach & Kielbaso, 1979). Some researchers did not consider size at all (Sommer *et al,* 1990) or asked residents to describe tree size but carried out no measurements (Flannigan, 2005; Schroeder & Ruffolo, 1996).

There is considerable inconsistency within the literature about tree size categories. Schroeder & Cannon (1983) described large trees as those with trunk diameters exceeding 16 inches; Kalmbach & Kielbaso (1979) decided that trees over 25 feet in height were 'large'; whilst Heimlich *et al* (2008) did not describe tree size other than correlating larger trees to maturity and that they 'canopied' the street. Larger trees were preferred but it is not clear what dimensions make such trees 'large'.

Williams (2002) concluded that residents in Melbourne preferred 'medium' sized trees but does not provide information about how tree size categories were determined.

Tree size and location does appear to be a factor influencing opinions about trees. Kalmbach & Kielbaso (1979) found that planting density of one tree per property and trees over 25 feet tall were preferred. Schroeder & Cannon (1983) described how larger trees had most impact on aesthetic contribution whilst small trees had no impact at all. Schroeder & Cannon concluded that whilst larger trees provide significant aesthetic benefits this can be countered by the problems they bring such as increased maintenance costs. Gorman (2004) found a statistically significant difference in residents' opinions depending on whether there was a street tree

planted in front of their residence. Residents with trees outside their house were far more likely to report positive attributes, for example. Sommer and Cecchettini (1992) describe how trees planted furthest from property were preferred despite the associated increase in pavement damage.

Schroeder & Ruffolo (1996) reported a mix set of results about the influence of tree size on preference. In their survey of individual trees virtually no one rated their tree as too large whilst in their analysis of residents' perceptions of neighbourhood trees there were only small differences in opinion with the 'small-tree neighbourhood' being rated only slightly lower than the other areas, but still averaged 'good'. Annoyances were rated as less severe in the small-tree neighbourhood whilst the large trees that over-canopied the street had the highest 'annoyance' rankings.

The two species evaluated in Sommer *et al's* (1989) study were mature specimens suggesting that their size was not a negative feature; otherwise they would not have scored so highly in overall opinion.

Whilst Orland *et al* (1992) described that larger trees tended to reduce the value of property, Lien and Buhyoff (1986), on the other hand found that the presence of larger, more mature trees increased scenic quality.

Sommer *et al* (1990) commenting on the greater appreciation of larger trees described how they considered that the smallness of two species had caused a more negative response to their shading ability and their aesthetic appeal than they would have when more mature. Sommer *et al* added an important point stating that,

"It would be interesting to evaluate tree species over their life cycle",

suggesting that tree size/maturity is a factor that might later perceptions as they change with time. The literature does not describe whether this suggestion has been carried out.

During the course of the interviews held by Hitchmough & Bonugli (1997), respondents in all streets frequently provided unsolicited comments that their street

was too narrow for trees. Pavement widths were relatively narrow in some of the streets although according to the authors sufficient to allow the planting of small growing species.

Schroeder *et al* (2006) compared attitudes to street trees by USA and UK residents by analysing results from almost identical surveys. They found a significant difference between the Downers Grove, Chicago and North Somerset/Torbay surveys in respondents' evaluations of the size of the tree outside their home concluding that it appears likely that there is a real difference in preferences for tree size, with the respondents in the North Somerset/Torbay survey preferring their trees to be smaller than did the respondents in the Downers Grove survey.

In contrast to the views of these UK respondents the Helliwell system (Helliwell, 2004), which is a widely used, professional, UK method for evaluating tree amenity for purposes such as Tree Preservation Orders, larger trees are awarded higher ratings.

Summit & Sommer (1999) investigated preferred tree size in four different settings; no context, city, suburban, rural and wild. They found that,

"In developed settings such as the suburban or city context, people appeared to select trees whose size matched the size of the buildings, but in undeveloped settings preferred the tallest trees. This suggests that ... preferences in specific contexts are shaped by those contexts to a considerable degree."

Where residents have control over management, because the tree is on their property, Fazio & Krumpe (1999) found that 57% of respondents had carried out pruning because the tree was '*too big*' whilst Close *et al* (2001) noted that residents gave a number of reasons for choosing to have their own tree 'topped' including "*thought the tree was too large*" and "*wanted to reduce the number of large branches*".

Tree size and location therefore appears to influence residents' perceptions of street trees but inconsistent measurements and the natural variability of the studies means

that no firm conclusions can be drawn in the UK without further comparative experiments between different populations of residents.

Demographic factors

Researchers have used basic demographic information such as age, gender, educational attainment and income to evaluate whether it has an influence on perceptions of the urban forest. Although not every piece of research described demographic factors as being important some factors do arise regularly. This would appear to be consistent with research about the much wider natural environment where preferences for natural settings are not consistent between adults and children (Balling & Falk, 1982) or among ethnic groups (Talbot & Kaplan, 1992).

When age was a significant factor it tended to be older respondents being less happy with nearby trees (Kalmbach & Kielbaso, 1979; Flannigan, 2005; Williams, 2002; Sommer *et al*, 1990). Evans (1995) found a positive correlation between older respondents and dislike of leaf related problems including clearing leaves from guttering. Sommer *et al* (1989) reported that opinions of the two trees within their study did not relate to any demographic variable except for age.

"Older householders had a lower opinion of ... trees than younger residents."

Schroeder & Ruffolo (1996) postulated that variations in preference to street trees were not related to differences in background of the respondents except, possibly length of residence. They speculate that this might be related to tree maintenance where elder residents were less happy overall with city tree maintenance.

Flannigan (2005) found that the reduction of physical ability, demonstrated by inability to carry out strenuous tasks, caused by increasing age, correlated with lower overall opinion of nearby trees. With tree debris being a consistently highly rated annoyance this is therefore expected.

Both Fazio & Krumpe (1999) and Close *et al* (2001) found that 'topping' was more common among older, less educated and less affluent segments of society.

Gender appears to have little influence on street tree preference although Lohr *et al* (2004) noted that younger, black males were least interested in urban trees whereas Hitchmough & Bonugli (1997) reported that men were more likely to want tree planting and preferred bigger trees.

Educational attainment also showed some effect with those who stayed in education beyond sixteen years old favouring larger trees (Williams, 2002; Sommer *et al*, 1990). Gorman (2004) considered his findings should not be extrapolated elsewhere because of the higher level of educational attainment of the respondents suggesting that this caused higher appreciation of the value of street trees. Getz *et al* (1982) reported that participants with higher levels of education attributed higher increases in property prices related to trees.

Sommer & Summit (1995, 1996) describe how both evolutionary and cognitive processes help influence tree shape preference whilst Dwyer *et al* (1991) have described the wider benefits of the urban forest to humans. On the other hand demographic factors provide inconsistent explanations about attitudes to street trees. Deeper analysis of individual's psychological profiles would, it seem, add to knowledge. For example, clearing up debris is a significant annoyance so it might be feasible that individuals who prefer tidy environments would appreciate trees less.

Clearly, there is scope here for a great deal more research that;

- addresses residents' attitudes to street trees in a range of UK locations
- looks specifically at the deeper values that residents have towards street trees specifically around the different possible relationships they may have with them
- involves a greater integration of methodologies within a defined population to test the extent of residents' different relationships with street trees
- considers the influence of 'localness' on street tree perception as well as investigating factors that have generic appeal
- looks specifically at the validity of visual simulation surveys as a tool to understand perceptions of street trees
- aims to identify effects of tree size and proximity on residents' satisfaction.

Methodology

Introduction

Urban forestry researchers have been able to describe the attributes of street trees that residents prefer and find annoying and have begun to establish patterns of behaviour towards street trees in different situations including at a neighbourhood level, close to people's homes and in visual simulations.

However, there is little UK research in this field and understanding is further limited due to concerns about extrapolating conclusions beyond their place of origin. There are also other limitations to ongoing research related to the reliance on quantitative methods which mean there is little in-depth understanding of the relationship that residents have with street trees. Furthermore, the methodologies that have been used have not been carried out in an integrated fashion casting doubt over the appropriateness of sharing conclusions from each component.

Research specifically addresses residents' relationships with street trees in these three scenarios:

- The relationship a resident may have when regarding the overall street scene.
- The relationship a resident may have when in their house or carrying out house related activities.
- The relationship a resident may have with street trees in a visual simulation situation.

The methodology also addresses the issues raised in the literature in order to create a greater understanding of residents' perceptions of street trees. The aims of the research are thus to:

- Further knowledge regarding the factors that affect residents' perceptions of street trees.

- Consider the positive and negative relationships that exist between residents and trees in the context of the street and the nature of the value system underpinning these relationships.
- Review and utilise a range of current approaches used to determine residents' values and perceptions of street trees in relation to specific case studies of street tree populations and local street communities.
- Evaluate the impact of tree size and proximity on residents' perceptions of nearby street trees.

Figure 2 illustrates the approach used to meet these objectives.

Research design

Firstly a pilot study was carried out to address two areas of weakness highlighted in the literature review namely increasing understanding of UK residents' perceptions of street trees and developing a visual simulation method that was realistic and maintained control over the variables. These pilots were subsequently modified to inform the approach used in the case study.

One pilot study consisted of a householder survey seeking information about residents' perceptions of the tree closest to their home and was carried out to increase basic knowledge of UK residents' attitudes to street trees; as well as evaluating the usefulness of such an approach, and a summary of it is provided on page 49 (Flannigan, 2005). The questionnaire was based on previous work by Sommer *et al* (1989, 1990) but was directly adapted from Schroeder & Ruffolo (1996) who had applied it to the Chicago suburb of Downers Grove. An opportunity to compare UK and USA residents' perceptions was also thus realised by comparing results from these two papers which addressed ongoing concerns about extrapolating results beyond the location of the study area (Schroeder *et al,* 2006) and a summary of this paper is also provided on page 49.

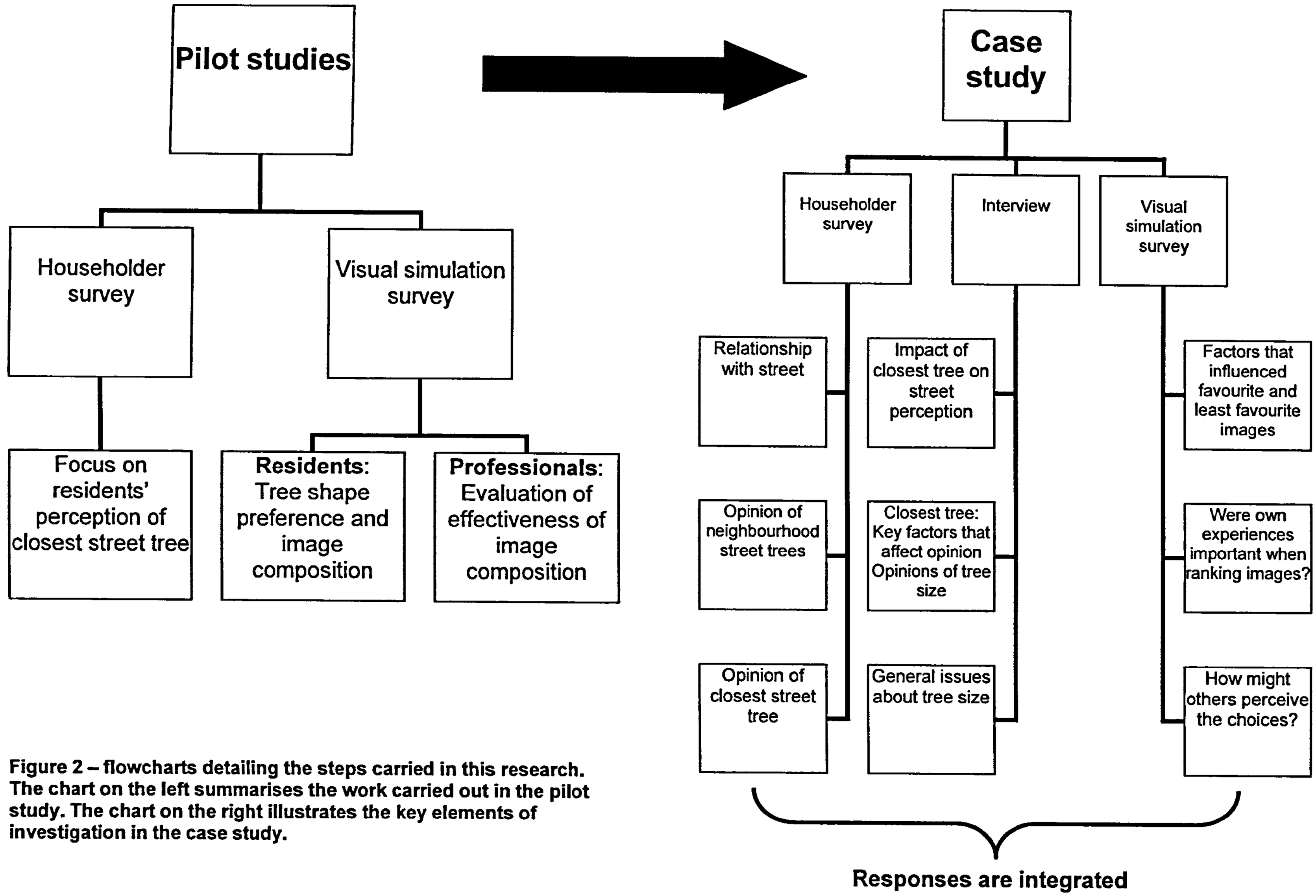


Figure 2 – flowcharts detailing the steps carried in this research. The chart on the left summarises the work carried out in the pilot study. The chart on the right illustrates the key elements of investigation in the case study.

The majority of research into attitudes to street trees close to residents' homes has been undertaken in the USA, where a generally positive attitude towards such trees exists. Limited UK research thus far suggests less positive attitudes to street trees, which is reinforced by anecdotal reports from professional Arboriculturists who describe negative opinions by residents to nearby trees. Residents from three case study areas in southwest England were questioned about their attitudes to nearby street trees by the survey method developed by North American researchers (Sommer et al, 1989; Schroeder & Ruffolo, 1996). The survey assessed residents' satisfaction with the benefits and annoyance they receive from the trees; the trees' size, shape, and growth rate. Two case studies considered regularly pollarded street trees and one case study used non-pollarded trees. Residents had a generally good overall opinion of the tree near their home irrespective of tree type, rating visual attractiveness as the highest benefit and raking fallen leaves in autumn as the most annoying feature. Annoyances were rated less significantly overall than benefits. Demographic factors appeared to have little influence on attitudes to trees although evidence was collected that found when physical ability is negatively affected by age overall opinion of nearby street trees reduces. No resident reported that the tree outside their home was too small or grew too slowly, suggesting that residents preferred smaller trees.

Summary of the pilot householder survey used in south west England (Flannigan, 2005).

Research on residents' attitudes has shown that street trees are highly valued elements of the urban environment and that their benefits far outweigh their annoyances. Much of this research was done in communities in the United States, and it is uncertain whether the findings can be generalized to other communities or countries. We compared residents' opinions of street trees, perceptions of the benefits and annoyances trees provide, and preferences for tree size, shape, and growth rate between three communities in the United States and the United Kingdom. Overall, opinions of nearby street trees were positive and did not differ between the two UK communities and the U.S. community. Respondents in the UK communities rated annoyances as more serious, shade as less of a benefit, and physical benefits as more significant than did the residents of the U.S. community. Respondents in the two UK communities also preferred smaller trees with slower growth rates. Although these comparisons cannot be used to make inferences about differences between the entire United Kingdom and United States, they do suggest some specific ways in which community characteristics such as climate and proximity of trees to houses may contribute to variation in attitudes toward trees.

Summary of Flannigan's (2005) and Schroeder & Ruffolo's (1996) comparison of householder's opinions of street trees (Schroeder *et al*, 2006).

Data from Flannigan's (2005) surveys was also compared with that from Schroeder & Ruffolo's (1996) earlier study. This was the first investigation of similarities and differences in attitudes toward street trees between residents of communities in the UK and the USA. Results indicated that overall the international conclusions about residents' high preference for nearby street trees were relevant for the UK yet differences do exist between different communities.

Visual simulation design issues

This thesis also had to address the shortcomings found in earlier visual simulation research, examples of which are illustrated below, to accurately convey the problems of this type of investigation to date.

The two images in Plate 2 are examples of those used in Schroeder & Cannon's (1983) study of street tree aesthetics in Ohio. They illustrate several of the key criticisms particularly around the issue of consistency. For example, the roads are aligned differently; the properties are of different designs; and in the lower images the overhead power lines are visually dominant. Schroeder & Cannon recorded several aspects of the images noting that features other than trees, such as bare soil and cars, influenced aesthetic opinion but the significance of these factors for residents was not addressed because of the quantitative nature of the methodology. They also noted how difficult it was to control the variability of the participants explaining how the age of the residents within their 16 randomly selected streets varied considerably.

Figure 1 — Example of a street rated high in esthetic quality. There are many large trees and no cars. The houses are mostly hidden by the trees.

Figure 2 —Example of a street rated low in esthetic quality. The newly planted trees are very small. Buildings, utility poles, and wires are in plain view.

Plate 2 – these images from Schroeder & Cannon (1983) illustrate common limitations around the issue of consistency. For example, the roads are aligned differently; the properties are of different designs; and in the lower images the overhead power lines are visually dominant.

The set of images below are from Sommer *et al* (1993a) and illustrate a sample of the 80 photographs they used in their study comparing the different methods used to ascertain responses to street trees (Plate 3). Participants were required to rate them for visual aesthetics, shade and overall suitability to ascertain whether species influenced perceptions of these factors. Similarly to Schroeder & Cannon (1983) these slides show how difficult it was, despite their efforts, to control the variables. For example, the Fern pine image contains an overhead power line whereas the Chinese hackberry does not and as Schroeder & Cannon (1983) have described this has a significant influence on image perception. Participants in this part of their research were also students and it is possible that this group of respondents have

yet to face issues around property maintenance and therefore perceive the relationship between street trees and property differently than house owners.

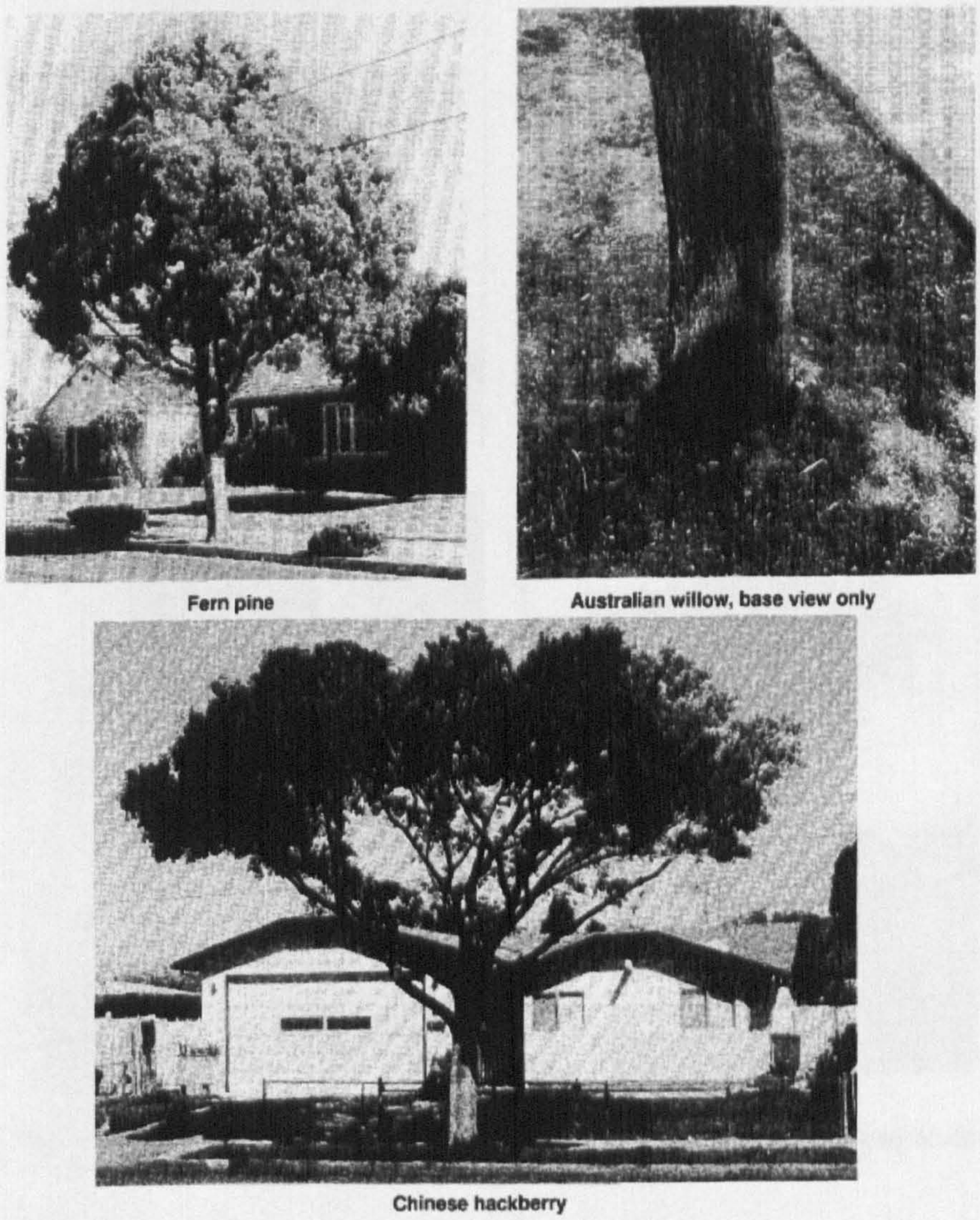


Figure 1. Examples of trees shown to students via slides to obtain species ratings.

Plate 3 – examples of images used by Sommer *et al* (1993a) which demonstrate significant variability of content.

Williams (2002) asked randomly selected participants in Melbourne to assess trees in a series of 36 slides for size, form and foliage. The images in Plate 4 further illustrate the difficulties of controlling variables where in the examples image quality is affected by overhead power lines in the photographs internally labelled Figures 3 and 5 but not in Figures 4 and 6.

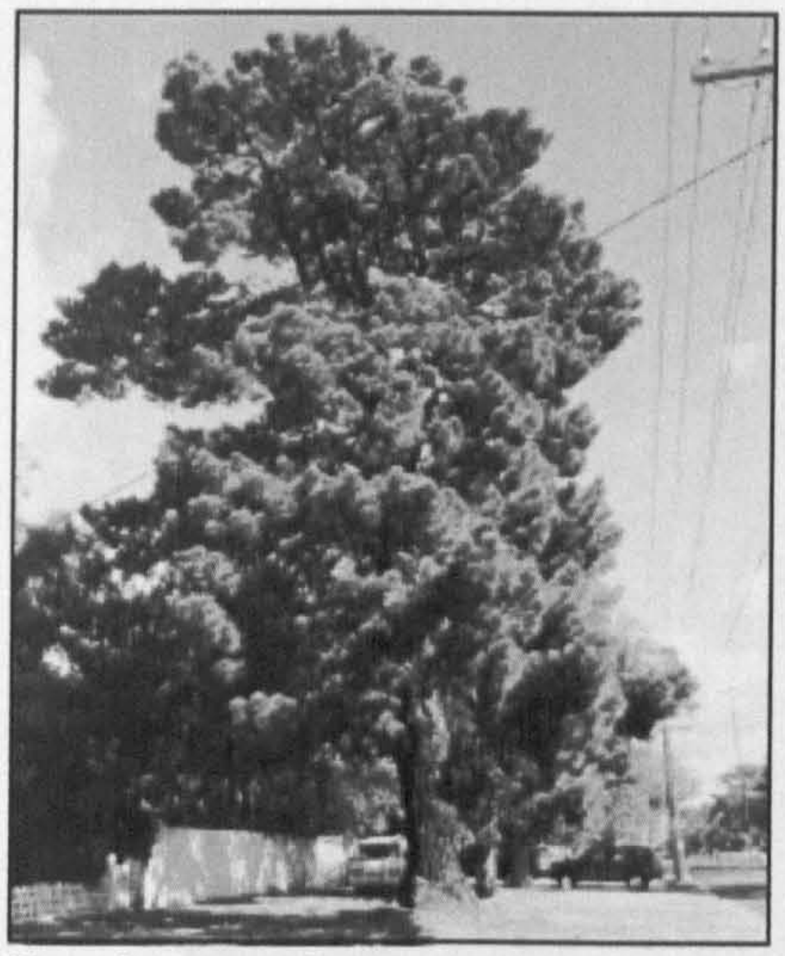


Figure 3. Category 3.

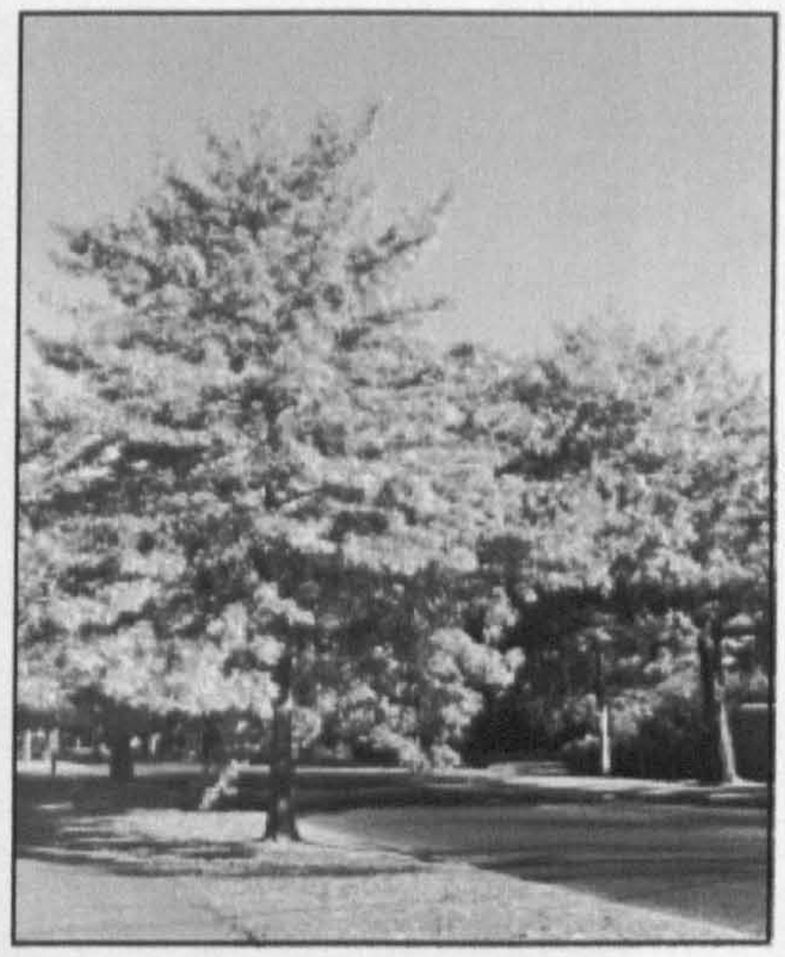


Figure 4. Category 4.

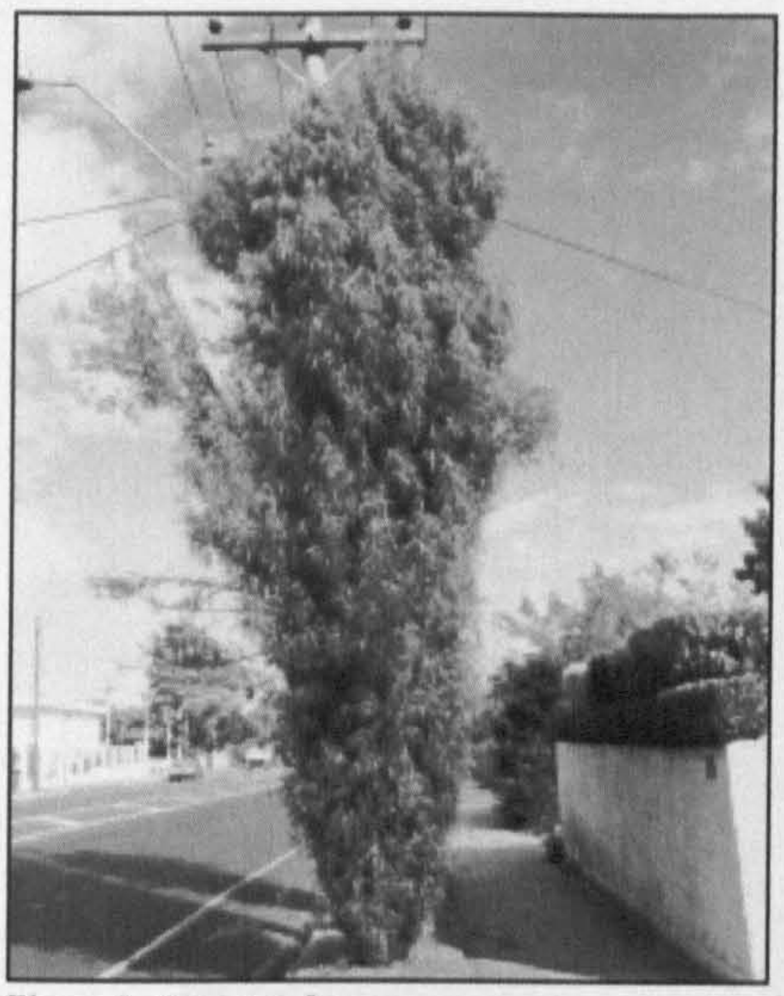


Figure 5. Category 5.

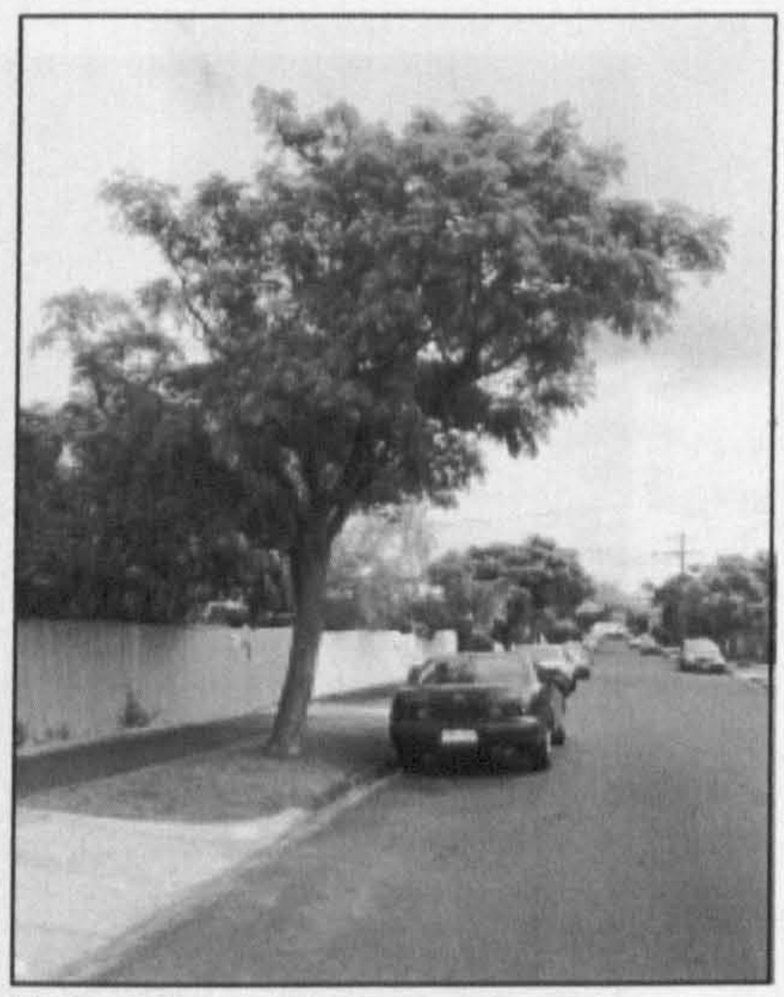


Figure 6. Category 6.

Plate 4 – examples of images from Williams (2002) demonstrating visual inconsistencies

Orland *et al* (1992) introduced digitally enhanced photographs into street tree research (Plate 5). Although their focus was on people's perceptions of property values their work opened the door for better control over the street variables. Despite the poor quality of this reproduction it is possible to see how this technology allows the tree variable to be manipulated.

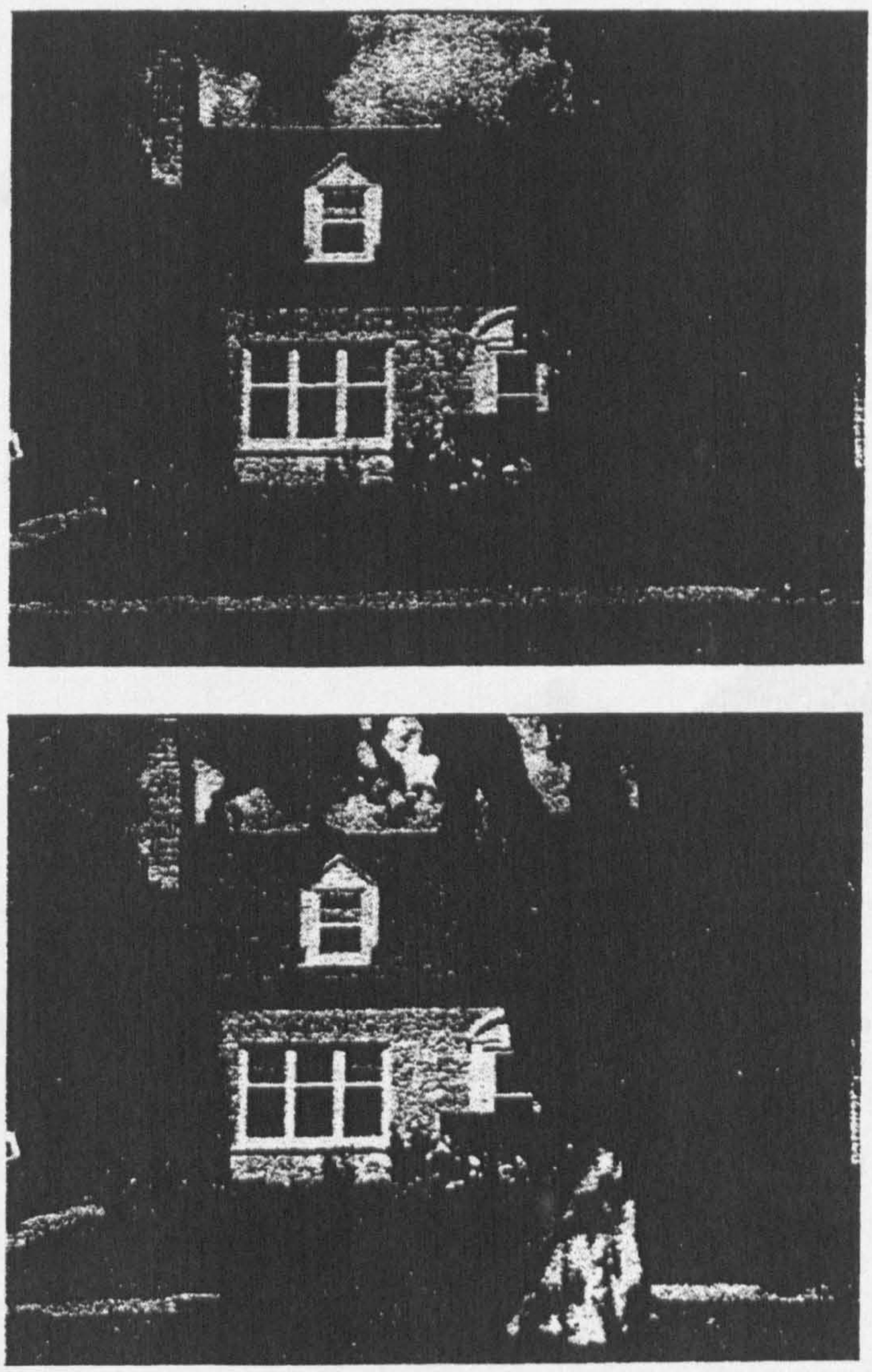


Figure 1: Typical Image: Original View and Manipulated View With Large Tree Added

Plate 5 – it is possible to make out the added tree in the bottom image (right foreground) demonstrating how Orland *et al* (1992) used digital photography to resolve issues around variability of image content.

Sommer & Summitt (1995) used line drawings to maintain control over the variables when attempting to evaluate perceptions of tree shape and size. As Plate 6 demonstrates this objective was successfully met but at the significant cost of a loss of realism when compared to photographs. With people's perceptions of trees appearing to be based on a wide range of tangible and intangible factors including visual, aural and olfactory impacts such a loss of realism could encourage viewers to view these images as abstract ideas rather than associating them with their day-to-day experiences of trees.

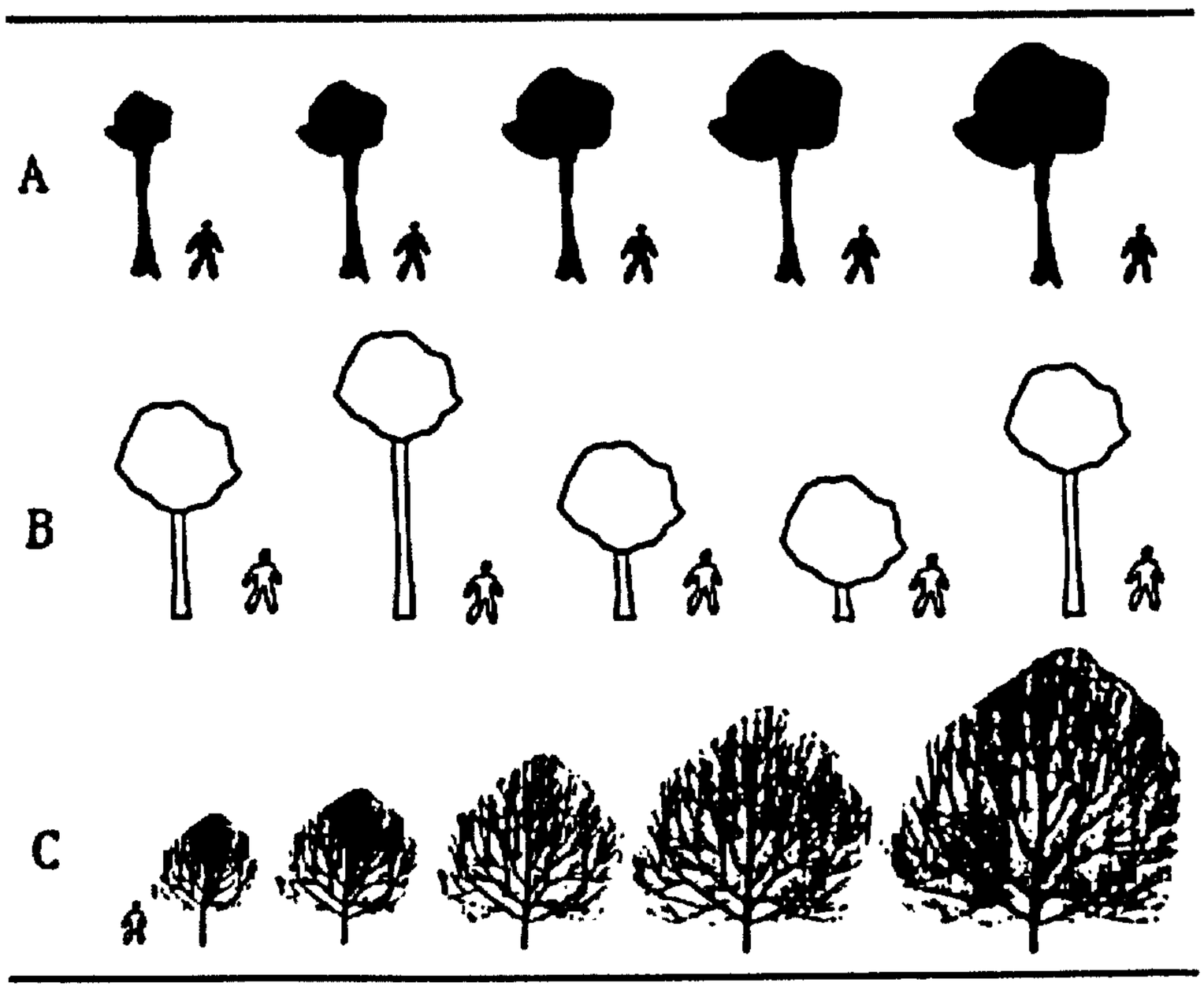
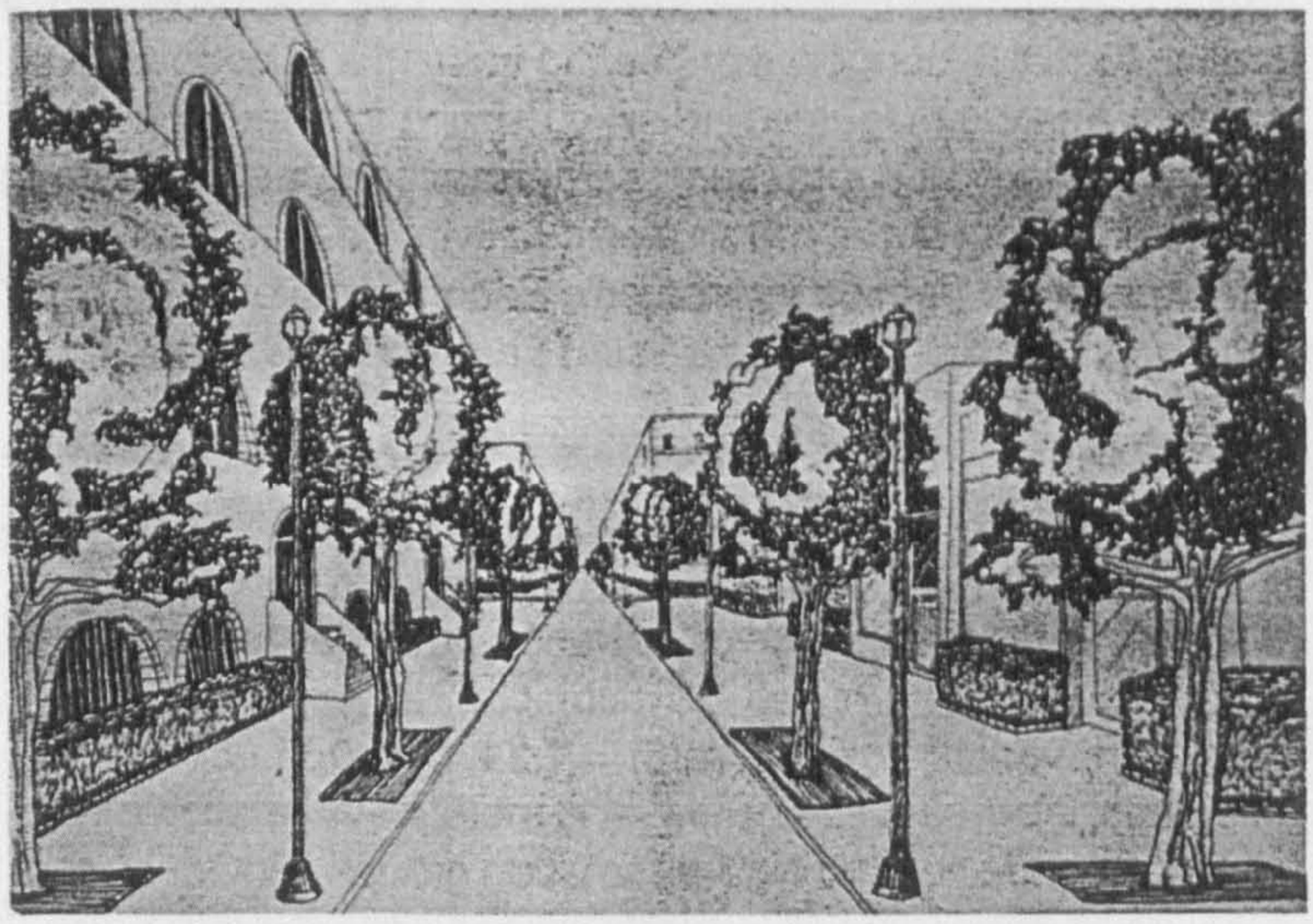


Figure 1: Tree Icons Used in the Research

Plate 6 – line drawings used by Sommer & Summitt (1995) demonstrating the lack of realism of this method

Sheets & Manzer (1991) also used line drawings and it is possible to see the same issue (Plate 7).



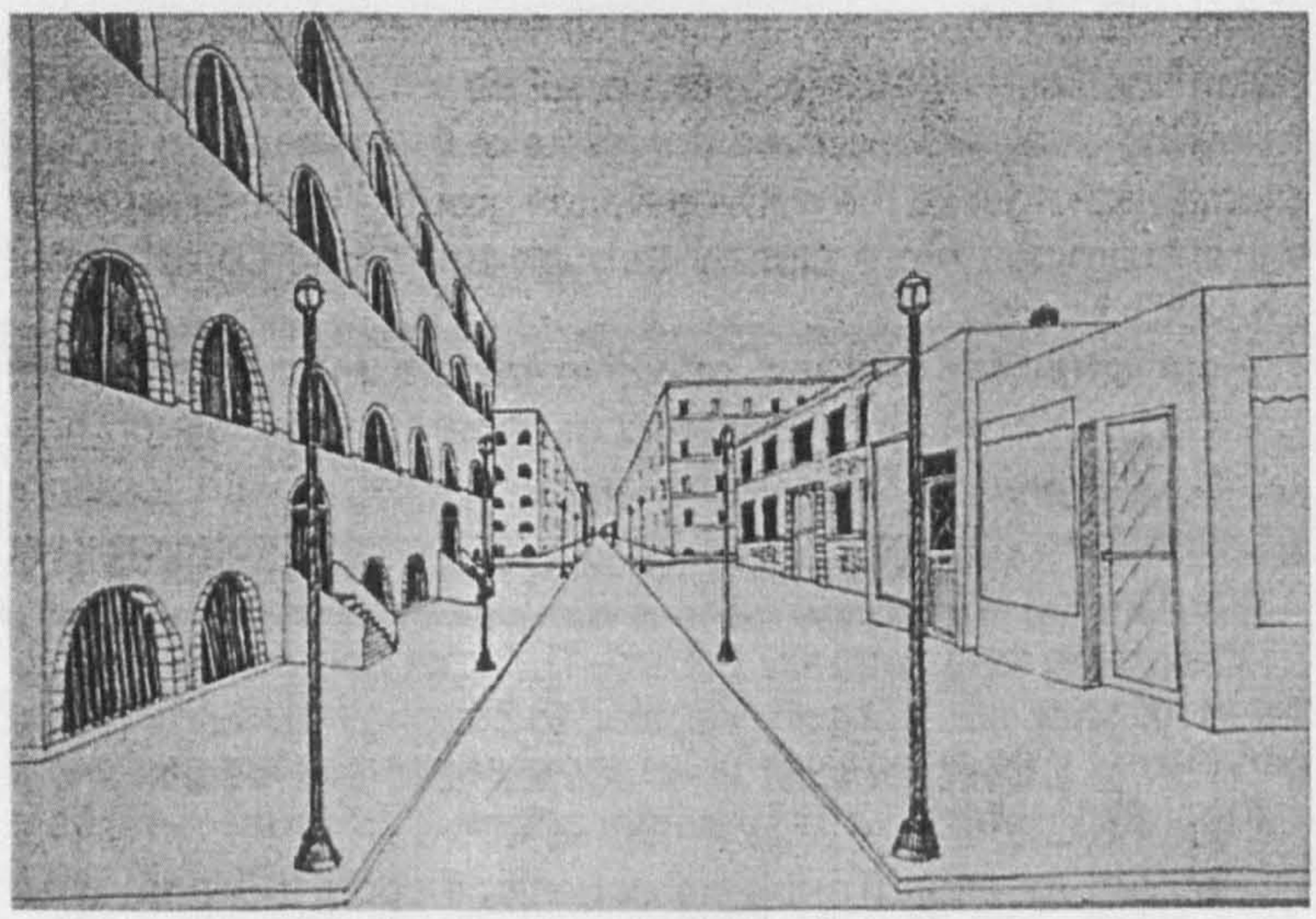


Figure 1: Slides Used for the No-Vegetation and High-Vegetation Conditions for Experiment 1

Plate 7 – a further example of the loss of realism from line drawings (Sheets & Manzer, 1991)

Because of the lack of such visual simulation research in the UK, and the reliance on non-digital image methods, which lacked control over the variables, it became necessary to develop a method for use in the UK. Two pilot studies were carried out specifically to develop Orland *et al's* (1992) digital photograph approach. The first pilot involved a survey of residents in a suburban street in Weston super Mare whilst the second pilot was carried out at the Arboricultural Association National Conference, 2005.

Visual simulation pilot survey – Weston super Mare

This pilot study relates to a cul-de-sac location that had once been lined with cherry trees but which had all been removed by the local Council to prevent claims being made for trips or damage to property caused by the cherry tree roots. When the final few trees were felled a delegation of residents demanded re-planting which the Council agreed to do following more detailed local consultation.

Survey forms were subsequently sent to all 47 properties in the street asking the inhabitants to make a choice of replacement tree. The survey showed four images on one sheet of A4 paper (Appendix C, Slide M) and asked residents to rate them in order of preference. The pollarded tree (Appendix C, Slide M; Image 2) was familiar to residents because the surrounding streets contained such trees. The images therefore contained a range of generic tree shapes considered suitable for that location which represented trees of different sizes so residents were able to consider what the future would hold in terms of their growth.

By using the background image of their street with different tree types superimposed meant that residents could make a judgement about how their street would look as the trees grew into the future. No special equipment or techniques needed to be used to acquire the background image except a digital camera. The images of the trees were created using Adobe Photoshop, based on shape rather than species with the three main types shown namely columnar and spreading alongside the locally common pollard.

Thirty five responses were returned from forty seven surveys sent out for a response rate of almost 75%.

Table 3 provides a summary of the responses to each of the images. Although not everyone commented on each tree, which is why the totals are not all the same, Image 1 was clearly the most favoured tree.

Image	Preference	Total responses recorded
1 Columnar shaped tree	Most pleasing to the eye	27
	Second most pleasing to the eye	2
	Least pleasing to the eye	2
2 Pollarded shape	Most pleasing to the eye	2
	Second most pleasing to the eye	3
	Third most pleasing to the eye	10
	Least pleasing to the eye	10
3 No street tree present	Most pleasing to the eye	2
	Second most pleasing to the eye	6
	Third most pleasing to the eye	10
	Least pleasing to the eye	9
4 Spreading shaped tree	Most pleasing to the eye	3
	Second most pleasing to the eye	14
	Third most pleasing to the eye	5
	Least pleasing to the eye	5

Table 3 - Summary of residents' preferences for the images shown in the visual simulation survey pilot study in Weston super Mare.

Crucial for the development of the visual simulation survey methodology was the way in which residents accepted the images as suitable surrogates to the real world by demonstrating that they were able to make informed decisions based on the scenes. Testing this method to evaluate residents' opinions of street trees in a situation where the outcome would affect their lives added a degree of authenticity to the images that would be difficult to achieve otherwise.

Pilot study – Arboricultural Association Conference, 2005

A larger collection of slides were prepared using the same methodology described above incorporating four separate images containing different street tree types but each with the same background, onto one slide (see Appendix C, after Slide M, for an example of one of these slides). Forty one slides were subsequently shown to delegates at the Arboricultural Association National Conference at Exeter in 2005

where volunteers completed a survey ranking images in order of preference during a lunch interval.

The trial showing of these images indicated that participants could rank the four images in order of preference supporting the results of the earlier trial. Another important issue was also resolved about preparing the content of the slides so that meaningful results can be achieved.

Although Conference participants were able to rank the images in order of preference it was not possible to pinpoint, when analysing the results, why images were preferred because the mix of images meant that it could be either tree size or tree shape. This discovery was particularly relevant because research was investigating whether tree size and other spatial features influenced residents' values of street trees.

The set of slides that would be shown to residents in the study area would therefore have to enable effective analysis but also be relevant, in the context of residents' experiences with street trees. This would assist with investigations whether residents had a different relationship with street trees in a visual simulation context. Images used in the case study were therefore modified to address the shortcomings highlighted in the Arboricultural Association element of the pilot study.

Case study: addressing the three relationships

The next stage involved developing a process that could interrogate residents' in-depth attitudes to street trees paying particular attention to three identified relationships from the literature namely with street trees in their neighbourhood, their closest tree and when evaluating street trees in visual simulation surveys. A survey method was thus prepared that would enable residents to provide detailed responses. See Figure 2 for a summary of this approach.

McLean *et al* (2007) have criticised the focus on quantitative research into attitudes to urban trees noting that the opportunity to gain far richer data has been missed, particularly when considering the unknown, but potentially limitless, interactions that

exist between people and street trees. Examples of such include changes due to the seasons, different times of day and spatial qualities of the tree and the street layout.

This thesis recognises McLean *et al's* (2007) recommendation for more in depth understanding of residents' perceptions of street trees but at the same time acknowledges the paucity of basic data of such perceptions on the UK. A methodology has subsequently been adopted to address both these factors by combining qualitative and quantitative methods. Thus a systematic, quantitative approach, utilising the detailed background work carried out by Sommer *et al* (1989) would be productive because it would enable direct understanding of key issues thereby addressing the veracity of the 'I love trees but...' phenomenon described in UK publications, which is so at odds with the international literature.

Supplementing this quantitative data with qualitative description would enable a much fuller description of residents' perceptions helping to derive a full and meaningful understanding of the relationships between residents and street trees (Jones, 2004).

It is important to note that whilst the literature has described a tried and tested quantitative householder survey to gain an understanding of residents' preferences it was still possible that the questions, particularly around annoyances and benefits, might not apply in the UK context.

Although the literature describes an overall positive experience of street trees in-depth experiences at an individual level are less well known and are, potentially, likely to be the product of the individual's circumstances. An in-depth investigation of individual's values needs to be carried out to identify the conditions under which these relationships function.

Residents were subsequently subjected to an approach using several protocols designed to elicit detailed information about nearby street trees. A hand delivered householder questionnaire, containing open and closed questions, sought to find out residents' attitudes to nearby street trees, the context in which these trees contributed to the liveability of their street and basic demographic information.

Residents were also able to volunteer for a follow up, semi-structured, interview and a visual simulation survey to enable a deeper exploration of their values and perceptions related to the potentially different relationships they might have with nearby street trees.

The streets

The street is considered as a focal point of the study being a key element of the local community providing the physical environment which offers opportunities for residents to meet their needs and desires. It contains the individual homes of the residents, whose values research is seeking to understand, and links people in a common framework. People recognise the street as a unit of their home and become attached to it so residents therefore have an interest in their home but also their street (Appleyard & Lintell, 1982). The participants of this research are therefore people living in a residential area, surrounded by a population of street trees.

Key variables that were considered to influence outcomes within this environment, in terms of the three relationships, were identified as street layout, street trees, property type and the residents' demographics.

A homogenous group of residents would enable research the opportunity to carry out meaningful comparative analysis between residents particularly because research was not only seeking individual's values of their closest street tree but also the trees experienced by their neighbours and others in their street.

It was also considered important that the spatial dimensions of the streets and property types were similar so that all residents lived as equally close to the trees as possible further reducing opportunities for variability.

Another key factor was the street tree population where each selected street needed to contain street trees of noticeably different size to the others. Residents' perceptions could therefore be related to the dominant tree size class in the road where they lived.

Such streets would enable an analysis of responses to similar trees for individual residents, create the opportunity to compare how residents perceived their street and would create a base on which to compare how residents evaluated the visual simulation survey.

It was therefore desirable to match, as close as possible, a range of tree sizes with a homogenous group of residents. Areas were therefore sought in a convenient nearby city which contained approximately 20,000 street trees thereby making the existence of a suitable study area more likely.

Streets were therefore sought with the following attributes considered important;

1. Streets had to be adjoining.
    a. This increased the likelihood of the area containing residents with similar demographics.
    b. Surveying would be more convenient.
    c. It was more likely that adjoining streets would be of similar spatial layout and architectural style.
    d. Residents would relate to the wider concept of their neighbourhood.
2. Separate streets had to contain a dominant tree size
    a. This increased the likelihood of controlling the tree size variable to analyse its effect on street tree perception.
    b. It was recognised that a feature of residential streets is the mosaic of tree cover and species so overall dominance of a particular size was considered most important.

Subsequently four streets, aided by advice from the Local Authority arboriculturist, were identified which matched these criteria (Map 1). Table 4 describes the dominant tree size class in each of the streets.

Street*	Minimum height	Maximum height	Height Range	Mean height	Crown area (m^2)†
A (N = 17)	9.39	13.47	4.08	11.03	63.38
B (N = 24)	4.05	14.33	10.28	9.24	45.66
C (N = 27)	2.10	9.36	7.26	5.78	22.17
D (N = 2)	11.76	12.28	0.52	12.02	51.04

*Two trees were removed between the time of the general tree survey, undertaken at the same time the survey forms were hand delivered when trees were simply plotted, and the more detailed survey of tree measurements, hence total number of measurable trees in this table equalling 70.
† These figures represent the mean crown area described in more detail in the Methodology chapter
Table 4 – summary of tree dimensions in each of the four streets (metres)

Streets have been assigned a letter, rather than using their name, to maintain confidentiality for the respondents. Where maps and images are used features that would help to identify the location of these four streets, and therefore individual respondents, are also obscured.

Measurement of tree size and proximity to buildings

Tree size and proximity to property are important variables within this research. The following describes how the tree measurement methodology was developed and applied. Of critical importance was the need to determine what this research means when it describes 'tree size' particularly since the literature has shown how researchers have not yet agreed a standardised method.

Tree size must therefore be approached in a way that provides clear meaning and can be consistently measured in any situation. To support this objective the surveys will actively seek to find out what residents think about when they describe tree size by asking them to articulate their opinions of street tree size, both near to their home and in their neighbourhood, and then comparing responses with accurate tree size measurements.

Standards for tree mensuration are focussed primarily at forest trees where the focus has been on calculating timber volume (Hamilton, 1998). Trunk diameter is the most frequently used tree measurement operation carried out by Arboriculturists

because of legislative and best practice demands (British Standards Institute, 2005; National Joint Utilities Group, 1995; Town and Country Planning Act, 1990).

Trunk diameter is also straightforward to measure (Hamilton, 1998) and can help provide a reasonably accurate indicator for tree height, with which it correlates, but this is not always true for trees in the urban environment where management through pruning can dramatically reduce the trees' canopy affecting growth rates. Although Schroeder & Cannon (1983) used trunk diameter to differentiate tree size it is not considered robust enough to reflect actual tree size because of the consequences of pruning.

The following describes how tree size is measured in this thesis.

Tree size is a three-dimensional phenomenon affected by height, trunk diameter, height of lowest branch and the spread of the canopy and these dimensions can appear to be different depending on the place from where the tree is viewed. Crown spread may appear to be narrow when viewed in one plane but much wider when viewed from another, for example.

Decisions therefore had to be made about which size attributes would be recorded and this was reduced to two factors namely tree height and 'canopy area' parallel to the property. The option was also available that, if residents raised particular size issues unrelated to these two, they could be measured at a later date.

Tree height was chosen because it is straightforward to measure (Hamilton, 1998) as well as being an easily recognisable dimension. Tree attributes that appear to be favoured by residents such as blocking unwelcome views and casting shade (Flannigan, 2005) are directly related to tree size of which height clearly plays a role.

Tree height was measured using a LaserAce® hypsometer, a handheld instrument which uses Class I eye safe laser technology to measure tree diameters, tree height and log volumes, and which is specifically designed for one-person operation.

The height of each tree was measured three times using the method described in the equipment instructions and the recorded height was the mean height of these measurements. This technique was used to reduce errors that may have arisen when visually selecting the highest point of the tree from the ground during the measurement process.

Linked to tree height measurement is the dimension of 'canopy area'. This describes the surface area of the canopy that residents face when looking at street trees from their home and is essentially a two-dimensional feature. It is this part of the tree that dominates the field of vision from the perspective of a window or when in the garden and gives more relative guidance to actual size of the tree compared to linear measurements such as height.

'Canopy area' was calculated using two dimensions measured from the opposite side of the road to the tree. The maximum canopy width (commonly known as the drip-line), parallel to the properties was measured using the LaserAce® hypsometer. This measurement was then multiplied by the recorded height (less the height of the trunk) to create the 'canopy area' measurement (see Plate 8). Such an approach resolved practical issues by removing the time consuming need to accurately trace the outline of each tree and prevented the need to gain access agreements with all residents in the case study area to measure the trees when viewed from the property.

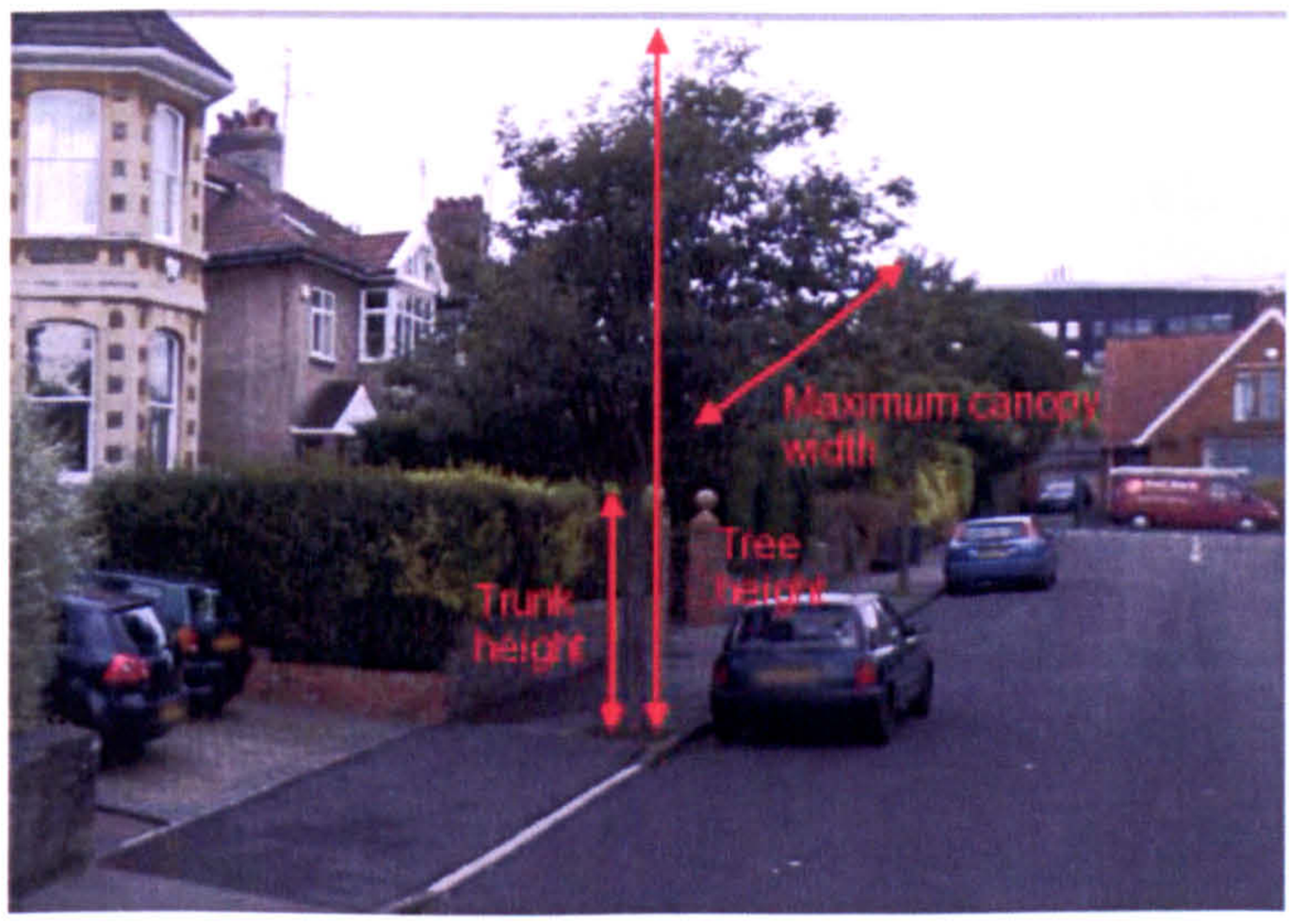


Plate 8 – illustration of the dimensions used to measure 'canopy area'.

Tree proximity

Whilst tree dimensions are absolute residents' perception of their proximity to the tree is considered to be a relative issue. Researchers have sought to find out what residents perceived as the ideal tree spacing in their street (Kalmbach & Kielbaso, 1979) but have not clearly described the spatial relationship between survey respondents and their nearest tree in survey questionnaires (Sommer *et al,* 1990; Schroeder & Ruffolo, 1996) or visual simulation surveys (Schroeder & Cannon, 1983; Sheets & Manzer, 1991).

More recently Gorman (2004) described residents' street tree preferences in context with the proximity of the trees and noted that differences existed in opinions of nearby street trees depending on whether they had a tree planted directly outside their house or not.

Due to the lack of a systematic method to address how street tree proximity may influence values of nearby street trees in the UK the following approach was undertaken. Residents were asked to state whether there were trees in the pavement near their home and secondly whether there was a tree outside their home. This served the purpose of allowing participants to determine their spatial relationship with street trees rather than the researcher doing so.

In addition to the collection of tree dimensions the street trees in Streets A – D were also plotted (see Maps 2 – 5) and their species recorded (see Table 9).

Research subjects

The key characteristic of the participants was that they had to be residents of this neighbourhood and the population size for this research was therefore limited to the number of separate properties in these four streets.

The survey, and follow up interview, was designed for one member of each household to complete due to time and resource constraints. Future research could gain even more information if it approached every member of each property.

Data collection methods

A quantitative approach was used specifically in the pilot studies to gain an understanding of UK residents' attitudes to street trees (Flannigan, 2005) and further to introduce a meaningful comparison between USA and UK residents' preferences (Schroeder *et al*, 2006).

Whilst these papers provided useful information about residents' preferences they did not provide sufficient detail about their experiences or values around street trees. McLean *et al* (2007) have described how quantitative research has dominated the Arboricultural literature and this has resulted in a lack of deeper understanding about how '*political, social, cultural and socioeconomic factors'* influence residents' perceptions and values.

The following data capture methods have been used to investigate how individuals perceive street trees from the three potential relationships that have been identified earlier. The methodology also addresses whether tree related parameters such as size and physical location influence these attitudes (Figure 2 for a summary of the approach).

The method undertaken in this research was thus to develop a structured approach to data collection, utilising householder questionnaires and interview techniques, because of the scarcity of data available about residents' interactions with nearby street trees. This structured approach directs respondents towards specific issues, in this case not only how they perceive nearby trees, but also those in the street and responses to visual simulation surveys.

Moreover, the particular approach adopted here included opportunities for residents to express their own opinions in open-ended survey questions and free discussion at the end of the semi-structured interview.

An alternative unstructured method would allow for detailed discussions with issues being developed and analysed more deeply but this would be at the cost of overall

achievability because this approach is costly in terms of time (Sommer *et al*, 1990) thereby affecting the ability to meet the wider objective of the research, which was to analyse attitudes to street trees in a number of different milieu.

The chosen data collection methods, using semi-structured interviews and questionnaires, therefore allows information to be collected that enables comparisons to be made between residents for each of the three different relationships but limits the amount of in-depth data which can be derived from a less structured approach.

The following three, integrated, approaches were therefore adopted.

Householder survey

The householder survey sought residents' views about street trees near their home and in their street posing a series of closed questions to generate quantitative data about preferences and perceptions alongside open ended questions whose purpose was to seek more qualitative data thereby gaining a deeper understanding of residents' values. This mix of question types was considered necessary because research is so sparse in this field that new data will add to greater understanding of important issues.

The householder survey was posted to each individual property in the study area using address details collected from the Local Authority's website. Gorman (2004) addressed his surveys to individuals and received a response rate of 36% whilst Flannigan (2005) had addressed his surveys to 'The Resident' and achieved a response rates close to 60%. Surveys were subsequently addressed to 'The Resident' and contained a cover letter, the survey form and a stamped addressed envelope to return it (see Appendix A for letter and survey).

The questionnaire was modelled on the one developed in the pilot study (Flannigan, 2005) which itself had followed work by Schroeder & Ruffolo (1996) and Sommer *et al* (1990).

There were however, crucial changes made to this survey in order to help address, in more detail, residents' perceptions of street trees and these involved focusing on the different ways residents interact with the trees in their street.

The survey was thus designed to tackle key issues namely:

- Understanding the context of residents' responses in relation to street trees
- Investigating residents' perceptions of street trees in their road
- Investigating residents' perceptions of their nearest street tree
- Collecting basic demographic data

Questions were included that were intended to build up a level of knowledge about residents' perceptions of street trees and how these trees affected their lives whilst drawing out deeper values held towards street trees.

A key part of the survey was encouraging respondents to determine their relationship with street trees by directing them to establish whether they thought they lived in a tree lined road and whether they perceived a street tree as being outside their home or not. Responses to this could be later analysed against the actual layout of trees in their road. Such an approach was crucial for investigating the spatial questions raised earlier.

Residents' opinions of their street

It was important that respondents' opinions of street trees could be analysed in context with their overall perception of their street. Two questions focused on residents' opinions of their road. The first closed question asked them to rate how they liked living there, linked to an open question asking how they felt about living in their street describing both good and bad points.

McLean *et al* (2007) noted that a quantitative focus (e.g. Wolf, 2005) can establish that vegetation is important but it cannot determine its importance in relation to other factors such as accessibility or parking.

These questions were also important because they would help establish the homogeneity of the respondents in respect of their perception of their street through analysing responses.

It was also considered important to see if it was possible to understand what residents felt about street trees as a concept irrespective of their personal circumstances. They were asked to respond to a statement that *"trees growing in the pavement make streets nicer places to live in"* followed up with a request to describe in more detail the things that influenced their opinion.

Such questions would also provide more information about the homogeneity of the population and, crucially, they might also tease out whether residents have different opinions of street trees in general compared to trees close to their home and in their own street.

All respondents were also asked to describe how they felt about a list of tree benefits and annoyances rating them on a Likert-type scale derived from Flannigan's (2005) earlier study. This question was included because it is a popular element of related research but it is not known whether the attributes are relevant in the UK context despite its seemingly successful use (e.g. Flannigan, 2005).

The survey allowed respondents to describe whether they considered that they lived in a street with street trees or not. This was included to evaluate whether people in the same street had the same opinion of its '*treed*' nature.

Those that described living in a 'tree-less' street were directed to a separate section of the questionnaire where they were asked whether they would like trees planted outside their house. Respondents were then asked to give five reasons, in order of importance, explaining their decision about wanting a street tree planted directly outside their house or not.

Respondents who affirmed there were trees in the pavement near their home were asked a different set of closed questions relating to their perception of trees in their

street. These focussed on perceptions of the size of the trees in their street, their rate of growth, their attractiveness and how well the Council maintained them.

Investigating residents' opinions and values about nearest street tree

Respondents who had affirmed that there were street trees in their road were also asked to decide whether they had a tree directly outside their house or not. This was included to allow residents to describe their perception of this rather than relying on the researcher to determine any spatial relationships. As Gorman (2004) had found, residents' perception of their proximity to street trees reflects characteristics other than the physical layout of the property and street tree components.

Residents were subsequently asked further closed questions about their perception of the closest tree's size, their overall opinion of it and how they felt about its proximity.

Participants were also asked to describe, in an open ended question, the things that influenced their overall opinion of the tree closest to their home.

Demographic data

Respondents were asked to provide basic demographic information regarding their age, education, salary, gender and length of residence. The purpose of this information was not to use it for carrying out comparisons using statistical tests but to evaluate whether respondents were, overall, homogenous, as was the intention of selecting streets that were geographically close.

Interviews

Interviews were used to explore more deeply specific issues from the householder questionnaire survey and the visual simulation survey. Interviews were considered to allow a better understanding of residents' experience of living alongside street trees within that environment. Interviewees were self-selected having stated in the householder questionnaire that they could be contacted again.

It was important that the interviews were carried out in the same time of year as the questionnaire to keep seasonal differences to a minimum. Time constraints meant that interviews could not be carried out during the same summer in which the questionnaires were completed so they were carried out one year later. This increased the possibility that interview volunteers could move away or forget the whole matter.

Potential changes in residents' opinions in the intervening period would provide valuable information because the reasons for any such change could be explored. This decision to delay was also taken in the knowledge that the Local Authority did not intend to prune these trees during that period. It was considered most appropriate to keep the landscape as constant as possible, particularly trees in full leaf, when interviewing as would have been the case when the questionnaire was completed.

All interviews were recorded, with the prior consent of the participants, and later transcribed *verbatim* in order to avoid omitting any key information whilst simultaneously allowing the interviewer to focus on the interviewee.

Letters were sent to residents that had agreed in the survey, asking if they would like to be interviewed, at their house, and a series of appointment dates were included with a stamped addressed envelope for potential interviewees to specify a preferred time and a date for their interview. Letters of confirmation were subsequently posted to each interviewee confirming their appointment details.

A semi-structured interview technique was used with interviewees facing the same set of questions, in the same order but being free to discuss each point as they saw fit (see Appendix B for interview request letter and schedule). With such little information available about residents' in-depth perceptions of trees this approach allowed for a focus on key issues whilst providing the option for comparing and contrasting the responses (Lindlof & Taylor, 2002). Such was considered the greatest priority at this stage of information gathering and future research will be able to build on this thesis using less structured interviews.

Particularly the semi-structured interview allows for the responses between interviewees to be evaluated alongside each other and this was considered important because information was sought about people's relationships with street trees in different settings so meaningful and comparable information was required to establish any common issues. This was especially critical because responses would also be evaluated in context with each individual's own spatial relationship with nearby street trees.

The interview schedule

The interview was divided into specific areas of questioning and these are described below along with their rationale.

It was considered necessary to actively explore to what extent street trees influenced residents' values and opinions in other areas of their life. Interviewees were therefore asked to describe how much street trees contributed to their opinion about living in their street.

The interview complemented the householder survey by giving residents the opportunity to discuss several issues more deeply, for example, the key attribute about the tree that most influenced their opinion. Interviewees were therefore asked to describe the things that would make them change their overall opinion of it. Such questioning should unravel key attributes.

Investigation of values around tree size is also an important component of this research. Previous researchers have described specific tree size characteristics (Kalmbach & Kielbaso, 1979; Schroeder & Cannon, 1983; Williams, 2002) but it is not clear whether these are ones that residents would recognise. Despite residents clearly being able to describe tree size in terms of relativity, such as 'just right' (Schroeder *et al,* 2006), researchers have yet to describe how residents calculate tree size to come to this type of decision. Interviewees were subsequently asked to explain what they thought about when considering tree size.

Related to this line of questioning interviewees were asked to explain whether the context of the tree affected their evaluation of tree size. For example, would they consider that their perception of the size of a tree was dependent on where it was growing? This was intended to elicit further detail about the ways in which residents might react differently to trees depending on the circumstances of their interaction with it.

The final interview question asked residents who should make the decisions about managing street trees because it is not known whether residents' generally high ratings of street trees reflects a superficial appreciation or includes a more profound relationship where wider issues such as management and liability were also part of their thought processes.

At the end of the interview respondents were encouraged to enter into a conversation about street trees, initiated by the interviewer offering some background information about the research and then encouraging a discussion about whatever subject the interviewee chose about street trees.

Visual simulation survey

Visual simulation surveys have been a recognised technique for investigating attitudes to street trees (Kalmbach & Kielbaso, 1979; Schroeder & Cannon, 1983; Sheets & Manzer, 1991; Sommer *et al,* 1993; Williams, 2002) although not in the UK.

These visual simulation surveys had also used techniques that included a range of variability (e.g. Schroeder & Cannon, 1983) or lacked realism (Sheets & Manzer, 1991). For example, Kalmbach & Kielbaso (1979) reported that,

"*Difficulties were experienced in obtaining perfect matches* [of paired photographs]"

Orland *et al* (1992) used visual simulation methods as a surrogate for equivalent real-world settings and argued that their image-editing method proved useful in allowing the easy manipulation of the study variable. However, this approach does

not appear to have been used since within the field of evaluating responses to street trees using images (see Williams, 2002).

Schroeder & Ruffolo (1996) noted that,

"The evaluations of visual quality of streets in these studies have usually been made by people who do not actually live in the neighborhoods or communities shown in the photographs."

In addition, researchers have used groups of participants to evaluate such scenes who were least likely to have held the responsibility of property ownership such as students (e.g. Sommer *et al,* 1993) and therefore have little understanding of the impact of the whole range of annoyances

Orland *et al's* (1992) approach of manipulating digitised images makes it possible to create data sets in which numerous original images can be subjected to a variety of treatments, enabling researchers to increase the validity of their findings and to generalise their findings to a broader range of settings.

Visual simulation surveys in arboriculture have been used primarily to understand preferences. Schroeder & Cannon (1983) described how other factors influenced preference ratings when considering images containing street trees including vegetation in gardens, number of cars and other items such as overhead wires. Digitally prepared images ensure that the street scene remains constant whilst the only variable becomes the street tree thereby reducing this effect.

Slide characteristics

Table 5 summarises the key issues to address in order to develop and enhance the visual simulation surveys described in the literature.

Item	Literature review findings	Visual simulation approach for Streets A – D
1	Kalmbach & Kielbaso (1976) Schroeder & Cannon (1983) and Sheets & Manzer (1991) all found that streets without trees were least preferred.	The survey would contain images with no street trees to test this outcome in a UK setting.
2	Schroeder & Cannon (1983) found that variation in opinions could be attributed to variables such as power lines and cars.	Digital photography will be used enabling software techniques to remove unwanted variables and to allow trees to be superimposed on identical backgrounds
3	Sommer *et al* (1993) found that slide presentations were appropriate for gauging visual assessment of a scene but not for the physical impact that trees cause especially root related. Viewing slides appears to distant respondents from the physical element of street trees.	Digital photographic techniques allows for participants to be able to rate images of the streets where the live therefore relating the scenes to their home life. The associated interview allowed deeper analysis of the context in which the participants made their image choices.
4	Individual circumstances, frequently only reported as demographics, have not provided any consistent response to understanding attitudes. Flannigan (2005) has found evidence that indicates that physical ability may be a factor that influences attitudes to trees.	Carrying out the visual simulation survey at the same time as the interview gave respondents the opportunity to raise issues about the factors that influenced their image choice.
5	Summit & Sommer (1999) found that tree size preference appeared to be related to the context of the image being viewed. Smaller trees were preferred in built up scenes and larger trees in rural scenes.	Different tree sizes were superimposed over the background images.
6	Summit & Sommer (1999) describe how certain tree shapes are preferred.	A variety of tree shapes were used.

Table 5 - A summary of the visual simulation techniques used in the street tree literature and lessons learned to improve the case study visual simulation survey in Streets A – D.

The following itemises the key issues relating to the construction and presentation of the thirteen slides labelled A – M.

Street D was laid out in such a way that it allowed a long view of the street to be photographed without showing street trees. It was therefore selected for the background scene because it is much easier to add trees then remove them from digital images. Three different views were used with each one containing different content including amount of vegetation and numbers of cars and these are described in more detail in Table 6.

Reference	Image of background scenes from Street D	Summary of key features
A		Abundant vegetation in front gardens obscuring most properties. The road is straight and cars are parked along it although not completely dominating the scene
B		Abundant vegetation in front gardens but more properties visible than in A. The road is straight and parked cars are most dominant in this of the three images
C		Least vegetation in front gardens and most properties are visible. The road is curved and parked cars are the least dominant visually of the three backgrounds.

Table 6 – images used as backdrops, taken in Street D, and a brief summary of their contents, relative to each other.

Street D also contains features familiar to the participants thus making their image ranking decisions grounded in their own experiences.

Three generic tree shapes were used (Table 7). Evidence from other research indicates that tree shape can influence preference (e.g. Sommer & Summit, 1995). Tree shape also has an impact on tree size with columnar trees having less 'crown area' than spreading trees of the same height, for example. The visual simulation survey will also test the influence of tree shape over the different backdrops.

Spreading tree shape	Columnar tree shape	Pyramid tree shape
		

Table 7 – illustration of the tree shapes used in the visual simulation survey.

Tree size was based on tree height because this was the most straightforward way to scale the trees in each image. Each slide thus contained images of trees that were identical in everyway except being three metres taller than the preceding image. This was designed to reflect different stages of the tree's life, a feature that would be familiar to most people.

Slide M (Appendix C) from the pilot study slide in Weston super Mare was also included to enable a comparison between residents from these different areas.

Respondents viewed 13 slides, with four images in each, containing permutations of these components and their layout is outlined below.

Slides A – H: These slides were laid out so that the same sized trees were always in the same location on the slide no matter what the background. For example, Image 1 always contained a tree of height six metres; Image 2 was always tree-less; Image 3 contained the medium sized tree measuring nine metres; and Image 4 had the largest tree measuring 12 metres in height. Each tree shape was presented against each back drop.

Slides J, K and L: These three slides focused on the impact of tree shape. Each of the three background images therefore contained all tree shapes but of identical height.

Slide M: This was the identical slide used in the pilot study in Weston super Mare.

Table 8 summarises the permutations shown in all the slides.

Characteristics	Slide												
	A	B	C	D	E	F	G	H	I	J	K	L	M
Shape of trees[a]	S	C	P	S	C	P	S	C	P	All	All	All	Pilot study
Size of trees[b]	All	All	All	All	All	All	All	All	All	6	6	6	
Background[c]	A	A	A	B	B	B	C	C	C	A	B	C	

[a] Shape of the trees in the slide where S = spreading; C = Column; P = Pyramid
[b] Tree size relates to tree height where three different sizes were used; 6 metres; 9 metres and 12 metres.
[c] Background relates to the image used as the backdrop. Detailed information is provided above.
Table 8 - summary of the main visual characteristics of each of the slides in the visual simulation survey

Presentation of the visual simulation to residents

Each slide was displayed in its own plastic sleeve and they were all arranged in order in a folder for respondents to view.

The visual simulation survey was the first part of the interview. Before being asked to look through the slides respondents were given the following instructions:

a. *Each slide contains four images and you are asked to rank the individual images in order of preference.*
b. *Please use this sheet to record your answers (see Appendix D).*
c. *The example at the top of the sheet is there to help if you need it. Otherwise I can go through the process with you if you wish*
d. *Please let me know when you have finished*

Participants had already agreed that the interview could be recorded and this included the period that the visual simulation took place. It was not known what might be said during this stage but with the interviewer being in the room participants might choose to interact and thereby offer an insight into their decision making processes. At no stage though could the interviewer initiate discussion or lead the interviewee in anyway to prevent influencing responses. There does not appear to be a precedent for this within the street tree literature.

Data analysis

A crucial aspect of the methodology is recognising that the analysis of street tree perceptions must remain rooted at a very local level. This opinion recognises that the individual's perspective is influenced by factors that are independent to anyone else, including possibly, people that live in the same house. Key focus for the thesis are thus residents' perceptions in three different relationships:

- The street level
- The house level
- Visual simulation survey

Such reflects the key tenet of the research in that UK residents might perceive street trees differently depending on their relationship with them at any given time. Given that this creates the potential for a multiplicity of potential opinions from one individual it is unlikely that their views will coincide with any one else, because

others will have, potentially, a different perspective dependent on the question or experience they face at any given time.

Understanding how these different perspectives are experienced by every individual are key features of this thesis. Thus it is important to recognise that each individual will have their own perceptions on a whole range of issues based on factors that are not yet fully understood. Moreover, the consequences of these different spatial layouts on the tolerance of each individual for balancing the costs and benefits of the various street tree attributes is also considered to be wide ranging, although currently unknown. Within these factors are a myriad of issues that will be explored though the interview and visual simulation survey where the uniqueness of the individual is given more free rein to describe their own personal experiences.

Research thus seeks to consider the depth and range of values in context with the householder's own spatial arrangement with nearby street trees; and find out how each person values the street trees in the context of their spatial arrangement with street trees.

Whilst the quantitative element is important it is included to provide some much needed general information and has not been designed to represent a full statistical analysis of the issues. Statistical analysis will therefore be limited to descriptive statistics which will be used to support the more in-depth interviews and open ended questions in establishing how residents value nearby street trees.

Analysis of the visual simulation survey is based around the most common opinions of the images and the mode is therefore of key importance when describing viewer's preferences. Due to the extent of the data available from the visual simulation survey the decision was also taken to focus on the most popular and the least popular images to seek a broader understanding of extreme features that residents find preferable.

The comparison of residents preferences with those from the Midland Tree Officer Association seminar in 2009 will also focus on the opinions around the most and least liked images. It is considered an area for further research to understand the

subtleties of preference across four images whilst also relating those views to the individual's circumstances.

For the purposes of this research it is particularly important to seek to establish whether residents' opinions of street trees experienced via a visual simulation exercise differ to their experiences of trees close to their home and street trees throughout the road where they live.

Residents' opinions of street trees will therefore be carefully evaluated in three different environments in a way that would be applicable elsewhere. Careful measurement of the spatial arrangement for individuals and the use of semi-structured interviews alongside householder surveys have been implemented to encourage a consistency of approach that is necessary when dealing with such an enormous number of variables in a field where no theory has been recognised in the UK context.

The use of these multiple methods for data collection is an essential part of the methodology because no single approach can address the range of issues.

Such an approach has been endorsed by Sommer *et al* (1993) who used a multiple data collection approach, identifying four different techniques (householder survey, professional opinion, visual simulation, physical inspection) when evaluating suitability of street trees but this broad approach has not been carried out in research evaluating residents' *values* of street trees in an integrated way before.

Results and analysis

Introduction

This chapter presents the results of the case study presenting information relating to the householder survey, the interviews and the visual simulation survey and is laid out to provide a full account of residents' perceptions of street trees.

These perceptions are set within the context of the three different relationships that residents may have with street trees namely:

- The relationship a resident may have when regarding the overall street scene.
- The relationship a resident may have when in their house or carrying out house related activities.
- The relationship a resident may have with street trees in a visual simulation situation.

Results firstly describe the setting of the case study including street layout, street tree population and demographic details of the inhabitants. Images of the streets are used to help illustrate the key features of the case study area such as the street trees, architecture and road layout.

This will be followed by a description of the responses to the householder questionnaire from all participants. Data will be described which shows overall responses to the closed questions and due to the ordinal nature of the questions the mode will be used to identify the central tendency. Responses, which best demonstrate key points, will be described from the open-ended questions. Results and analysis will be laid out in such a way so as to reflect the three key relationships.

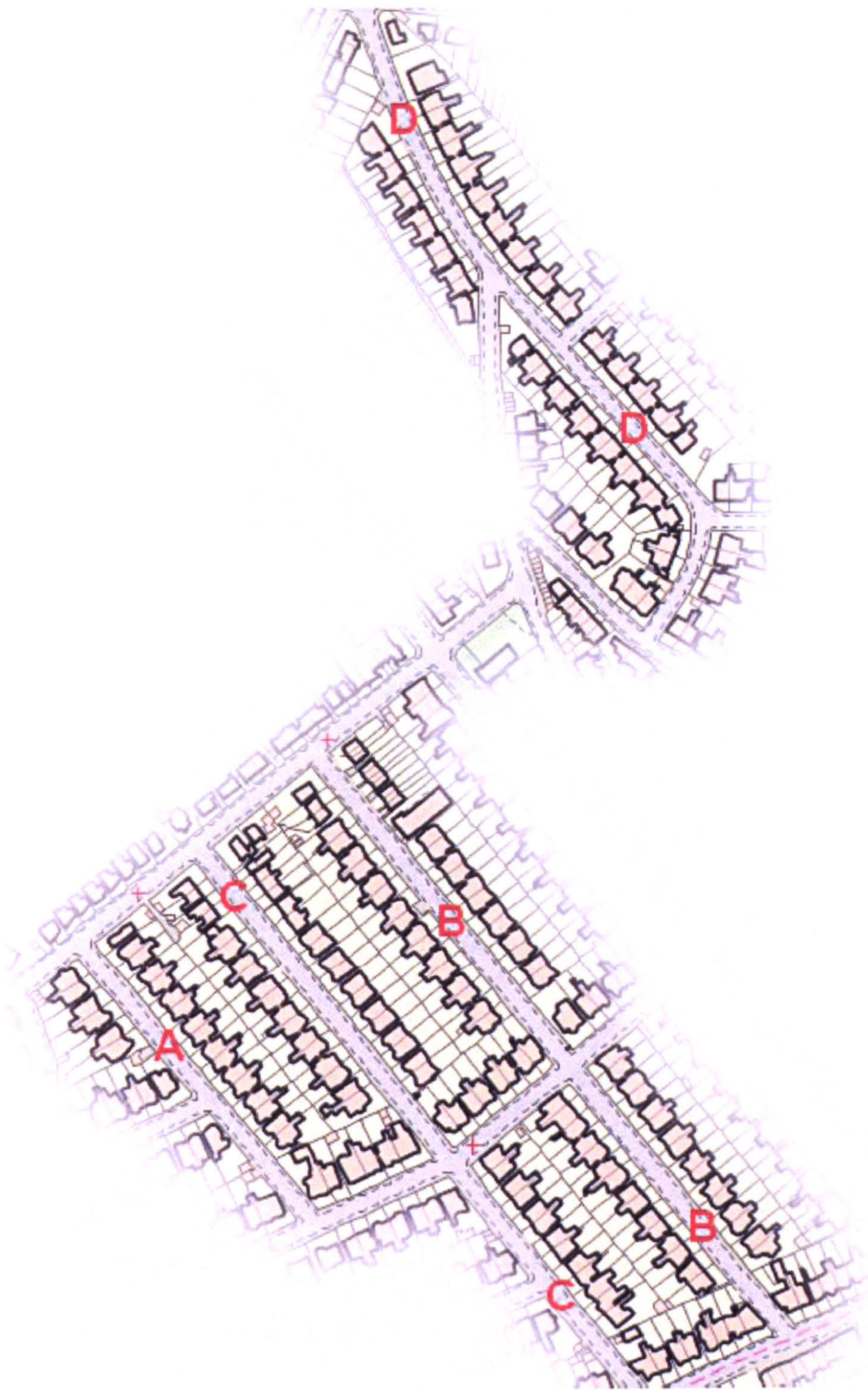
There will follow closer analysis of perceptions focusing on a number of vignettes within the case study area. Such scenarios are included to show how neighbours living next to the same tree describe their relationships with it thereby identifying

factors that influence the individual's perceptions. The scenarios focus on neighbours who describe different perceptions of the same tree.

Description of the case study streets

Map 1 identifies the relationship between the four surveyed streets (labelled A – D) and shows their layout. All maps have been obscured around the edges to help conceal the identity of the area to protect the respondents' identity.

Photographs of each of the roads are included within each street description to illustrate property type and architecture, each street's spatial dimensions and the arrangement of the trees along with their size and appearance. Maps of each street are also provided which locate each of the street trees and provide more detail about the layout of individual roads.



This map shows the area of the case study and identifies each of the four different streets from A – D. It has had the surrounding areas obscured to conceal the neighbourhood's location in order to protect the participants' identities.

Map 1 - layout of Streets A – D showing their relative position and the orientation of the properties.

Street A – dominated by the largest street trees

This map provides a close up of Street A illustrating the relationship between each of the properties and the street trees (marked by a black circle).
The red circles identify residents that answered in the postal survey that they did not have a tree directly outside their house. The blue circles represent survey respondents who stated that they did have a street tree directly outside their house. Two or more circles in a property identify a multi-occupancy residence.

Map 2 – layout of street trees in Street A including residents' perceptions about whether they have a street tree directly outside their home or not.

Street A is illustrated in Plates 9 and 10. It is 195 metres long, aligned north-west to south-east and the width of the road from property boundary to property boundary is 13 metres. The 22 separate residential properties are terraced with one flank wall entirely shared, but only a smaller porch type connection with the other neighbour which gives the impression that they are semi-detached houses. All the houses are three storeys high. Front gardens are uniform in depth along the street measuring about six metres from the road boundary to bay window and eight metres to the main front wall.

View from the midpoint of Street A looking north west. The regular pruning carried out by the Council has created the uniform appearance of the street trees. Few front gardens have been converted to driveways allowing relatively abundant vegetation to dominate the foreground of the houses. Road and pavement width are typical for the roads in this neighbourhood as is the architectural style of the properties. See Table 4 for a summary of tree sizes.

Plate 9 - view of Street A from its mid point looking north west

Street A contains the largest trees in the case study and this is well demonstrated in this image which illustrates the dominant size of the trees in relation to the properties and the way in which the trunks spread across the pavement. The consequences of the regular pruning on tree shape and size are very clear in this image with the trees all appearing very similar irrespective of species or age.

Plate 10 – view of Street A from its midpoint looking south east

Street B – dominated by the medium sized trees

This map provides a close up of Street B illustrating the relationship between each of the properties and the street trees (marked by a black circle).
The red circles identify residents that answered in the postal survey that they did not have a tree directly outside their house. The blue circles represent survey respondents who stated that they did have a street tree directly outside their house. Two or more circles in a property identify a multi-occupancy residence.

Map 3 - layout of street trees in Street B including residents' perceptions about whether they have a street tree directly outside their home or not.

Plates 11 and 12 illustrate the layout of Street B which is 410 metres long, aligned north-west to south-east and the width of the road from property boundary to property boundary is 13 metres. The road is divided into two at approximately its midpoint by another residential street that runs perpendicular to it. There are 30 residential properties in the southern section of the road with those on the eastern side being all semi-detached. Four homes on the western side are semi-detached and the remainder are terraced with one flank wall entirely shared, but only a smaller porch type connection with the other neighbour which gives the impression that they are semi-detached houses.

There are 39 houses in the northern half of the street which are terraced similarly to the other houses in this case study area. The northern half contains a church and the 11 properties at the far north end have all been added recently. Other than these properties the street is uniform in appearance.

All the houses are two storeys high. Front gardens are uniform in depth along the street measuring about six metres from the road boundary to bay window and eight metres to the main front wall.

View from the midpoint of Street B looking north west. Street B contains the medium sized trees and these are evident in the foreground of this image. Towards the background it is possible to see larger London plane trees. Car parking is an identifiable feature of the street which increases in the evening and at weekends. There are more converted front gardens than in Street A but residents have still been able to maintain some vegetation as shown to the foreground on the right. See Table 4 for a summary of tree sizes.

Plate 11 – view of Street B from the midpoint looking north west

View from the mid point of Street B looking south east. The trees in this street are not part of a regular pruning programme and have grown in the way typical of their species. These are medium sized trees compared to the trees in Street A (Plates 9 and 10).

Plate 12 – view of Street B from the midpoint looking south east

Street C – dominated by the smallest sized trees

This map provides a close up of Street C illustrating the relationship between each of the properties and the street trees (marked by a black circle).
The red circles identify residents that answered in the postal survey that they did not have a tree directly outside their house. The blue circles represent survey respondents who stated that they did have a street tree directly outside their house. Two or more circles in a property identify a multi-occupancy residence.
See page 126 for explanation about the black arrows.

Map 4 - layout of street trees in Street C including residents' perceptions about whether they have a street tree directly outside their home or not.

Plates 13 and 14 illustrate the layout of Street C which is 385 metres long, aligned north-west to south-east and the width of the road from property boundary to property boundary is 13 metres. The road is divided into two at approximately its midpoint by a different residential street that runs perpendicular to it. In the south-east half of the street the 13 semi-detached properties are all only the eastern side of the road. Houses on the other side of the road are associated with neighbouring streets.

The 36 houses on the northern half of the street are found on both sides of the road. They are generally semi detached on the eastern side whereas on the western side they are terraced similarly to the layout in Street A having one flank wall entirely shared, but only a smaller porch type connection with the other neighbour which gives the impression that they are semi-detached houses.

The period of their construction and their style gives the street a uniform, visual appearance which is slightly reduced at the northern end of the street because eight newer properties have been added. All the houses are two storeys high. Front gardens are uniform in depth along the street measuring about six metres from the road boundary to bay window and eight metres to the main front wall.

Car parking remains a dominant visual feature of the neighbourhood. Vegetation is prevalent in front gardens and in conjunction with the street trees the buildings are obscured. Tree size in this street is considered small overall. See Table 4 for a summary of tree sizes.

Plate 13 – view of Street C from the midpoint looking north west

This image reveals how the houses in Street C are architecturally similar to those in the other streets. The small trees typical of this street are also evident.

Plate 14 - view of Street C from the midpoint looking south east

Street D – split street

This map provides a close up of Street D illustrating the relationship between each of the properties and the street trees (marked by a black circle).

The red circles identify residents that answered in the postal survey that they did not have a tree directly outside their house. The blue circles represent survey respondents who stated that they did have a street tree directly outside their house. The green circles identify the respondents who stated that they did not live in a road that contained street trees.

Two or more circles in a property identify a multi-occupancy residence.

Map 5 - layout of street trees in Street D including residents' perceptions about whether they have a street tree directly outside their home or not.

Street D is 415 metres long and is illustrated in Plates 15 and 16. The layout of Street D is less straightforward to describe than the other surveyed roads. Overall it is aligned north-west to south-east but approximately 40 metres before the southern end of the road there is a sharp bend and this stretch is aligned more northeast-southwest. Properties in this stretch are visually isolated from the remaining part of the street. Street D is also unusual because 100 metres from the northern end the road continues uninterrupted in a southerly direction at a junction and changes name at that point whereas Street D is accessed by a 'left turn' at that junction and continues thereafter. This gives the impression of the street being split in two.

The width of the road from property boundary to property boundary is 13 metres. The six properties at the southern end are semi-detached and two storeys high. The 28 residential properties south of the junction are terraced with one flank wall entirely shared, but only a smaller porch type connection with the other neighbour which gives the impression that they are semi-detached houses. The remaining 26 properties north of the junction are also similarly arranged. Front gardens are uniform in depth along the street measuring six metres from the road boundary to bay window and eight metres to the main front wall.

This view shows how this section of the street is devoid of street trees. The two street trees are visible in the middle of the image in the background. On street car parking is prevalent and many properties have also converted their front gardens on this section of the road. The road sign in the foreground indicates a right bend and this gives the impression that Street D bears right although as Map 5 illustrates it actually continues in a straight line at that point hence the description of it being a 'split' road. See Table 4 for a summary of tree sizes.

Plate 15 – view of Street D looking south east from the northern end

The two street trees are visible in the centre of the image in the back ground. This end of the street appears narrower than the other section illustrated by the fact that cars are parking on the pavement. Front gardens also tend to have more vegetation in this part of the street.

Plate 16 – view of Street D looking north west from its southern end

The street trees

The locations of the trees in each of the four streets are shown in Maps 2 – 5 whilst Table 9 illustrates the diverse range of species. It is unknown whether the roads once contained uniform avenues of trees but it is perhaps inevitable that trees of varying species, dependent on contemporary fashions, would be added over the decades of the street's existence as trees died or were removed for development. Individual streets were dominated by particular species which were all growing in the 2.2 metres wide pavement at the kerb edge. For example, the common lime was most prominent in Street A; in Street B it was the silver birch and London plane; and in Street C it was the Swedish whitebeam. The most consistent treescape was presented in Street A where the majority of lime trees formed a clearly defined avenue.

Street	Species	Frequency	Percent
A	*Tilia x europaea*	13	76.5
	Platanus x hispanica	4	23.5
	Total	**17**	**100.0**
B	*Betula pendula*	9	37.5
	Platanus x hispanica	8	33.3
	Betula utilis jacquemontii	2	8.3
	Acer negundo	2	8.3
	Sorbus x intermedia	1	4.2
	Prunus spp	1	4.2
	Betula pubescens	1	4.2
	Total	**24**	**100.0**
C	*Sorbus x intermedia*	14	51.9
	Prunus spp	6	22.2
	Prunus cerasifera 'Pissardii'	3	11.1
	Sorbus aucuparia	3	11.1
	Betula pendula	1	3.7
	Total	**27**	**100.0**
D	*Platanus x hispanica*	2	100.0
	Total	**2**	**100.0**

Table 9 – the frequency of the different species growing in each of the four streets in the case study area

Regular, consistent pruning is also undertaken by the Local Authority on the larger trees across all streets which causes uniformity of appearance. This was most noticeable in Streets A and B where large limes and London planes were growing (see Plates 9 and 10 for an example of this in Street A).

Data in Table 4 provides an example of the range of tree heights and crown areas found in these streets. This data confirms the intention laid out in the methodology to select streets where tree populations were different in each of the streets. Streets will also be referred to in terms of the dominant tree size. Street A therefore contains the largest street trees; Street B the medium sized trees; and Street C the smallest trees. Street D contains two street trees situated in such a way that they are isolated from the majority of properties.

The householder survey

The respondents

A total of 258 separate properties were identified within the selected four streets and 102 surveys, including three which were unusable, were returned for an overall response rate of 39.5% (Table 10).

Street	N	Response number	Response rate %
A	49	19	38.8
B	83	32	38.6
C	60	24	40.0
D	66	27	40.9
Total	258	102*	39.5†

*Three of the returned surveys were unusable
† Overall response rate
Table 10 - response rate to the survey from all residents in Streets A - D

Basic demographic data was collected to help ascertain the background of the residents in the study area and Table 11 summarises the key information, which establishes that residents in Streets A - D are broadly a stable population of mainly middle aged people with above average education and income.

Demographic attribute		Street			
		A	B	C	D
Mean length of residency (years)		9	13.25	14.5	15.8
Gender*	Male	10	9	7	10
	Female	8	17	13	16
Mean age (years)		41.7	50.4	50.2	53.2
Property*	Own	9	25	16	26
	Rent	9	4	5	0
Income – greater than £35,000		50%	66%	66%	70%
Education - graduates		94%	84.6%	91.2%	87.5%

* These show number of responses

Table 11 - summary of the basic demographic information provided by residents in Streets A – D.

Results and analysis of the postal survey follow and they are reported in the following sequence:

- Review of the variable tree size
- Residents' perception of their street and the influence of street trees
- Perceptions of street trees in general
- Perceptions of the closest tree

A combination of tables and charts has been used to illustrate the findings and these can be cross referenced to the images in Plates 9 – 16 to aid understanding of spatial and visual points.

Review of the variable 'tree size'

Residents' perceptions of tree size is a key component of the thesis so analysis of attitudes to this were carried out first. The majority of residents, irrespective of where they lived, had generally high opinions of street trees in general and for the tree nearest to their home. These residents also considered that the size of the

trees in their neighbourhood were 'just right' as was the tree closest to their home (Figure 3). It was therefore apparent during early data analysis that differences in the trees' dimensional qualities did not appear to be critical in street tree perception. Such data defies arboricultural perceptions of this relationship providing weight against the 'I love trees but…' phenomenon described in the literature review.

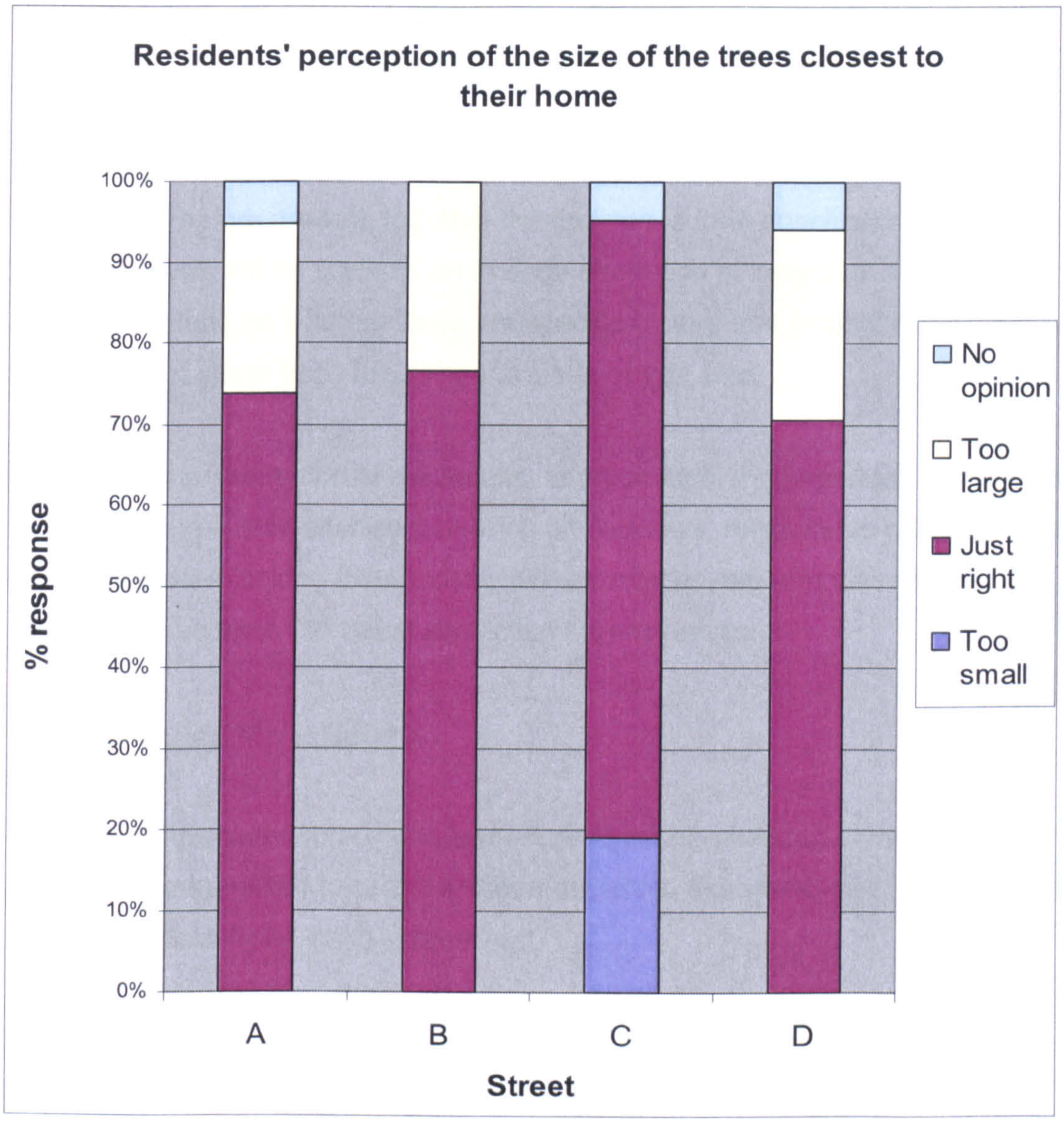


Figure 3 – residents' perception of the size of the trees in their street described in the householder survey

Figure 3 identifies that the majority of residents rated their closest tree as 'just right' irrespective of the dominance of the size of trees in their street. Only residents in Street C, dominated by smaller trees, described tree size as 'too small' and had no-

one comment that they were 'too large'. Otherwise there is a generally uniform opinion between residents irrespective of the dominance of tree size in their road.

Such data served to shift the emphasis of data analysis away from the notion that there would be a specific response from residents dependent on the size of nearby trees. Analysis of the results will not therefore follow that envisaged at the research design stage where statistical analysis of residents' perceptions across streets, linked to tree size, was considered possible.

Instead, the results and analysis will focus separately on the three identified relationships before drawing together the findings to form conclusions from the data. Deeper analysis will be undertaken in each street and at individual house level to attempt to determine whether there are specific factors that influence individual's perceptions of street trees including the issue of tree size.

The following presentation of the results, and corresponding analysis, reflects the order of the three relationships focussing on residents' relationship with street trees in general before looking more closely at their relationship with their closest tree. Finally, it will address the visual simulation survey results.

Perception of the street

Firstly, it is important to place into context residents' perception of their street so participants were asked to select a statement which described their response to the question 'Overall, I like living in my street.'

Figure 4 summarises responses which shows overall that the respondents had very positive opinions about living in their street with only one resident in Street B not enjoying living there and one resident in each of Streets C and D neither agreeing nor disagreeing. Reinforcing this information the modal response to this question was 'strongly agree'.

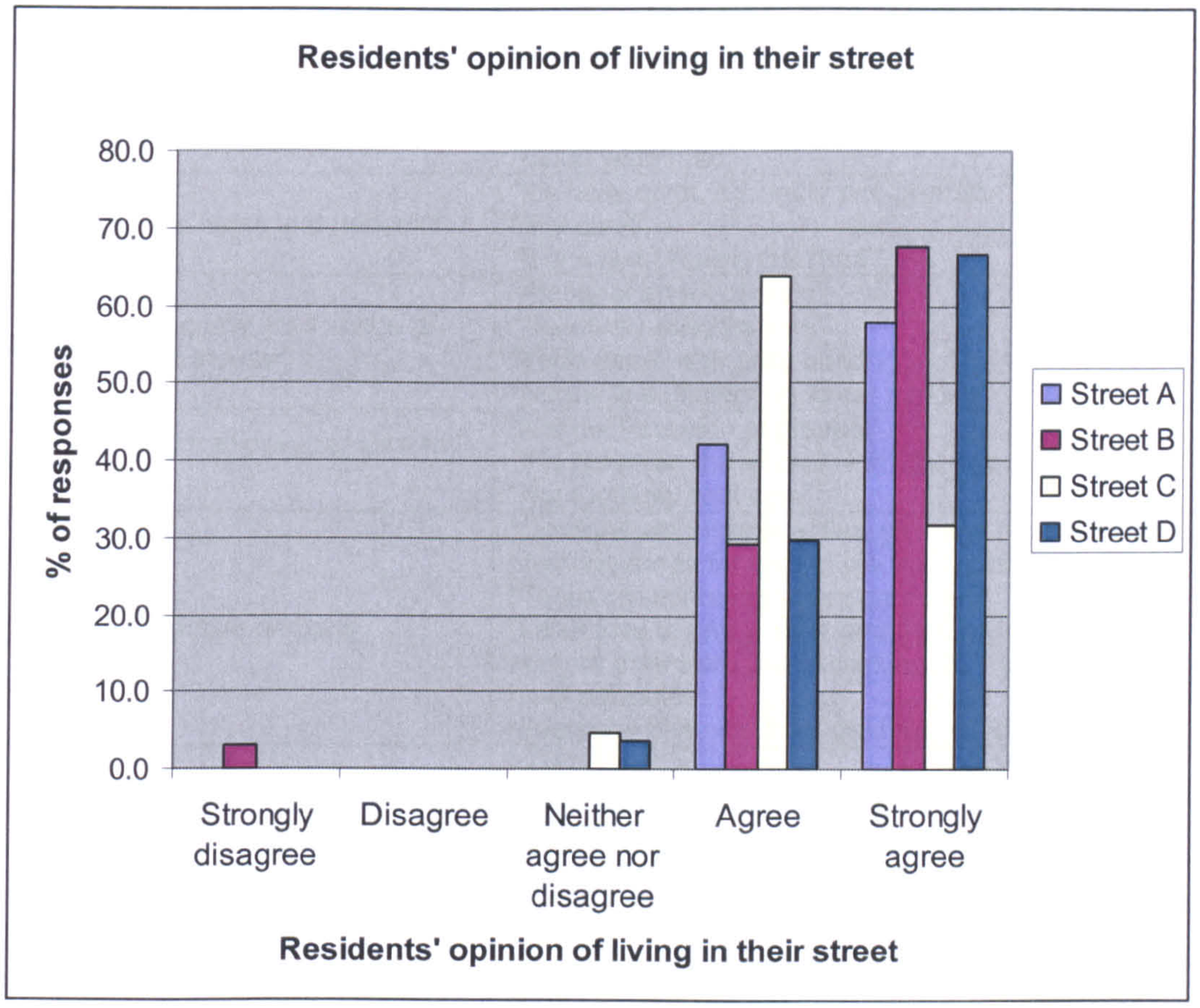


Figure 4 – residents' opinion of living in their street, described in the householder survey, on a street by street basis

In further seeking to establish the deeper issues influencing these opinions, and specifically seeking to discover the extent of the role that street trees played, residents were asked to explain, using their own words, the good and bad points about living in their street. Such questioning gave the opportunity to investigate the presence of any themes that supported the reasons behind participants' statements about their street including the opportunity to develop an understanding of the place of street trees within the much wider context of 'life' satisfaction.

Responses were analysed in order to extract themes that represented how residents felt about living in their street and these have been separated into positive (Table 12) and negative comments (Table 13).

Theme	Description	Indicative quotations
Space	Area feels spacious/wide roads	"The street is wide" "It's a fairly wide road" "Nice wide street" "Good wide road"
Quiet	Little noise and peaceful	"It's fairly quiet, it's pretty and peaceful" "It is quiet" "It is a quiet residential road"
Easy parking	Adequate road space to park the car	"Plenty of street parking" "Relatively easy parking" "Wide street with easy parking" "Normally sufficient on street parking"
Low traffic	Low traffic levels/not a rat run	"Not cut through - at present" "It is quiet (on the whole) with little through traffic" "Not too busy with cars"
Attractive gardens	Attractive gardens	"Gardens are attractive, though many have now put hard standing areas for cars in the front gardens" "There are interesting front gardens" "I also love to enjoy other people's front gardens - I would be sorry of they were lost to parking BUT parking is becoming a bit of a problem." "Everyone has nice front gardens, which I like."
Prospect	Good/interesting view from the house	"Good view" "We have great views over our area from our third flat, road is on a hill." "The view over the city from the back of the house is beautiful and I can often see fireworks and balloons and beautiful sunsets."
Street trees general	Street trees in the road	"Many large trees - mainly limes. Very good but in reality too large for scale of road" "Good, mature substantial trees" "Many attractive trees on both sides of the street" "The road is wide with trees all down it on either side - it really makes a difference." "You can hardly see the houses for the trees"
Community	Friendly neighbours/street party/children playing/mixed age range	"This is a nice area - quiet, residential, nice peaceable neighbours - a middle class area." "Nice people" "Good neighbours, annual street party"
Leafy	Denotes non-specific approval of vegetation	"Lots of greenery to look out on even though it's in town" "Typical 'leafy suburbia'" "Leafy"
Access – local	Good access to local shops/facilities/parks/public transport	"close to all amenities" "the house is convenient to my work, the local shops" "Convenient for shops and social facilities and GP surgery."
Beauty	The street is beautiful	"I'm lucky because I live in a beautiful street." "It is an aesthetically pleasing view up the street as you turn in from either end."
Positive	Upbeat positive comment	"Great and fab" "I love living in my street!" "It is a pleasant street"
Clean	Streets are litter/dog mess free	"There are very few dogs around (one guide dog next door) so the pavements are usually clear."
Low crime	Low levels of crime and anti-social behaviour/feels safe	"It feels safe"
Street tree specific	Specific street tree outside their home	"I like the plane tree outside my house" "the tree outside my house is lovely and is a deep red all year round."

Well maintained	Properties are well maintained	"Most gardens and houses well kept"
Attractive property	Attractive houses/pleasing architecture	"Nice old-fashioned architecture"
Access - city	Good access to city centre	"close access to central city"
Birds	Specifically described/bird song	"Nice to hear birdsong outside the window."
House	Like their own house	"The houses are spacious with good sized gardens.
Good Council services	Council provides good services	"Council services good"
Wildlife	Denotes non-specific wildlife benefits	"There is plenty of wildlife (birds, foxes etc)"
Countryside	Greenness brings countryside into the city	"I chose this flat partly because we have a big sycamore tree outside the bedroom window, at eye level - makes it feel pleasant and natural and 'countryfied'"

Each theme has been assigned a longer description and indicative quotes have also been included to aid interpretation.

Table 12– themes about positive aspects around living in their road that have been determined from the language used by residents when describing their experiences about living in their street.

Theme	Description	Indicative quotations
Car parking	Difficult to park/too many cars	"Cars always a problem – parking" "Parking is hopeless - the worst problem" "Parking on street increasingly crowded" "Too many cars and inconsiderate parking are annoyances."
Traffic	Passing traffic is noisy/too fast/dangerous/rat run	"Dangerous for kids to play on street as it is a through road" "Bit of a 'rat run'. Could do with pedestrianising Dutch style" "Traffic at times is busy and likely to increase with the new school"
Off-road parking	Front gardens turned into car parking spaces	"Some houses have created off-street parking in front gardens which is a shame as the street edge is lost and planting lost." "Would prefer more front gardens and fewer driveways."
Poor community	Distant neighbours/fewer families	"The only bad point is that I don't know any of my neighbours and don't feel part of a community"
Multi-occupancy	Development of houses into flats causes problems e.g. more cars, less pride, more rubbish	"Bad - more multi-occupancy than I'd want (bins/cars - but not noise)." "With more multi-occupancy in the road there are far more cars and fewer front gardens (now concreted into parking)."
Topography	On a hill so hard to access	"Street is on a hill so have to leave car in gear and puts pressure on handbrake." "A pleasant road - a bit steep."
Waste collection	Too long between visits/bins left in road for too long	"Also wheelie bins and refuse (fortnight collections!) are ugly."
Tree litter	Nuisance factor	"Trees add to the attractiveness, though the large leaves of plane trees and seeds from silver birch can be a nuisance."
Poorly maintained housing	Some houses are not cared for	"Dislike some of the mess from house in multi-occupancy."
Vegetation	Poorly maintained/dead/not enough trees	"Trees not always attractive, some dead"
Vandalism	Graffiti	"Graffiti"
Noise	Specifically teenagers	"Noisy teenagers are occasionally a problem when they shout to each other in the street and honk car horns late at night."

Crime	Burglary/alarms	These complaints number one per description and further quotes are not provided.
Dark	Feels threatening at night	
Bird mess	Bird mess on cars and property	
Poorly maintained highway	Potholes etc	
Lacks green space	Little green space in the area	
Renters	Take less pride than owners	
Expensive	Property becoming too expensive	
Poor Council services	Council tax too high	
Tree subsidence	Tree subsidence	
Tree access	Low branches	
Weather	Dark/windy	

Each theme has been assigned a longer description and indicative quotes have also been included to aid interpretation.

Table 13 – themes about negative aspects around living in their road that have been determined from the language used by residents when describing their experiences about living in their street.

Within the identified themes there are common areas of agreement between the residents. The most frequently cited positive reason for living in their street related to the theme 'community' being described on 46 separate occasions. A 'quiet' street was also considered important alongside easy access to local facilities. Street trees were the third most frequently cited benefit of living in these streets and when combined with the other vegetation related themes of 'attractive gardens', 'leafy' and 'street tree specific' it is clear that these residents valued, overall, natural features more than anything else.

Car related factors made up more than half of the 85 cited negative reasons with 'car parking' being the largest single annoyance. Trees were barely described with only three mentions of 'tree litter' and one each of 'tree subsidence' and 'tree access'.

These results indicate a population of residents that have a very positive perception of the road where they live with street trees contributing positively to that feeling.

Residents in all roads described positive themes about living in their street much more frequently than negative ones as Figure 5 demonstrates.

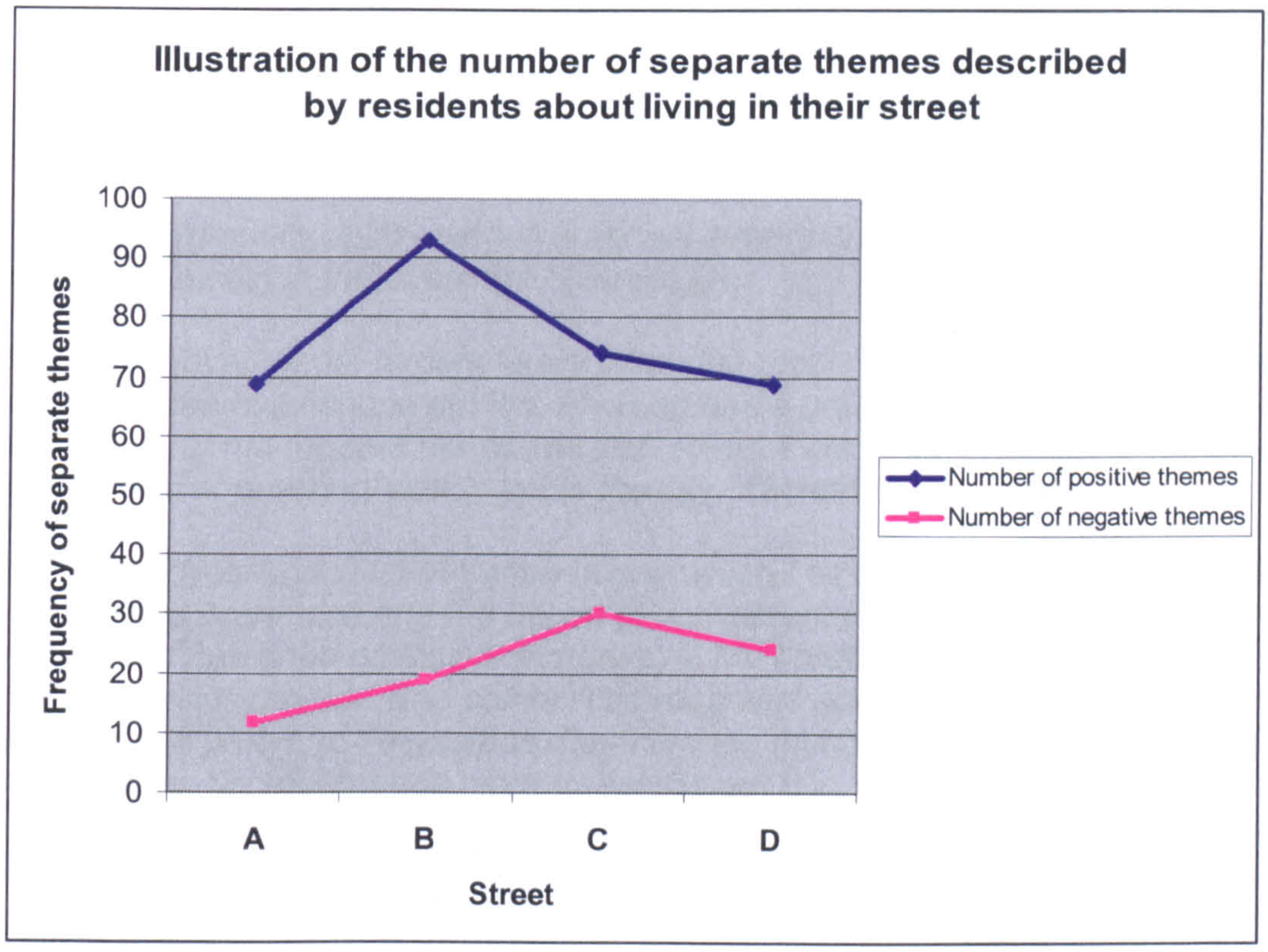


Figure 5 – illustration of the distribution of positive and negative themes that residents used to describe living in their street drawn from the householder survey

Quotations below illustrate how these themes (Tables 12 and 13) were derived and demonstrate an eloquence about living in their street and a deep level of sophistication particularly around the issue of balancing positive and negative experiences. Special attributes of the street included a shared sense of community, the convenience of little traffic and the presence of street trees to enhance visual quality.

Information about which street the quote originates from is included in brackets. All these quotes are from female participants.

"I like the fact it's fairly quiet and there's little passing traffic. There's also plenty of on street parking. It's a fairly wide road. There are also a few trees so it's quite green." **(Street A)**

"My street is a very pleasant place to live and in my opinion this is largely because of the street trees which are especially beautiful in spring and autumn. Without the

trees it would look very different and I would never want to live in a street without trees. I can't really think of any bad points about living in my street." **(Street B)**

"I'm lucky because I live in a beautiful street. Tree lined, large, handsome Edwardian homes. The street is wide and on the whole front gardens are well maintained. Too many cars and inconsiderate parking are annoyances. Also wheelie bins and refuse (fortnight collections!) are ugly." **(Street C)**

"Strong community spirit - we have annual street party, go camping together - the children play out in the evenings." **(Street C)**

"I live in a lovely wide, largely family inhabited road - typical 'leafy suburbia' yet very very near the busy shops etc too. My road has a great sense of community is quiet and not a rat run for cars nor on the 'pub route'. Lots of gardens and trees so an ideal blend of greenery peace yet in the city." **(Street D)**

"I have a lovely spacious Victorian house which I enjoy living in. The area and neighbours is/are nice and the house is convenient to my work, the local shops, city centre and has good access to motorways. My garden is a convenient size and can be enjoyed in summer. Bad points. The road was not built with cars in mind and parking is a problem. People use their cars too much so don't have contact with their neighbours. My road needs more trees! **(Street D)**

Perceptions of street trees in general

In further seeking to build a picture around the relationships residents have with street trees the next step, having established the context of their lives in their street, is to consider how they perceive street trees in general.

The survey questionnaire sought residents' views about a number of factors relating to street trees in general including; whether they believed that '*Trees growing in the pavement make streets nicer places to live in*'; the attractiveness of the trees in their street; the size of the trees along their road; and their opinions about the growth rate of the street trees.

Figure 6 summarises the responses to the question '*Trees growing in the pavement make streets nicer places to live in*', which shows overall that the respondents had very positive opinions about street trees with the majority 'strongly agreeing' with the statement. Only one resident in Street D 'strongly disagreed' and five residents 'neither agreed nor disagreed'.

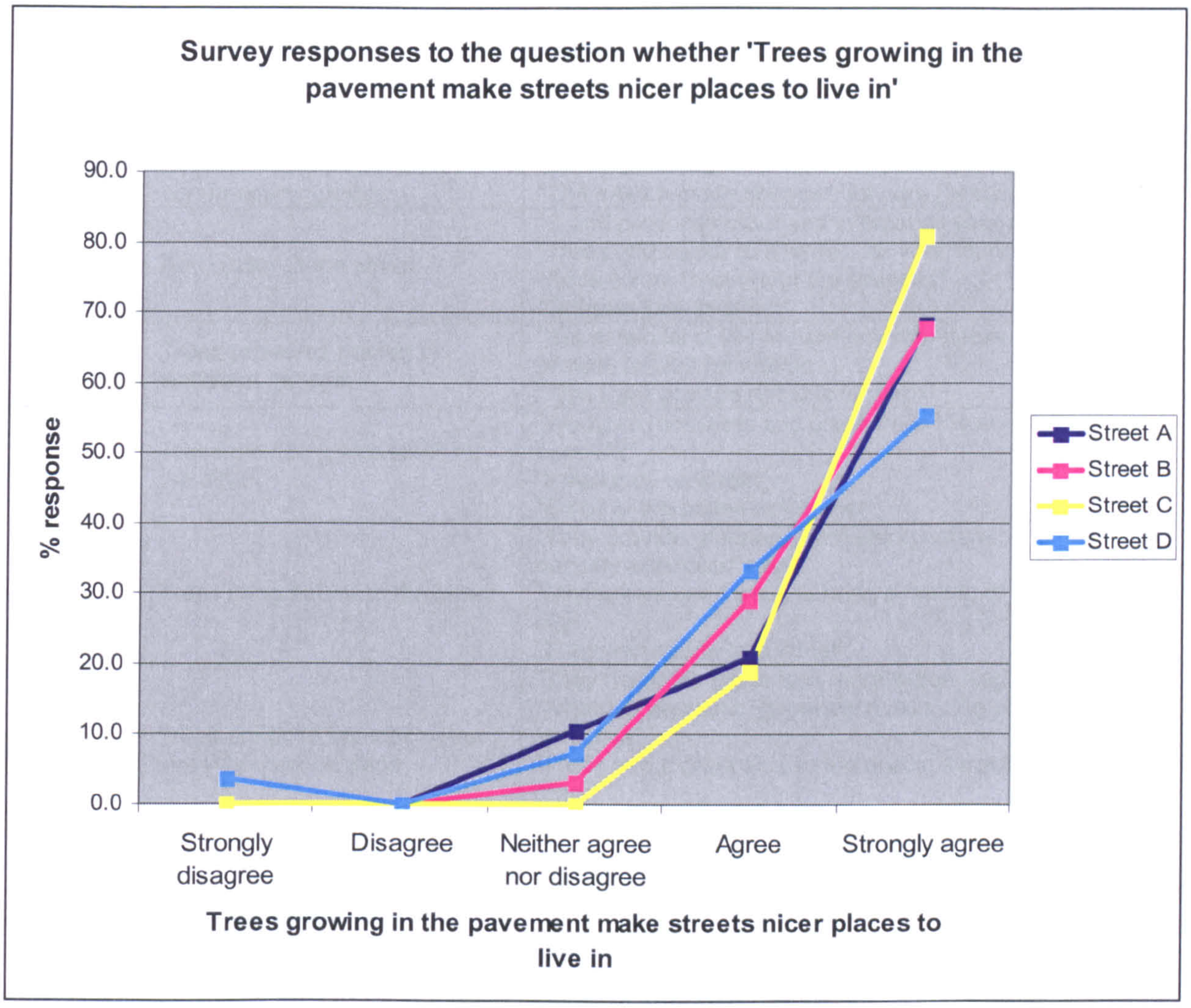


Figure 6 – residents' perceptions of whether street trees make streets nicer places to live in described in the householder survey

In further seeking to establish the deeper issues influencing these opinions residents were asked to explain, using their own words, the things that influenced their opinion about street trees. Such questioning gave the opportunity to investigate the presence of any themes that supported the reasons behind participants' statements.

Responses were analysed in order to draw out the themes that represented how residents felt about whether the presence of street trees made streets nicer places to live in and these have been separated into positive (Table 14) and negative comments (Table 15).

Theme	Deeper definition	Indicative quotations
Environment	Contribute to the environment/add variety	"they add variety to the environment" "Environmentally desirable" "They are better for the environment" "Improves the environment"
Shade - positive	Cast welcome shade onto cars/property/garden	"Provides shade" "The trees provide shadows for cars (keeping them cool)"
Colour	Add colour to the street	"...and produce colour and interest all year round" "Trees add colour to a street - all year round" "Adds colour throughout the seasons" "Greener look to street"
Habitat	Trees provide a habitat for wildlife in general	"It is essential to live in harmony with nature and to provide habitat for wildlife" "Also trees provide habitats for birds"
Smell	Trees provide a nice smell for the street	"We have lime trees and plane trees the scent of both is beautiful" "Smell nice on street" "Smell of the pollen in summer"
Nature	Trees bring nature to the street	"They provide greenery, something natural, in a very densely populated area" "City streets need trees to bring a feeling of nature into the city" "They add nature to a street"
Enhance look	Trees enhance the look of the street/houses/gardens	"They make the place look more welcoming" "A natural aesthetic, generally making the street more attractive" "Trees add a great deal to the scenic attraction of our road." "They just look more interesting than continuous footways"
Seasons	Mark the changing seasons	"Trees are very important giving us colour through the seasons" "You can feel the changing seasons" "Change through seasons" "Trees change with the seasons, thus continuously changing the appearance of the street."
Light	Enhance the light	"Enhance light and shade" "In the summer the light that comes into rooms is dappled and moving."
Sound	Trees make an interesting sound	"The other day I was lying in bed listening to the rain and wondered why summer rain sounded different to winter rain and my boyfriend pointed out that in summer you hear it pattering on the leaves." "...and rustle of the leaves when the wind blows." "They make a great sound when windy"
Countryside	Trees are associated with rural living	"Give impression of countryside" "It brings a bit of countryside into the city."
Wildlife	Attracts non-specified wildlife	"Encourage wildlife" "Attract wildlife" "Attract wildlife - we have a reasonable number of birds (too many pigeons and magpies) and squirrels."
Urban heat island	Trees contribute to cooling the area	"Trees help to prevent urban heat island effect"
Intercept rain	Trees intercept the rain	"Trees help to prevent flooding by intercepting rainfall"
Aesthetic	Trees look good/are beautiful in their own right	"Provides visual interest" "Tall trees – attractive" "are nice to look at" "they look nice"
Affluence	Make the area look affluent	"They make the place look more welcoming and more affluent."

Privacy	Afford privacy by obscuring property	"Privacy for houses" ""Gives privacy" "Screen you from neighbours - v important in crowded city." "...and also they help with privacy"
Pollution	Ameliorate pollution	"Give fresh air" "Trees keep the air clean and suck up the urban pollution" "They act as the lungs of the city"
Carbon sequestration	Take up carbon	"Also, helps combat climate change by soaking up CO2 from cars."
History	Offer a historical context for the street	"When fully mature they give a real sense of continuity i.e. I'm truly grateful to our Victorian and Edwardian forebears for all the tree planting they did here in Bristol."
I love trees	A general statement of approval	"Keen gardener so fond of plants and trees" "I like trees in general" "They are a constant reminder of my happy youth growing up in semi-rural village in Gloucester."
Shelter	From sun, wind, rain	"Even the canopy of leaves provide shelter in order that I can get out of the car and stay relatively dry even in a downpour."
Leaves - positive	Exercise in raking them up	"Sweeping up the leaves gives us all a bit of exercise!"
Establishment	Makes the area appear established	"I prefer/really like the very large avenue of trees which can be found up the road between Redland Girls School and Redland train station"
Enhance feel	Enhances the feel of the street	"Trees simply make the street look more pleasant and cared for. They give the residents something to enjoy and care about together"
Birds	Birds mentioned specifically e.g. song, species	"Trees provide homes for birds" "the birds that perch in them to sing are a welcome sight (except the magpies)." "The trees provide nesting and perching areas for birds." "Attract wildlife - we have a reasonable number of birds (too many pigeons and magpies)"
Psychological	Improve frame of mind	"A pleasant leafy road in the suburbs can be uplifting in the urban environment." "Makes you feel positive, happy, calm. Green a very calming colour." "Overall trees are beneficial - they have a calming effect on the neighbourhood and make it a pleasanter place to live."
Oxygen	Provide oxygen	"Trees provide oxygen"

Each theme has been assigned a longer description and indicative quotes have also been included to aid interpretation.

Table 14– themes drawn from positive comments made by residents about whether trees growing in pavements make streets nicer places to live in.

Theme	Deeper definition	Indicative quotations
Honeydew	Sticky honeydew is a nuisance	"They should not create hazards such as sticky mess on windscreen," "Another problem could be sap from some trees (lime?) - the tree outside my house was one of them and the sap was unpleasant on my car." "I accept that there are some down-sides to street trees - in particular the sap"
Bird mess	Bird mess on cars and property a nuisance	"bird mess that falls onto parked cars" "bird shit on cars causes much annoyance!"
Direct root damage	Trees damage property	"sometimes their roots break the pavement" "roots are undermining some of the houses and walls are cracking" "Roots may upset the evenness of the pavement."
Shade - negative	Cast unwelcome shade onto house/garden	"trees can become too large and restrict daylight."
Size	Can be too big and dominate street/houses	See above
Leaves	Raking up leaves/leaves block drains/slippery leaves	"Cars parked in street make sweeping up of leaves difficult and can be slippery in winter." "leaves that when fallen create a hazard in wet weather especially for the elderly who may fall." "Downside - leaves block drains"
Indirect root damage	Subsidence	"Only worry is when too big trees are planted that disturb foundations"
Berries	Fallen berries are a nuisance	These negative issues number one per description and further quotes are not provided.
Poor maintenance	Poorly cared for by Council	
Access problems	Wheelchairs, pushchairs etc	
Darkness	Make street dark at night	

Each theme has been assigned a longer description and indicative quotes have also been included to aid interpretation of the coding.

Table 15 – themes drawn from negative comments made by residents about whether trees growing in pavements make streets nicer places to live in.

Respondents described many more positive themes about street trees than negative ones with the significant difference being that tangible themes dominated negative perceptions and intangible themes dominated the positive features of street trees.

Overall there were 28 different positive themes which tended to focus around several key factors relating to the individual's personal and environmental outlook. In particular the personal outlook in relation to these street trees is broad ranging covering a number of issues such as aesthetic preference, relationships with nature and wildlife, olfactory experiences and a need to soften the built environment. Residents also considered the tree's ability to address environmental issues such as locking up carbon, minimising the urban heat island effect and intercepting rainfall

although these tended to be cited less frequently suggesting less significance (Figure 7).

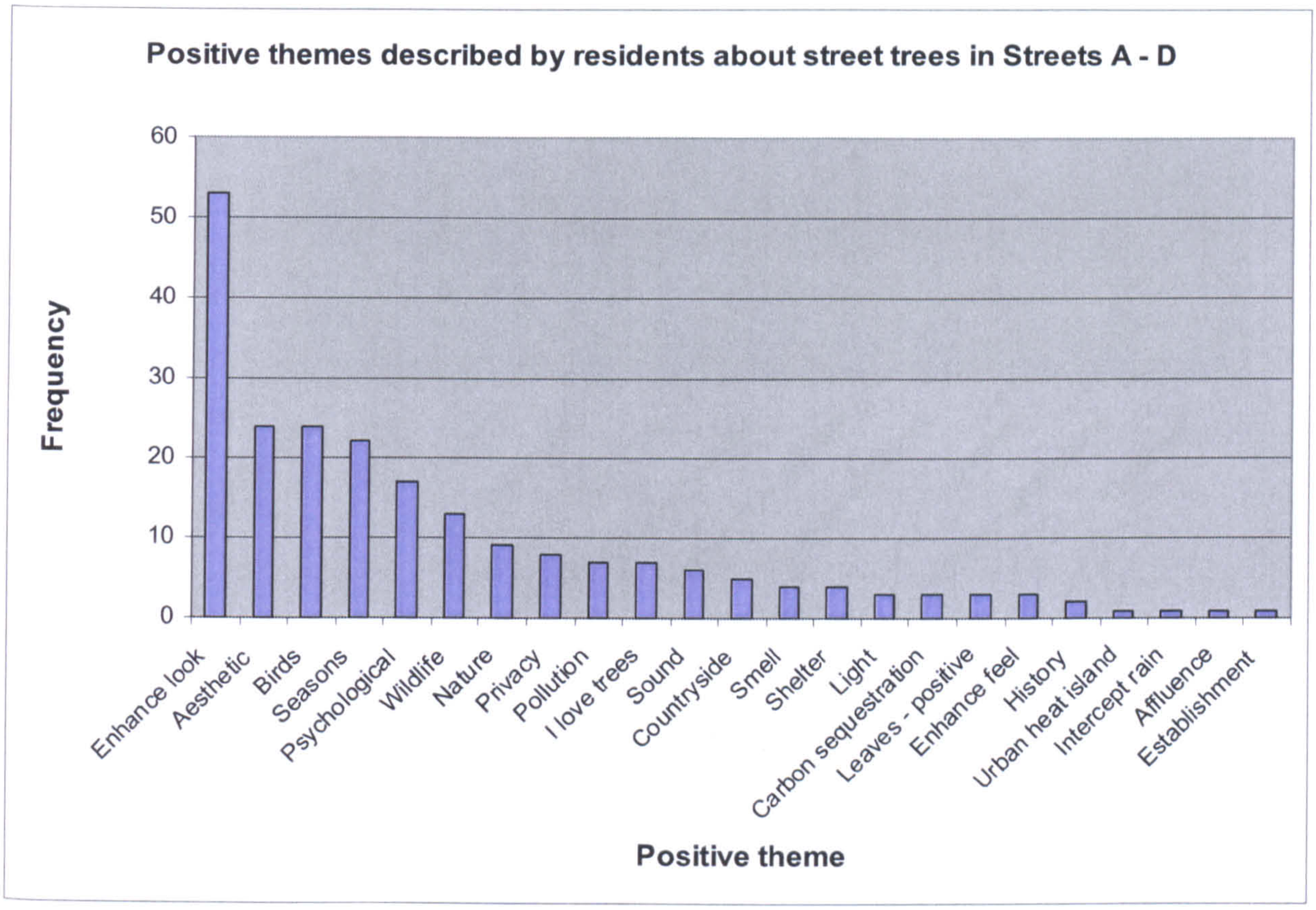


Figure 7 – themes used by residents in Streets A – D that describe their positive perceptions about street trees in general. A full explanation of these themes can be found in Table 14.

In contrast residents described a much narrower range of negative themes relating primarily to the physical impact of the trees on their property such as root damage, leaf clearance and sticky honeydew alongside their impact on accessibility along the street (Figure 8).

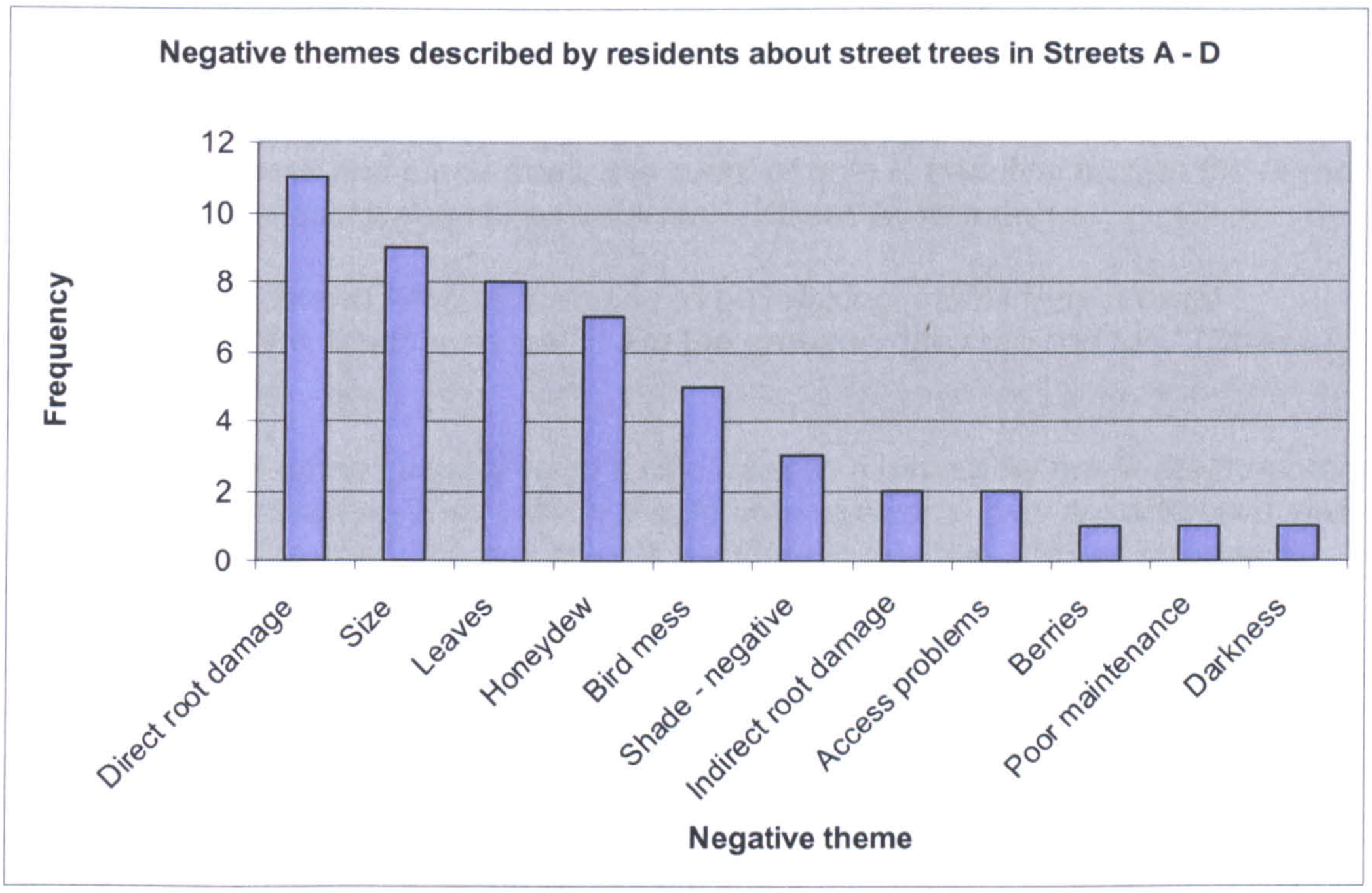


Figure 8 – themes used by residents in Streets A – D that describe their negative perceptions about street trees in general. A full explanation of these themes can be found in Table 15.

Not only were there more positive themes overall they were also mentioned more frequently and Table 16 compares the number of individual positive and negative responses described by the residents.

	Street			
	A	B	C	D
Number of positive themes	54	75	73	64
Number of negative themes	17	7	6	13

Table 16 - frequency of positive and negative themes described by residents about whether trees growing in pavements make streets nicer places to live in.

The following quotes, each from a different respondent, illustrate the way that residents describe these tangible and intangible attributes of street trees. Information relating to the street and gender of the respondent are included in brackets after the quote:

"They add variety to the environment, are beautiful themselves, enhance light and shade, provide a habitat for birds, though bird shit on cars causes much annoyance! We have lime trees and plane trees, the scent of both is beautiful though the former are the source of sticky deposit on vehicles." **(Street A; female)**

"They attract birds and I find bird singing to be relaxing. I think they provide protection from the weather as well. I like the greenery they provide too." **(Street A; female)**

"Even in a city, perhaps especially in a city, trees in a pavement break the monotony of man-made pathways. They vary in the different seasons, they are attractive and cause the street to 'live'. There is always a variety in the type of trees so interest from the bark, leaf, tree shape, berries and blossom." **(Street B; female)**

"Trees budding and flowering at the start of the year herald the start of spring and it brightens the spirits. The lush green colour brings height and life to the somewhat dull colours of the houses and the birds that perch in them to sing are a welcome sight (except the magpies). I love the changing colours of autumn as it is my favourite time of year. Even the canopy of leaves provide shelter in order that I can get out of the car and stay relatively dry even in a downpour. Finally the smell of trees, or at least the smell of the air when pollutants have been removed by them, is more pleasant than if they were not there. They are a constant reminder of my happy youth growing up in semi-rural village in Gloucester." **(Street B; female)**

"Trees in the street are the most attractive part - give colour. Trees provide small amount of nature in urban environment. Encourage some wildlife. Give an overall pleasant feel, relaxing, calming." **(Street C; male)**

"I love trees wherever they are. They soften any environment and change the skyline of sound - you can hear them in any breeze and see their movements; even though these are things you may not be overtly aware of, they give feeling of something natural, soothing and benign generally. Also provide a sense of space as they fill the sky area. Personally, I think trees are to people much as dogs or cats are supposed to be to old people and those who live alone - they are calming - the only way you could measure this of course would be by comparing environments, which I suppose is what you are doing in this survey. I have personal experience of the difference. I lived in a tree lined street in X in a rented flat. When I moved into a house in Y, the lack of front gardens and trees and space made me feel very claustrophobic and I hated it to begin with. It was only the fact that we had some 'real' big trees in our back garden that reconciled me to the change. Since then I've been particularly conscious of the part trees (and garden areas) play in creating and maintaining an 'open' state of mind. I feel more relaxed where there is space and greenery." **(Street D; female)**

Results were compared between residents who had a tree outside their house and those that did not and no discernible difference was identified.

Residents' perceptions of the attractiveness, size and growth rate of neighbourhood street trees

This section addresses issues relating specifically to residents' perceptions in relation to spatial and aesthetic matters of trees in their street.

Residents were asked to describe what they thought about key issues relating to the size of the street trees in their road, their growth rate and appearance by answering a series of closed questions. Results have been divided between those that have stated they have a tree outside their home and those that do not to enable an evaluation about whether this influences perceptions of these factors.

Figure 9 addresses the respondents' perception of the size of the trees in their street and it describes a population with significant agreement that, overall, tree size is 'just right'. This is an important finding because each street is considered to contain trees of different dominant size classes and yet this appears to have little influence over perception. There are some minor differences where residents with trees outside their house are more likely to consider the trees growing in the road where they live as 'too large' and where slightly more residents who have stated they do not have a tree outside their house (see p 126 for a detailed explanation of this) consider them 'too small'.

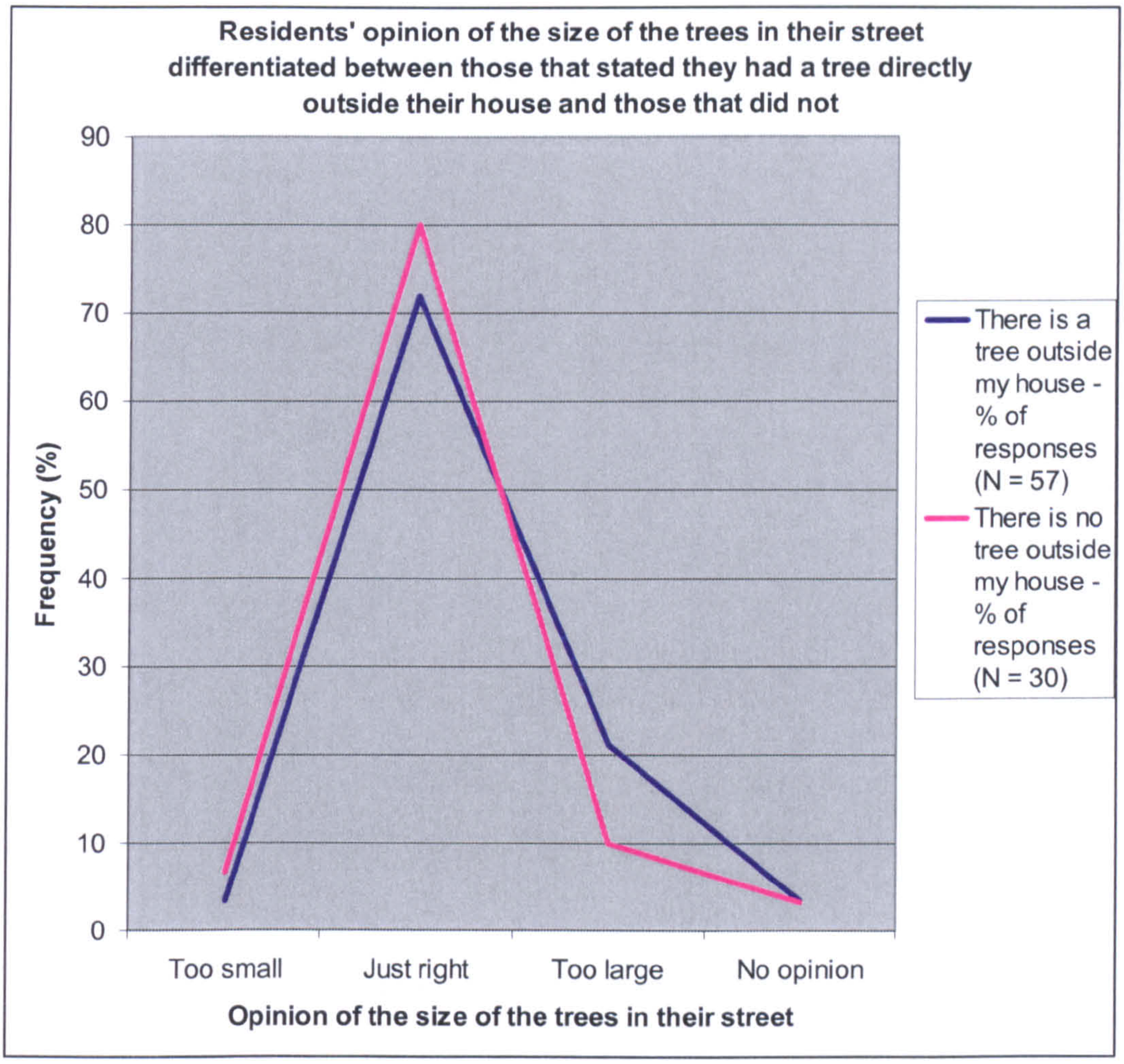


Figure 9 - respondents' perception of the size of the trees in their street, described in the householder survey, differentiated between those that stated they have a street tree outside their home and those that did not

Figure 10 illustrates what residents think of the growth rate of the trees in their road. Unlike the other questions in the survey a significant minority of residents stated that they had 'no opinion' about this factor suggesting that growth rate is a street tree issue that is not widely considered. Residents who had no tree outside their home were more likely to perceive growth rate as 'good' and those with trees outside their home were more likely to think they grew 'too fast'. Only one resident reported that the trees grew 'too slow'.

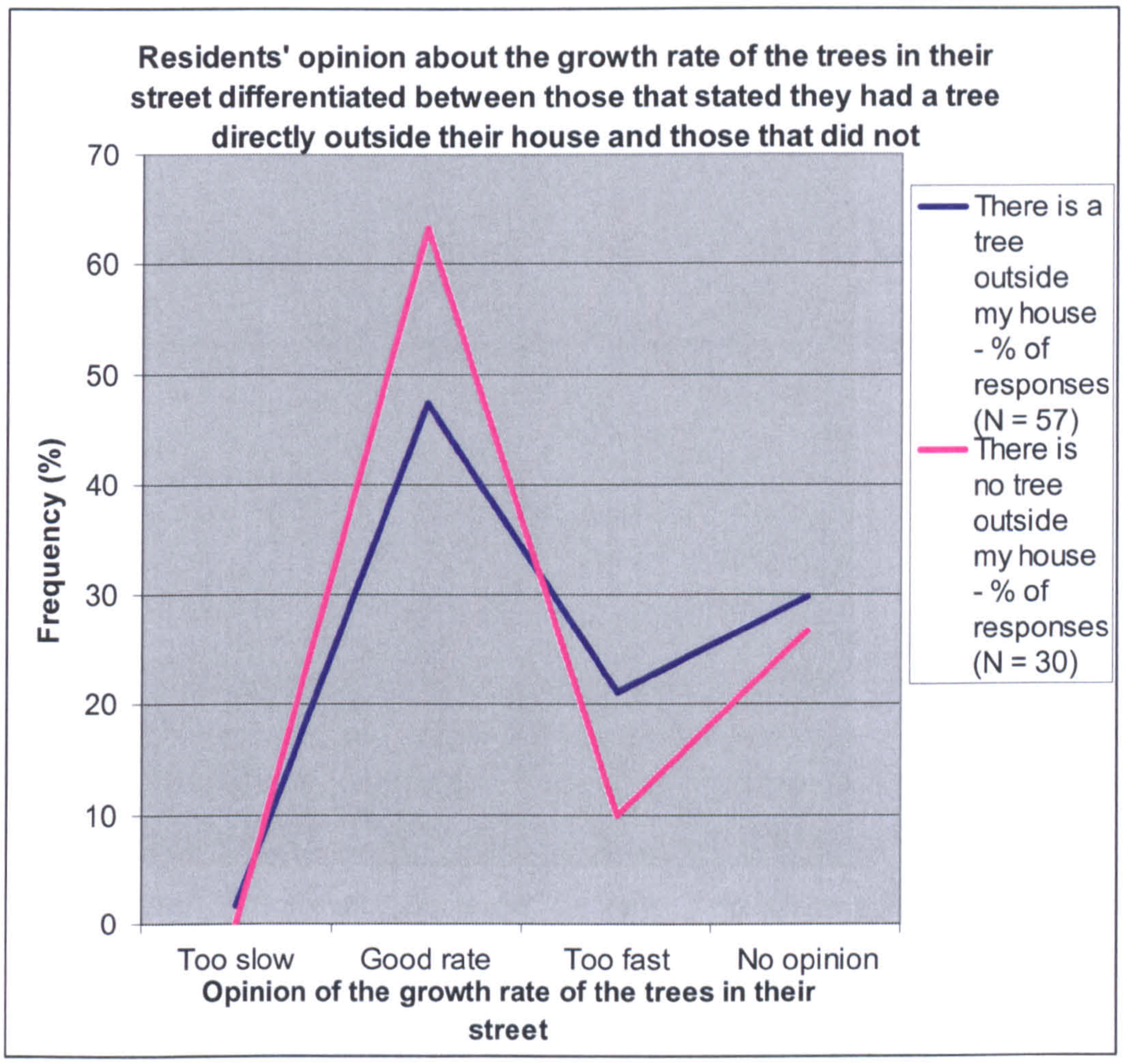


Figure 10 – residents' perception of the growth rate of the trees in their road differentiated between those that stated they have a street tree outside their home and those that did not

Figure 11 illustrates residents' perceptions of the attractiveness of the trees in their street. The chart shows very clearly that residents have a high appreciation of the attractiveness of street trees in their area and there is little discernible difference in opinion between those that have a tree outside their home and those that do not. Indeed the mode opinion of the appearance of the trees in their street was 'very attractive'. Furthermore, this reflects the results from all other related research where visual attractiveness is perceived as an important positive attribute of street trees (e.g. Kalmbach & Kielbaso, 1979; Heimlich *et al*, 2008).

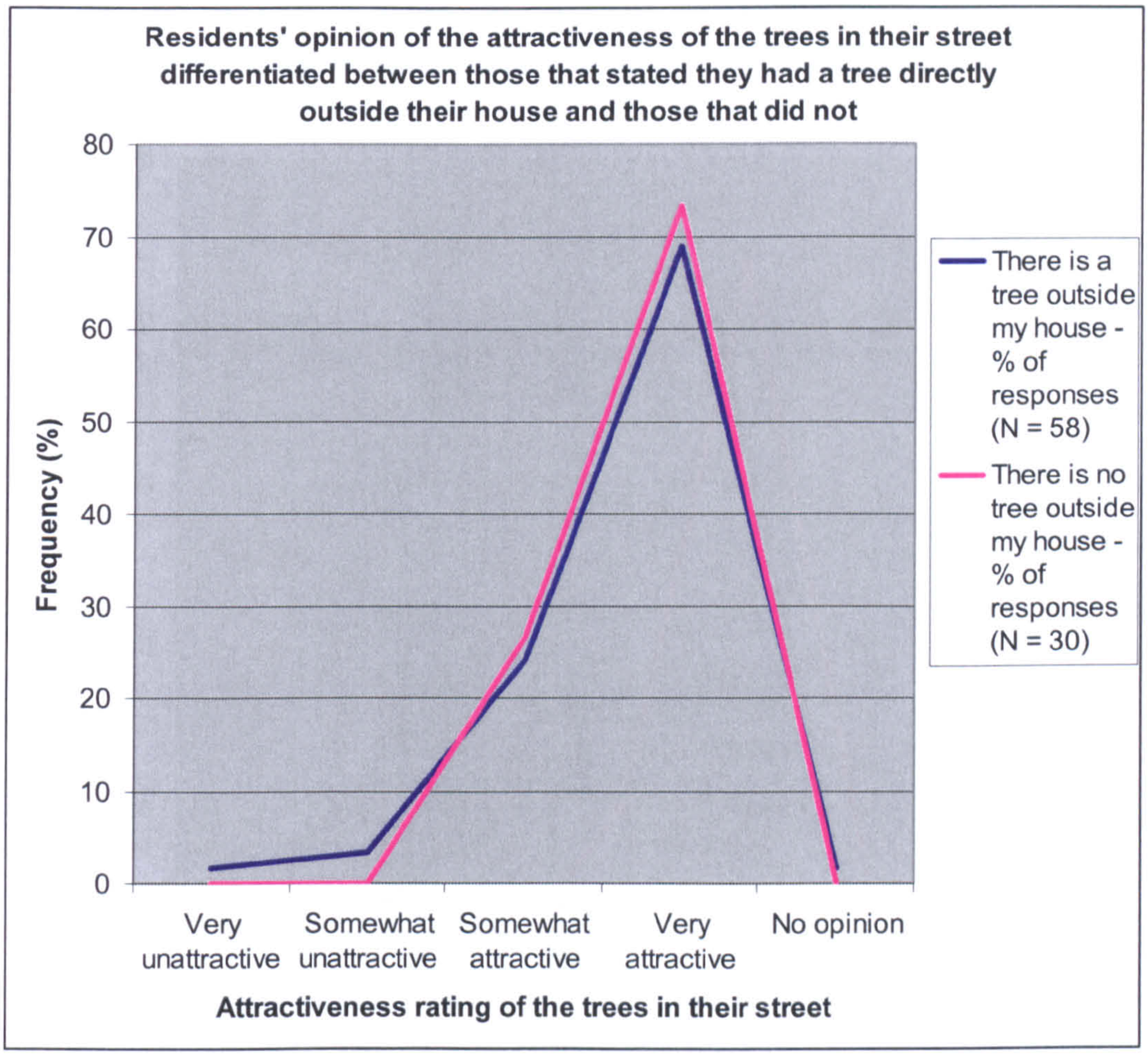


Figure 11 - residents' perceptions of the attractiveness of the trees in their street differentiated between those that stated they have a street tree outside their home and those that did not

The modal rating of local authority tree management was '4' indicating that, overall, residents were satisfied with the maintenance of the trees by the local Council and Figure 12 illustrates this point. Very few residents held 'no opinion' about this facet of street trees indicating a high degree of interest in this element of street tree care. Residents who had no tree outside their home were far more likely to rate the Council's maintenance more positively.

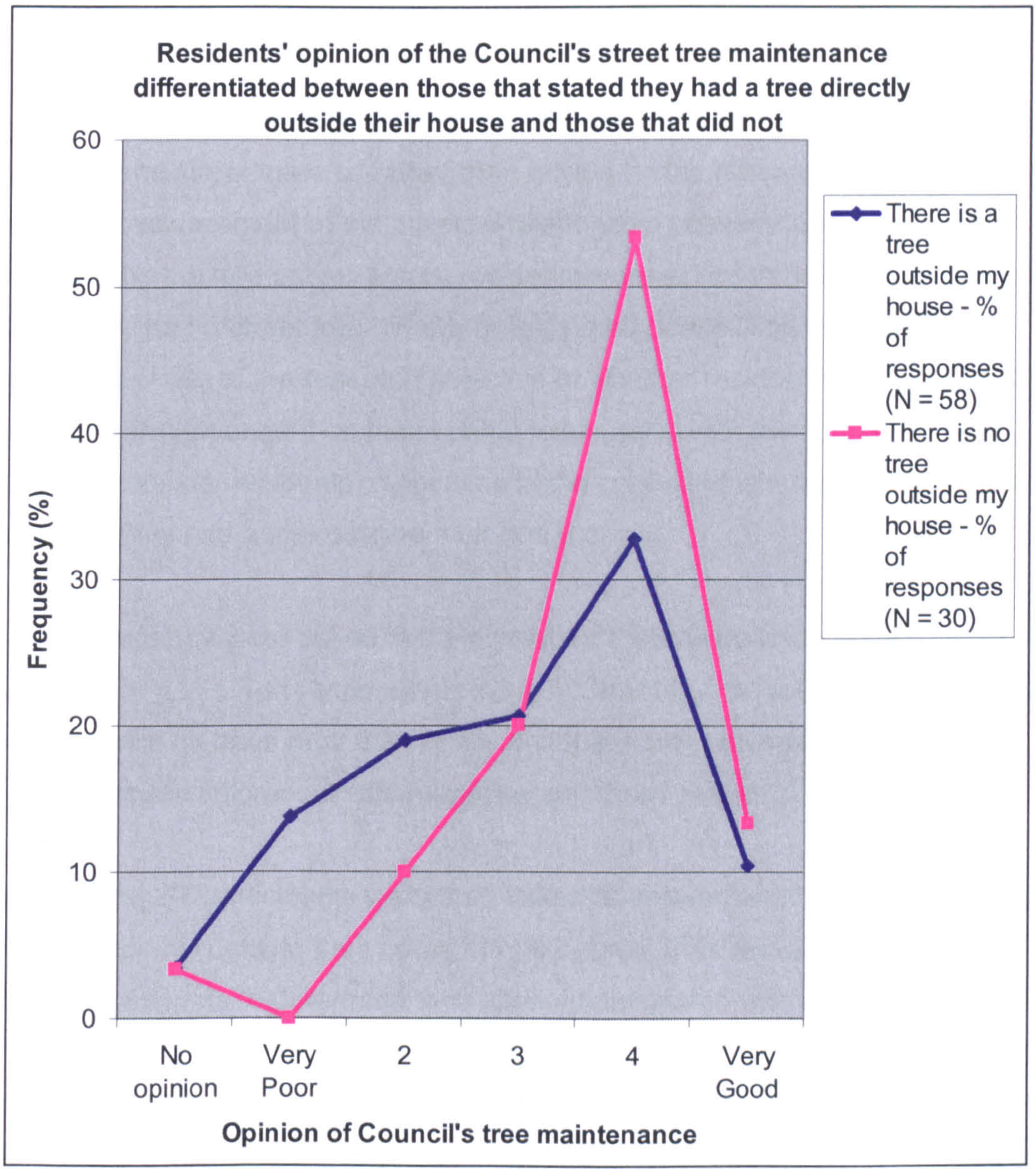


Figure 12 - residents' opinion of how well they think the Council maintains the trees in their street differentiated between those that stated they have a street tree outside their home and those that did not. Residents were asked to rate their opinion on a scale between 1 – 5; with 1 being very poor and 5 being very good.

Data from these questions appears to be building a scenario where residents articulate different relationships with street trees depending on their relative alignment. This issue is explored in more depth below.

Residents' spatial relationship with trees in their street

It has been important to understand residents' perceptions of the spatial features of their home and street trees so rather than relying on the researcher's perception, based on an assessment of the physical relationship between street trees and houses during the tree survey stage, residents were asked to determine themselves whether they had a street tree directly outside their house. This was particularly important because of the research objective of whether residents' perceptions of street trees are dependent on their spatial relationship with them. The following results will consider residents' responses in the context of whether the participant considered they had a tree outside their home or not.

Firstly respondents were asked to state whether there were trees in their street near their home (N = 97). Ten respondents living in Street D, the 'split' street, answered that there were no trees near their home and these were diverted to a part of the survey especially tailored for that response and these results are described later.

The remaining 87 participants were then asked to answer whether they thought they had a tree directly outside their home or one nearby. This served the purpose of allowing participants to determine their spatial relationship with street trees rather than the researcher doing so. The survey did not include a method for residents to identify their 'closest tree'. Results indicate that residents identify strongly with trees in their street being able to make clear judgements about their positioning relative to street trees in their road. Such judgements are not consistent and indicate a level of individuality that cannot be discernible by observation alone.

Fifty eight residents stated that they had a tree outside their house with 29 saying they did not. Maps 2 – 5 identify the location of each of the street trees and how each respondent perceived their spatial relationship with the trees in their road.

In Street A fifteen respondents stated they had a tree directly outside their home and four reported having one nearby (Map 2).

The majority of residents in Street A made decisions about their spatial relationship with nearby street trees that would be understood by most neutral observers. For example, Map 2 shows how the four residents who stated they did not have a tree outside their house (red circle) did not physically have a tree in the pavement in front of their house. Equally most of the respondents who stated they had a tree outside their house (blue circle) did. However, three residents who had no tree directly outside their house responded by stating that they did.

Twenty three respondents stated they had a tree directly outside their home and eight reported having one nearby in Street B.

Map 3 illustrates how residents in Street B have very different perceptions of what constitutes having a tree outside their house. Generally, residents without a tree outside their home confirmed this fact but those that stated they did have a tree outside their house appeared to have a wider interpretation and two had trees quite some distance from their home.

In Street C 15 residents stated they had a tree directly outside their home and five described having one nearby.

Map 4 illustrates how residents in Street C, similarly to those in Street A, can have quite different perceptions of what constitutes having a tree outside their house. The two black arrows highlight two properties that have very similar spatial relationships with a tree and yet the residents have different opinions about whether the tree is 'outside' their house. Generally, residents without a tree outside their home confirmed this fact but three residents who had no tree directly outside their home stated that they did.

Map 5 illustrates how the 27 respondents in Street D perceived their relationship with street trees showing how residents can have very different perceptions of what constitutes having a tree outside their house or even street trees in their road.

These results illustrate that whilst most residents agree with conventional views about their spatial relationship with street trees a minority consider that trees

influence their home even when they are some way off and the implications of this are considered when results are analysed later. What is most clear is that residents are capable of defining their relationship with the closest tree and that there is not a uniform response to this relationship.

The following information analyses the survey returns in more detail identifying trends in responses particularly between residents who stated they had a tree outside their house and those that did not. Such focussed analysis has not been carried out in the UK before and offers an opportunity to evaluate the extent to which street tree proximity influences perceptions.

Residents' perceptions of their nearest street tree

The following focuses on the relationships that individuals have with the nearest street tree when in their house or carrying out house related activities.

Residents were asked to describe their overall opinion of the closest street tree, their perception of it size and how they felt about the distance between it and their home by answering a series of closed questions. Results are displayed taking into account whether the respondent stated they had a tree outside their home or not to enable an evaluation about whether this influences perceptions.

Figure 13 illustrates residents' overall opinion of their closest tree, which is generally positive, with the mode response being 'good' irrespective of whether there is a tree outside their home or not. The chart emphasises that residents who have a tree outside their home are more likely to hold less positive opinions than those who claim not to have a tree directly outside their home. There is parity between those that have the opinion 'very good' suggesting that proximity to the home is of relatively little importance for this group of residents who are the most positive about street trees.

Figure 14 depicts residents' perceptions of the size of their closest street tree showing that the majority of residents have a positive opinion about the size of their closest tree although residents with a tree directly outside their home are more likely

to consider it to be 'too large'. Very few respondents considered the tree as 'too small' or had 'no opinion' about it. Residents that described the tree as 'too small' all lived in Street C which contains the smallest trees although these were in a minority (see Figure 3).

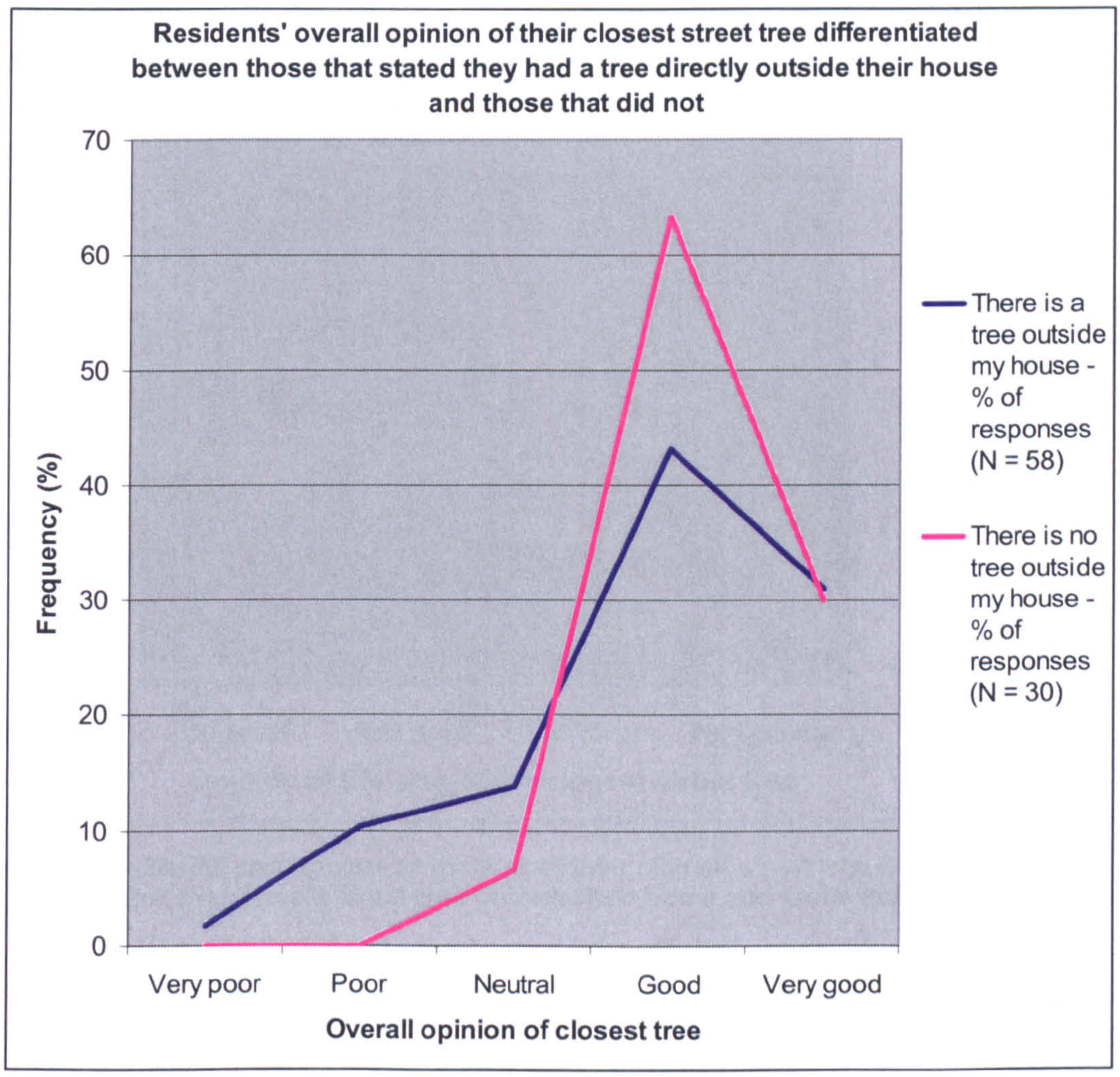


Figure 13 - residents' overall opinion of their closest tree differentiated between those that stated they have a street tree outside their home and those that did not

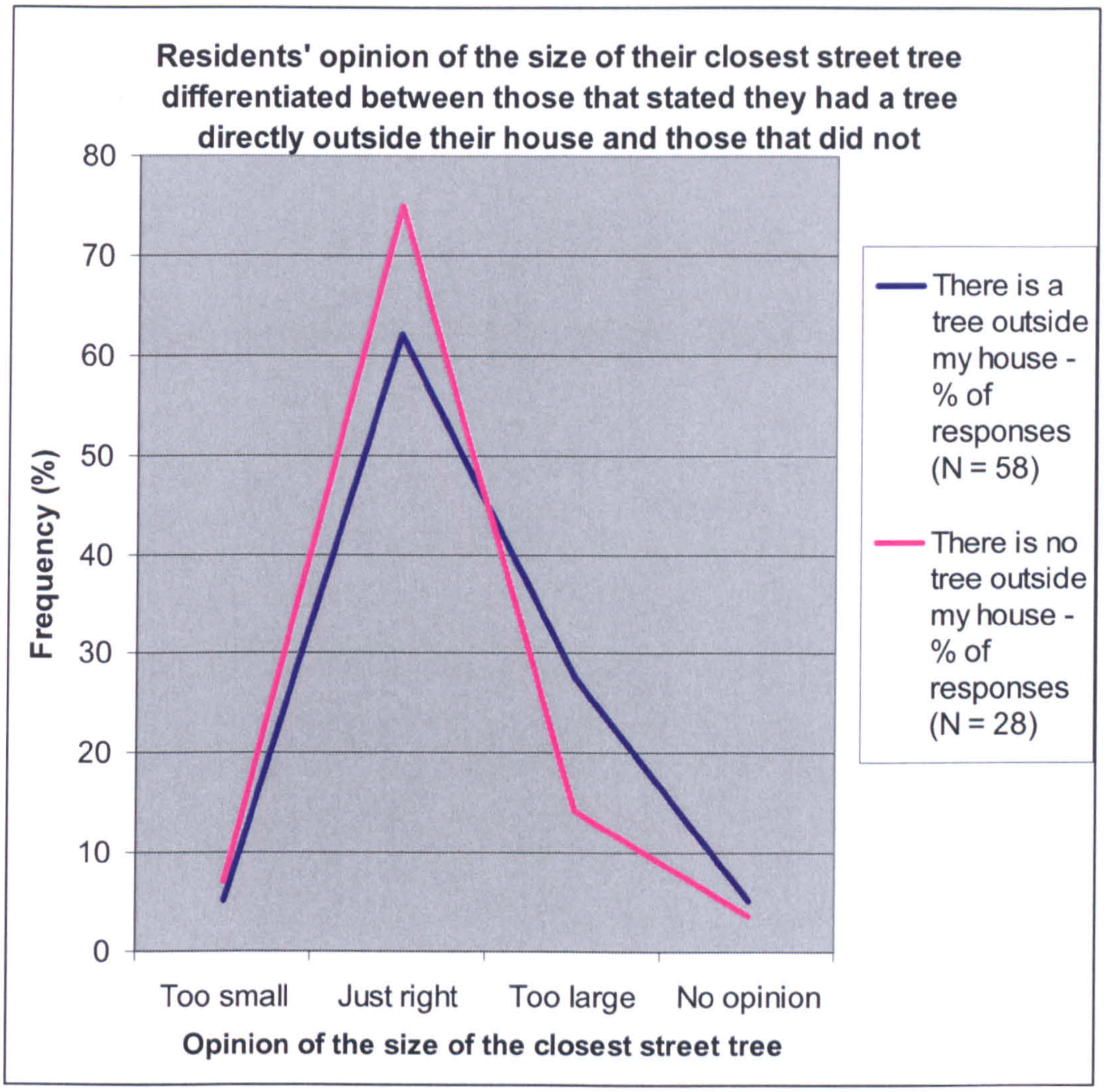


Figure 14 - residents' perceptions of the size of their closest street tree differentiated between those that stated they have a street tree outside their home and those that did not

The mode response for residents about the distance of the tree from their home was 'just right', irrespective if they thought the tree was directly outside their home or not and Figure 15 highlights this point. The chart also reveals a dichotomy of opinions where no residents with a tree outside their home thought the tree was 'too far' away or those without a street tree outside their home believing it to be 'too near'.

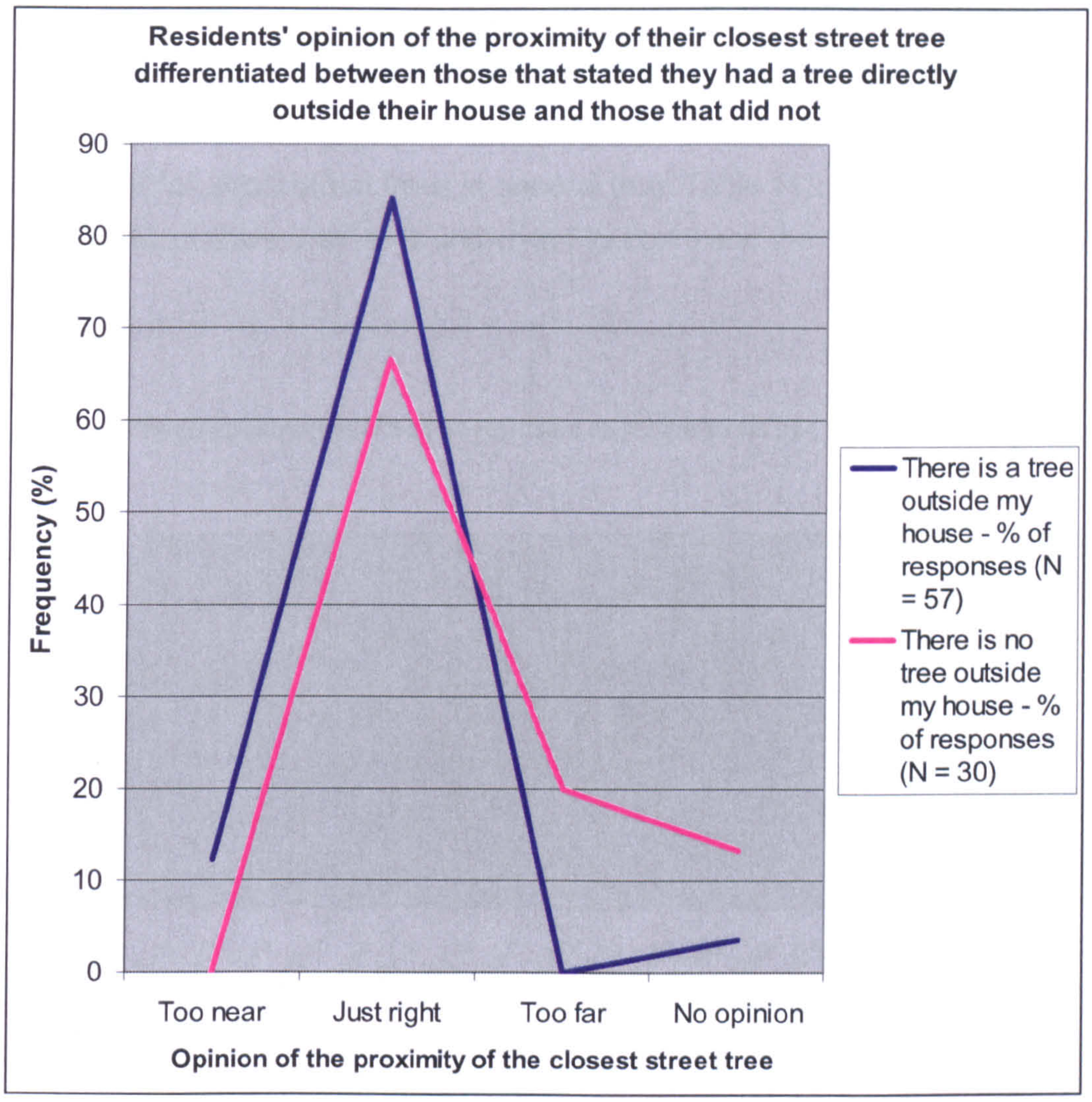


Figure 15 - residents' perceptions of the proximity of the closest street tree differentiated between those that stated they have a street tree outside their home and those that did not

Themes which influence perception of the closest street tree

In further seeking to establish the factors that influence residents' perceptions of the impact of the nearest street tree participants were asked to describe the attributes that influenced their overall opinion of the tree closest to their home.

Such questioning gave the opportunity to develop a detailed framework describing the reasons behind participants' opinions of nearby street trees thereby offering the opportunity to develop an understanding of the factors that influence perception of the very closest street trees.

Analysis of this information was carried out by assigning a theme to frequently recurring responses. Respondents described both good and bad points about the presence of their closest street trees and these were aligned to the themes described earlier about street trees in general (e.g. Table 14). The frequency of each of the 22 positive themes is shown in Figure 16 and the 15 negative themes in Figure 17.

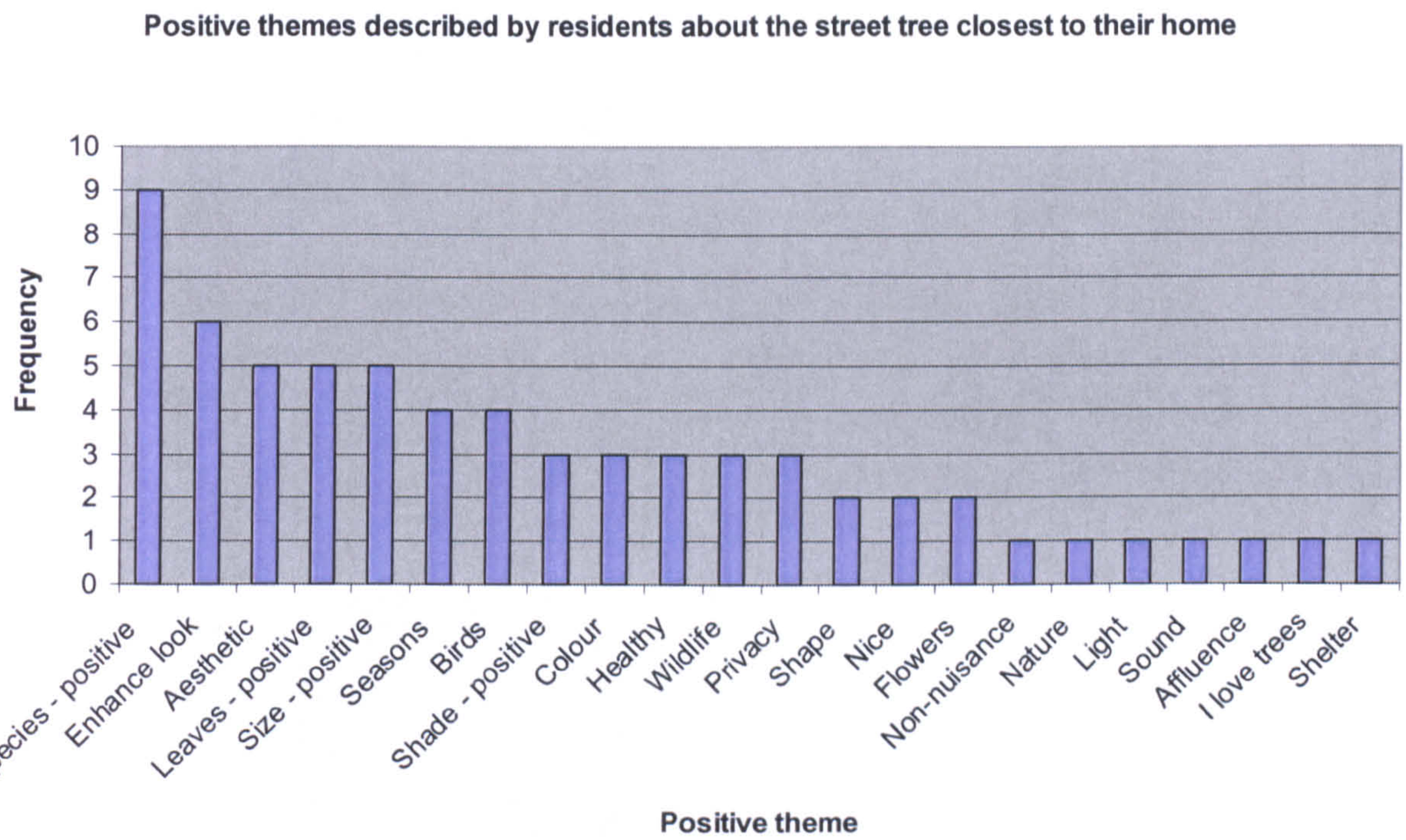


Figure 16 – themes used by residents in Streets A – D that describe their positive perceptions about their closest street tree. A full explanation of these themes can be found in Tables 14 and 17.

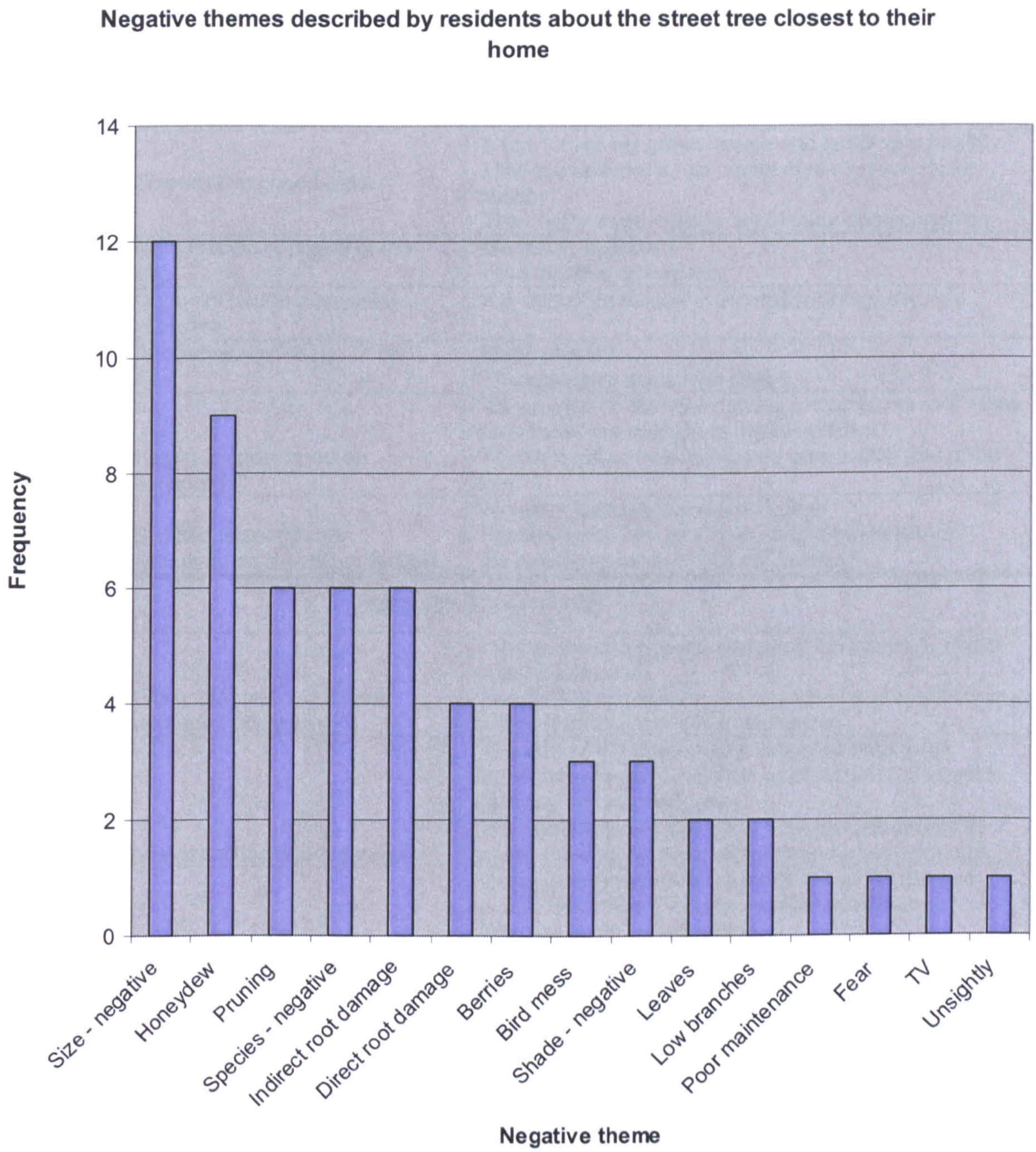


Figure 17 – themes used by residents in Streets A – D that describe their negative perceptions about their closest street tree. A full explanation of these themes can be found in Tables 15 and 17.

Additional themes to those described in Tables 14 and 15 were needed because residents introduced extra factors and these are described in Table 17.

POSITIVE FACTORS		
Code	**Deeper definition**	**Indicative quotations**
Calming	Help make the area/people calmer	
Flowers	Attractive blossom	'Lovely blossom in spring'
Healthy	Tree look in good health	'It has lots of big green leaves and looks very healthy.' 'I like the fact that it has plenty of leaves and looks healthy.' 'The cherry trees outside are in fairly good condition.'
Nice	Non-specific approval of the tree	'Generally approve.' 'I like the kind of tree it is.'
Non-nuisance	Does not cause a specified nuisance	'It is attractive to look at but doesn't block my light.'
Shape	Appreciate the shape of the tree	'Good shape.' 'The branches are a nice shape.'
Size - positive	Height is considered an advantage	'It's very tall so the main leaves are up to my roof - they don't block the sunlight to my living room.' 'I'd much rather have a big tree than a little tree or no tree.'
Species - positive	Species is specifically described as a positive feature	'I'd rather it was a plane than a lime.' 'Big sycamore leaves - lovely bright green colour.' 'It's a rowan tree and I like the berries.'
NEGATIVE FACTORS		
Fear	Worry that tree will cause damage to property	'I worry about the roots damaging the structure of the house/drains etc.' 'I worry that the telephone line might be brought down in a strong wind since leaves envelope it...'
Low branches	Low branches affect access	'The size of the tree and the height of the lowest branches - it's annoying having branches which get in your way as you walk pass.' 'The new trees are sprouting from the bottom of the trunks obstructing the pavement and need pruning.'
Pruning	Pruning raised as an issue - e.g. frequency, formative	'Council need to prune the lower branches more to ensure that it matures into a well shaped tree.' 'The tree badly needs pruning.' 'The tree grows quickly cutting out light and needs regular pruning'
Species - negative	Species is specifically described as a negative feature	'The tree is a lime tree which produces a sticky substance in spring/summer which coats everything including cars and wheelie bins making them unpleasantly sticky.' 'The only drawback is the tree outside my house is a lime tree which drops juice on the car windscreens.' 'I find our lime tree a real pain.'
TV	Tree affects TV reception	'Impacts on TV coverage and reception.'
Unsightly	Tree looks unattractive - poor pruning regime	'The tree looks unsightly when it has been pruned.'

Table 17 – positive and negative factors described by residents when discussing the nearest street tree in addition to those listed in Tables 14 and 15.

When given the opportunity residents continued to describe in detail their reasoning and expressed a high degree of knowledge about the good and bad points of the street trees closest to their home as the following examples, each from a different resident, demonstrate;

"Provide shade and colour. Connections with nature. Bird poo and the sap from the lime trees dripping onto cars are the only negatives." **(Street A; male)**

"Greatest factor is attracting wildlife. The only drawback is the tree outside my house is a lime tree which drops juice on the car windscreens. There are maples too. I prefer them a lot more. But would still prefer a lime to nothing" **(Street A; male)**

"The council fail to prune the tree adequately leading to desiccation of the surrounding soil and therefore structural damage to properties nearby including my house. The tree is a lime tree which produces a sticky substance in spring/summer which coats everything including cars and wheelie bins making them unpleasantly sticky. The tree looks unsightly when it has been pruned as pruning is often very drastic as it is done infrequently. However, the tree produces lovely big green leaves in spring/summer which make the street look lovely and really improve the environment of the street." **(Street A; female)**

"It's far too large. Has low growing branches. The leaves get into drives and front gardens - they are large and cannot be composted. They are not swept frequently. The trees are not pruned often enough." **(Street B; female)**

"It is a silver birch (I think) and it is still quite young, having replaced the previously mentioned lime. It is planted just on the boundary between my house and the one next door, so does not block out light from either of us." **(Street B; female)**

"I would like more trees or one directly outside my house. The trees in the road are too small but are OK." **(Street C; female)**

"The tree can be seen directly from the lounge and bedroom - provides glimpses of green and nature. Not sure of species but creates focal point to looking out of window." **(Street C; male)**

"The tree is very tall and overpowers the house. Its girth makes it difficult for pedestrians to use the pavement and the roots have severely distorted the pavement making the surface uneven and poor drainage causing large puddles during rain. Also the roots have undermined the gate pillars causing them to lean and to begin to crack. There is some concern that this may have an effect on the house. The Council are aware of these concerns but fail to address them." **(Street D; male)**

"We are lucky to have a large and beautiful tree close enough to our house to appreciate, but not so close that its roots affect our property or that it casts too much shade. The autumn leaf-drop is a bit of a pain but it is so temporary and of course it is just a part of nature's natural cycle. And of course there is much pleasure to be had scrunching and kicking your way through a pile of leaves on the pavement. The tree closest to us also acts as a useful pin board that loads of people use to advertise their lost cat or a jumble sale etc etc." **(Street D; female)**

Figure 18 illustrates the frequency of themes identified by residents when describing their relationship with street trees in general and the tree closest to their home. The identically coloured lines relate to the same relationship and the chart thus shows how residents have many positive things to say about street trees in general and far less negative things to mention (blue lines in Figure 18), regardless of the street in which they live. The pink lines illustrate the themes that relate to the residents' closest tree and this describes a situation where negative themes (dashed line) are much more prominent and in one case outrank positive factors in Street B. This is in stark contrast to the opinions expressed about street trees in general.

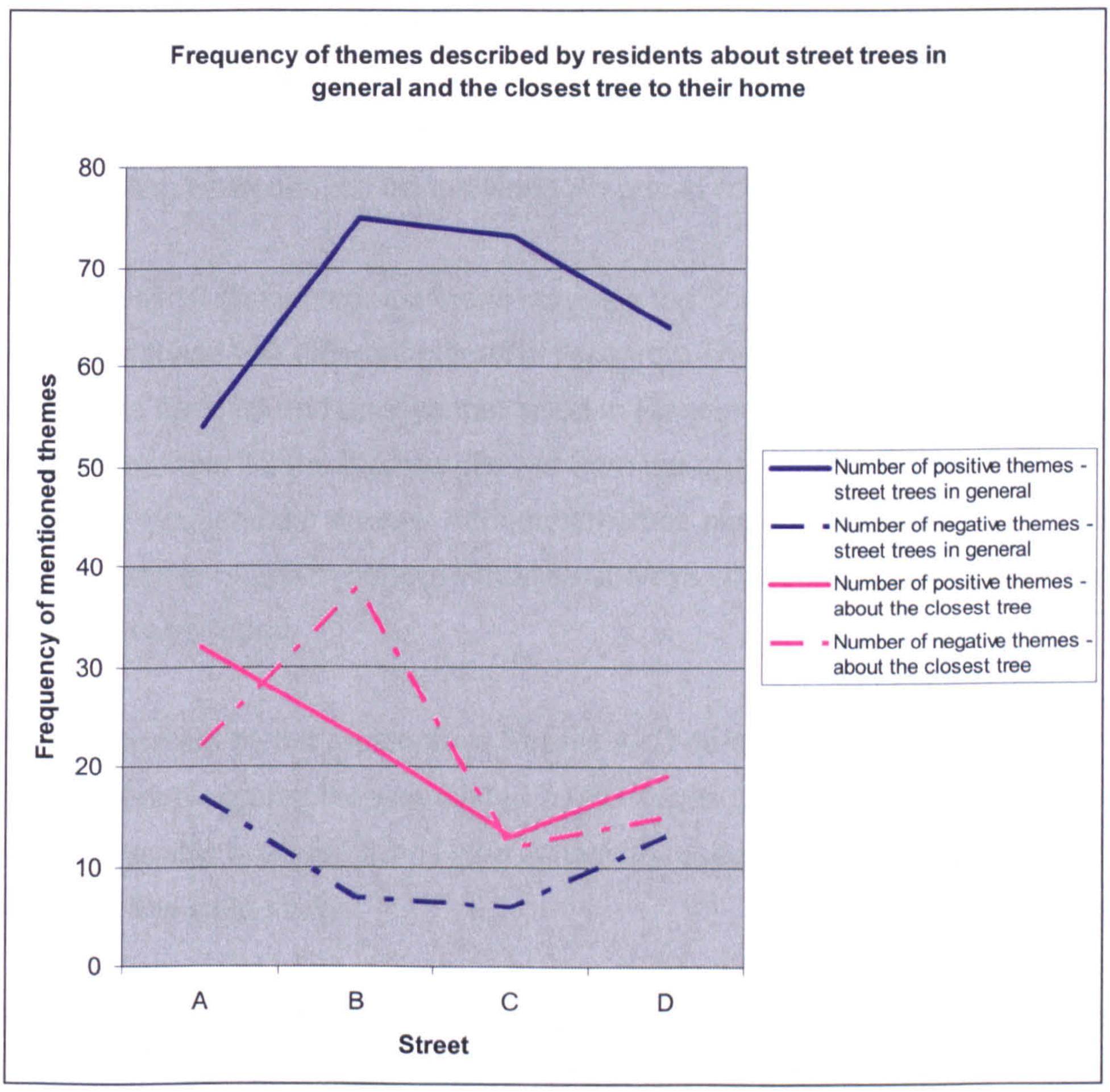


Figure 18 - the frequency of themes identified by residents when describing their relationship with street trees in general and the tree closest to their home

Residents' perceptions of a list of generic tree benefits and annoyances

In seeking to understand general attitudes to street trees all respondents were asked to describe how they felt about a provided list of tree benefits and annoyances. They were asked to evaluate the degree of benefit or annoyance attributable to street trees using a scale from 'strongly disagree', 'disagree', 'neither agree nor disagree', 'agree' and 'strongly agree'.

This list of benefits and annoyances originates from Flannigan's survey (2005) which itself was a slightly modified version of that used by Schroeder & Ruffolo (1996). It was included in this survey to evaluate the validity of the listed attributes because although Flannigan (2005) had previously shown that residents were able to rate the attributes but it was not known the extent to which these attributes were relevant having been derived from a North American context.

Tables 18 and 19 contain comparisons between the benefits and annoyances derived from these two different pieces of research. The left hand column in both tables list the benefits and annoyances used in Flannigan's (2005) paper and the right hand columns list the themes derived from the open ended questions in the case study's householder survey. Attributes/themes placed in the same row in both columns illustrate matches between the two surveys whereas blanks indicate where no matches were found.

Benefits described by the residents in Streets A- D demonstrate a richness of experiences outweighing those provided by Flannigan (2005) by one third. Almost half of the benefits provided from North American research were not recognised by residents in this case study.

In contrast the case study residents described only 11 annoying attributes compared to 18 listed by Flannigan (2005) but, in similar fashion with the benefits, there was little agreement about the attributes with only eight annoying attributes being matched.

Flannigan (2005) had modified the list of annoyances and benefits from the North American papers in recognition of differences that UK residents faced in their neighbourhood. However, these results indicate that a much more fundamental review of these attributes is needed to ensure that the differences between communities are not ignored.

Evidence from the householder survey suggests that current research of people's attitudes to street trees in the UK is currently insufficient to enable the meaningful use of generic lists of annoyances and benefits. It is also possible that the caution expressed by researchers about transferring the results of such studies away from their origins might also apply to transferring some of the contents of the surveys.

Benefit (householder survey)*	Benefit expressed by survey respondents †
Enhances look of garden and home	Trees enhance the look of the street/houses/gardens
Increases sense of home and family	
Brings nature closer – birds etc	Trees provide a habitat for wildlife in general
Increases property value	Make the area look affluent
Pleasing to the eye	Trees look good/are beautiful in their own right
Increases sense of community	
Provides spiritual values	
Autumn colour	
Filters pollutants from the air	Ameliorate pollution
Increases privacy	Afford privacy by obscuring property
Slows wind speed	
Reduces noise	
Screens unwanted views	Afford privacy by obscuring property
Flowers on tree	
Cools home in summer	Trees contribute to cooling the area
Gives shade in garden	Cast welcome shade onto cars/property/garden
Gives shade in home	Cast welcome shade onto cars/property/garden
	Contribute to the environment/add variety
	Add colour to the street
	Trees provide a nice smell for the street
	Mark the changing seasons
	Enhance the light
	Exercise in raking them up
	Makes the area appear established
	Take up carbon
	Trees intercept the rain
	Trees are associated with rural living
	Trees make an interesting sound
	Provide oxygen
	Improve frame of mind
	Shelter
	Offer a historical context for the street

* Benefits from Flannigan (2005) which were used in the postal survey.
† Tables 14 and 17 provide data about the benefits experienced by residents in the case study area. Matches in meaning with Flannigan (2005) have been made where it is obvious. Where no obvious matches have been found the adjoining column is blank

Table 18 – Comparison between positive tree attributes identified by Flannigan (2005) and those expressed by the residents in Streets A - D.

Annoyance (householder survey *	Annoyance expressed by survey respondents †
Sap/sticky liquid dripping from tree	Sticky honeydew is a nuisance
Causes allergies	
Attracts annoying insects	
Actual root damage to property, pavement, drive, wall, drains etc	▪ Subsidence ▪ Trees damage property
Fear of root damage to property, pavement, drive, wall, drains etc	
Branches or suckers grow from base obstructing access	Access issues affecting wheelchairs, pushchairs etc
General debris such as sticks or seeds fall from tree	Fallen berries are a nuisance
Flowers fall from tree	
Fallen leaves in autumn	Raking up leaves/leaves block drains/slippery leaves
Leaves fall continuously throughout summer	
Falling limbs	
Blocks street light	Make street dark at night
Reduces personal safety by limiting visibility	
Blocks view from property	
Blocks sun into home	Cast unwelcome shade onto house/garden
Blocks sun to garden	Cast unwelcome shade onto house/garden
Branches overhang garden	
Fearful tree might fall over in storms	
Fearful branches might fall off in storms	
	Poorly cared for by Council
	Can be too big and dominate
	Bird mess on cars and property a nuisance

* Annoyances from Flannigan (2005) which were used in the postal survey.
† Tables 15 and 17 provide data about the annoyances experienced by residents in the case study area. Matches in meaning with Flannigan (2005) have been made where it is obvious. Where no obvious matches have been found the adjoining column is blank

Table 19 – Comparison between annoying tree attributes identified by Flannigan (2005) and those expressed by the residents in Streets A - D.

Residents' opinions about planting trees outside their house in tree-less street

Eight participants, all of whom lived in Street D, described having no street trees in their road and were diverted to the section of the survey especially tailored for that response. Participants were asked to state whether they would like a tree planted in the pavement directly outside their home and to provide up to five separate reasons for their response, in order of importance.

The following describes each resident's reason for their decision about wanting a tree planted outside their house or not. Brief information about the respondent is provided in column one of Table 20.

The resident who wanted a tree planted directly outside their home described three reasons for this:

1. *"Provides/enhances environment*
2. *Provides life*
3. *Pleasing to the eye"* **(Female)**

The only resident in the survey who disagreed with the statement that street trees makes roads nicer places did not want trees planted outside their house. This respondent did not provide a list of reasons for this as requested but referred to the list of annoyances (see Table 19 above) where they had ticked 'strongly agree' for all of them. This respondent also provided no demographic information.

Table 20 itemises the lists provided by the remaining residents, who completed the section, which explain their reasoning. They had also been asked earlier to comment on whether '*Trees growing in the pavement make streets nicer places to live in'* and could choose from the following options; 'strongly disagree', 'disagree', 'neither agree nor disagree', 'agree' and 'strongly agree' and this information has also been included.

These results indicate further that residents in Streets A – D have a strong appreciation of street trees as urban landscape features but proximity to their own property can alter this perspective. Reasons for not wanting street trees focussed on tangible factors such as their presence preventing on and off street parking, roots damaging pavements and drains, shading and leaf litter. Five of the residents also stated that they had trees in their own garden obviating the need for street trees. There is a suggestion by these respondents that control over trees is also preferable.

Resident	Reasons provided by respondents for not wanting a tree planted outside their home	*'Trees growing in the pavement make streets nicer places to live in'*
Male	1. *"Although illegal cars need to park partly on the pavement* 2. *House insurance problems due to potential subsidence* 3. *Root problems with drainage systems* 4. *Subsidence potential"*	Neither agree nor disagree
Male	1. *"Because I already have two trees on the edge of the garden and there is not enough space for another on the pavement without removing these*	Strongly agree
Female	1. *"Because I have planted one in front garden to compensate for lack of street trees."*	Strongly agree
Female	1. *"Damages pavement* 2. *Blocks vision when exiting drive* 3. *Unnecessary as we have trees in our front gardens* 4. *Less sunshine in 'front of house' rooms."*	Agree
Female	1. *There isn't room because of a road sign* 2. *I planted a tree in my front garden*	Agree
Male	1. *"We have trees in our front garden."*	Strongly agree

Table 20 – reasons given by residents for not wanting a tree planted outside their home alongside their opinion about whether street trees make roads nicer places to live in.

Interviews with residents in Streets A - D

Eighteen residents from living in Streets A - D agreed to take part in a face-to-face interview which included carrying out a visual simulation survey (Table 21). In order to maintain anonymity each interviewee has been assigned a unique reference and this will be used throughout the thesis.

Street	Frequency	Percent
A	5	27.8
B	4	22.2
C	5	27.8
D	4	22.2
Total	**18**	**100.0**

Table 21 – frequency and street location of all 18 interviewees

Interviewees were asked a series of questions whose purpose was to investigate more deeply their perceptions of street trees particularly how such trees influenced their opinions of their street, the issues that influenced their opinion of the trees and their views on tree size (see Appendix B for the questions).

Information collected from the interviews is described in several ways. Firstly the results are described on a street by street basis allowing a more in depth understanding of the relationships that residents have with street trees at this level. Each of the interview questions will therefore be reported separately by street. This will give a broader picture of this relationship.

Secondly four vignettes will be used to explore in more depth individual relationships with street trees. As the previous results have started to explain there appears to be two levels of street tree interaction and this will be explored in more depth where clusters of respondents in each of the streets will be examined in more detail.

Interviewees also undertook a visual simulation survey and results from this are described later. Analysis of responses to the visual simulation survey will incorporate details drawn from the work described above.

How much do street trees contribute to interviewees' opinions of their street?

The literature has focused on people's perceptions of street trees in isolation and had not placed this relationship in context with other factors of life. This question therefore sought to understand more deeply the extent to which street trees impacted on residents' satisfaction of living in their street.

The householder survey had revealed that all interviewees liked living in their street with seven agreeing with the statement and 11 strongly agreeing. The follow-up open ended question had also shown that street trees were an important contributor towards street preference. This interview question allowed further probing of the specific role of street trees in that decision making.

The following quotes, described on a street by street basis illustrate three levels of enthusiasm about how trees influenced interviewees' opinions of their street. Interviewees were split between being very enthusiastic about the relationship between street satisfaction and street trees and those that were slightly more restrained in their opinion but still valued the presence of the street trees. Three residents stated that street trees did not contribute to their opinion about what influenced them about living in their street.

All these different opinions were distributed across all four streets although residents in Street C, the 'small tree' street, were affected most positively by the presence of street trees. Street D residents were least enthusiastic and this may reflect the 'split' nature of the street where some respondents did not believe they lived in a tree-lined street. Street A residents' opinions were spread across each category.

Analysis of residents' interviews follows on a street basis and basic information drawn from their householder survey is provided in brackets after each quote:

Street A – large trees

The householder survey found that interviewees in Street A liked living in their street with three of them 'strongly agreeing' with the statement and two 'agreeing'.

Three interviewees were enthusiastic about the positive contribution of trees to their satisfaction of living in their street and their reasoning is repeated below;

"OK - the word I would use would be significantly. If you go to other, in fact these are the nicest trees in the streets around here some of the houses are quite similar but these have got the nicest trees and since I've been here which is a long time now 25 - 30 years which is a long time none of them have got cut down but I'm a bit scared of what, the guy who measured the trees, who is the city council who does that stuff, talked about subsidence." **(Interviewee A1: male, aged 54. 'Strongly agrees' that he likes living in his street and 'strongly agrees' that trees growing in the pavement make streets nicer places to live in).**

"Quite a lot I think. They add a great deal to the attraction of the street even more to some other streets. I'm thinking of X Road where big planes overhang and the road that runs up to the church at the top and again has an avenue of big planes and they are incredibly attractive." **(Interviewee A2: male, aged 55. 'Strongly agrees' that he likes living in his street and 'strongly agrees' that trees growing in the pavement make streets nicer places to live in).**

"Quite a lot actually. As I was saying before it gives it a bit more greenery and as I grew up in a rural area so it's quite nice to have trees and stuff like that around." **(Interviewee A5: female, aged 26. 'Agrees' that she likes living in his street and 'strongly agrees' that trees growing in the pavement make streets nicer places to live in).**

The following quotes are from the two remaining residents who were more restrained in their opinion of the link between the trees and their opinion of the street but they still valued the presence of the street trees. The next quote comes from a resident who describes a position that appreciates street trees but on closer probing reveals that his position is affected by his relationship with the trees by his house.

"I think they do, they do enhance the look of the street and when you are driving down it looks good with trees I think that when they are pollarded, which happens every three years, they do get a bit too large and then look a bit strange when they have been pollarded but otherwise it does enhance the look of the street. I'm very fond of trees, it's just these particular trees which I think are a problem." **(Interviewee A3: male, aged 66. 'Agrees' that he likes living in his street and**

'agrees' that trees growing in the pavement make streets nicer places to live in).

Interviewee A4 (**Female, aged 83. 'Strongly agrees' that she likes living in his street but is neutral about whether trees growing in the pavement make streets nicer places to live in)** was brief in all her responses answered with a simple,

"No, I don't think so."

Street B – medium sized trees

All four of the Street B interviewees had stated in the householder survey that they liked living in their street and each of them associated trees as a positive contributory factor as these quotes demonstrate.

"Visually overwhelmingly because although there are gardens of various amounts of foliage I think the street trees certainly give the height, green height, in the road so very important." **(Interviewee B1: female, aged 67, owns her house and had lived in the street for 34 years. 'Strongly agrees' that she likes living in his street and 'agrees' that trees growing in the pavement make streets nicer places to live in).**

"When we first drove up this street when we knew the house was on the market which was only three and half years ago it just struck you that there were a lot of, I think there were quite a lot of trees in this area, but in this road there are quite a lot of quite big trees and in people's gardens some of them have been taken down in the last three years but it sort of struck you a bit like an avenue and it, in the middle of a city, it just had a really nice feel about it visually. Felt like a treat to have so many trees on a residential street." **(Interviewee B2: female, aged 42, owns her house and had lived in the street for 2.5 years. 'Strongly agrees' that she likes living in his street and 'agrees' that trees growing in the pavement make streets nicer places to live in).**

"A lot." **(Interviewee B3: male, aged 50, owns his house and had lived in the street for 18 years. 'Strongly agrees' that he likes living in his street and 'strongly agrees' that trees growing in the pavement make streets nicer places to live in).**

"Greatly. Obviously you can't always choose, you have to buy the house that you can afford and obviously you can't be too fussy but certainly given the choice yes, if I was offered two houses in two different streets and one had street trees and one didn't I would definitely go for the one that had street trees." **(Interviewee B4: female, aged 63, owns her house and had lived in the street for 7 years.**

'Agrees' that she likes living in this street and 'strongly agrees' that trees growing in the pavement make streets nicer places to live in).

Street C – small trees

The householder survey revealed that all interviewees in Street C liked living in the street. Three of those interviewed considered that street trees contributed significantly to that outcome whilst the other two were slightly less enthusiastic.

"Well I think greatly. Yes." **(Interviewee C1: female, aged 71, owns her house and had lived in the street for 43 years. 'Agrees' that she likes living in this street and 'strongly agrees' that trees growing in the pavement make streets nicer places to live in).**

"I think they contribute quite a lot. The thing is this is a really nice wide road that's probably the most important bit to me I don't like narrow streets. So the fact that it's a nice wide road with beautiful period properties contributes a lot but the trees make a big difference because it does attract birds and we've got rowan trees so we get red green and colour and they just make the place much brighter and I hate it when I go round and see them trimming." **(Interviewee C2: female, aged 43, owns her house and had lived in the street for 3 years. 'Strongly agrees' that she likes living in this street and 'strongly agrees' that trees growing in the pavement make streets nicer places to live in).**

"Enormously because of the parking problems here. A lot of people including ourselves, although it was done before we came here have converted their front gardens into parking. Some of them have converted the entire garden into parking so that would leave the street looking very grey if there weren't street trees as well. I mean some people have tried very hard to preserve garden around the outside like myself – I planted both the trees in my garden but not everybody feels like that so I think if it weren't for our street trees it would be an increasing problem that the street would become less and less green." **(Interviewee C3: female, aged 57, owns her house and had lived in the street for 20 years. 'Agrees' that she likes living in this street and 'Agrees' that trees growing in the pavement make streets nicer places to live in).**

"Quite considerably because it's a street, wide street, connecting two other roads at right angles and without the street trees and without the work people do on the front gardens it would be not only a boring streetscape but a very angular one caused by buildings which needs softening which the trees bring. Shade in the summer, the birdlife." **(Interviewee C4: male, aged 57, owns his house and had lived in the street for 12 years. 'Agrees' that he likes living in this street and 'strongly agrees' that trees growing in the pavement make streets nicer places to live in).**

"They contribute considerably. They give us a sense of the seasons, the growth of leaf, the fall of leaf and so on it reinforces the passage of time. I mean people often say they like the autumn this is very much to do with trees to do with the change of colouration of the foliage and the fresh green at the beginning of the early spring so yes its importance. I mean I think we feel the loss if they weren't there." **(Interviewee C5: male, aged 80, owns his house and had lived in the street for 12 years. 'Strongly agrees' that he likes living in this street and 'agrees' that trees growing in the pavement make streets nicer places to live in).**

Street D – split street

The householder survey revealed that all interviewees in Street D liked living in the street although residents in this street held widely mixed views about the contribution of street trees to this perception. Due to the layout of the street and the location of the two street trees one resident did not consider that she lived in a tree-lined street. One resident stated that the street trees did not contribute at all; one considered their impact was significant; and one thought they provided an element of importance.

"Not a lot really because we haven't got that many and the ones we have got are completely out of proportion and are not cared for or loved at all by the Council." **(Interviewee D1: male, aged 50, owns his house and had lived in the street for 2 years. 'Strongly agrees' that he likes living in this street and 'agrees' that trees growing in the pavement make streets nicer places to live in).**

"I suspect we chose the road partly because it had trees in it. I don't think we'd go for a road that didn't. Our first house was in a road that didn't have trees and that was because that's all we could afford probably the nature of the housing in that area of the city. Since then we have always lived in streets with trees so I think it's something I look for instinctively." **(Interviewee D2: female, aged 50, owns her house and had lived in the street for 8 years. 'Strongly agrees' that she likes living in this street and ' strongly agrees' that trees growing in the pavement make streets nicer places to live in).**

"Gosh well the bit of the street that I live at there aren't any street trees I don't think but there are quite a few trees in people's gardens it's that bit of the road, the road is crossed by another road, it's sort of in two bits yes it's very attractive". **(Interviewee D3: female, aged 61, owns her house and had lived in the street for 30 years. 'Agrees' that she likes living in this street and 'agrees' that trees growing in the pavement make streets nicer places to live in).**

"Well I think that garden greenery considerably affects my opinion whether the, there aren't actually very many trees left in our particular road although the road behind X Road has a lot of trees. I certainly prefer to live in an area as opposed to a street perhaps with mature trees." **(Interviewee D4: female, aged 65, owns her**

house and had lived in the street for 37 years. 'Strongly agrees' that she likes living in this street and 'strongly agrees' that trees growing in the pavement make streets nicer places to live in).

Changes to the nearest street tree that would affect overall opinion of it

This question focussed on interviewees' perceptions of their closest tree particularly the features that influenced their overall opinion of it. Interviewees had already expressed their overall opinion of the closest tree to them in the householder survey and described what influenced that decision in a follow-up open-ended question. This interview question sought to explore the matter more deeply by asking the interviewees to articulate street tree features that were so important that if these attributes were to change their opinion would also change.

Interviewees expressed a wide range of reasons that would make them change their opinion of their nearest street tree and the data has been described on a street by street basis.

The five respondents with the most positive viewpoints described a diverse range of factors that would make them lower their opinion ranging from making the tree smaller through more regular pruning, or allowing them to grow bigger by reducing pruning frequency. One interviewee would be affected if the tree was removed and replaced with an inappropriate species whilst the remaining two described how they would be negatively affected if the tree began to adversely affect property.

Interviewees with the overall opinion of 'good' also expressed a range of factors that would make then change their mind. Issues included reducing the amount of pruning, the tree affecting the use of their property and improving the tree maintenance regime. One resident would have had a more positive opinion if the tree had been healthier.

This range of responses is spread across all four streets with no obvious trends discernible. Information relating to the circumstances of the interviewee, gained from the householder survey, are described in brackets after each quote.

Street A – large trees

Three residents had a positive opinion of their closest street tree whilst the other two held negative opinions. The first set of quotes describes opinions from those that had a high opinion of their nearest tree.

"If the scale of it was reduced. It's at an appropriate scale it works really well. If it was cut pruned too regularly it's pruned at about the right amount." **(Interviewee A1. His overall opinion of his closest tree was 'very good'. This tree is a common lime, 10.25 metres tall with a 'crown area' of 59.7 m². The tree is directly outside his house).**

"Well if it was never trimmed and started to cut out huge amounts of light it would no longer be an asset I mean it's a lime and lime trees will grow into full sized trees which is not possible in that setting so I accept it has to be pruned and pollarded and so on. It's the only way to maintain it. It's interesting but this year hasn't been quite so bad. We've had an extremely wet summer the aphid dripping honeydew problem has not been nearly as bad. Whether that's due to all the rain or due to harlequin ladybirds eating all the aphids I don't know but I suspect it's the rain actually so the stickiness which gets all over the gate, railings and cars and everything underneath it and that has not been so much of a problem this year." **(Interviewee A2. His overall opinion of his closest tree was 'very good'. There is no tree directly outside his home but the physically closest tree is a common lime, 11.50 metres tall with a 'crown area' of 53.16 m²).**

"Well they tend to cut the trees back quite a lot along here and I don't really like that especially in the winter time when they've got no leaves I think they look a bit redundant sort of just a great big trunk and a few little branches sticking out. I don't really like it when they do that." **(Interviewee A5. Her overall opinion of the closest tree was 'good'. There is a common lime, 11.49 metres tall with a 'crown area' of 69.98 m² directly outside her flat).**

"Replacing the tree. I would like to see the trees sort of systematically replaced with ones that don't have this problem. There are one or two plane trees in this road for instance they're not so bad. I like the rather more delicate trees there are some rowan trees there are cherry trees various other ornamental trees which I think look much more attractive." ... with these other variety of trees they don't need nearly such frequent attention or management they are far more user friendly and less costly I would have thought in terms of maintenance." **(Interviewee A3. His overall opinion of his closest tree was 'poor'. His closest tree is on the boundary with his neighbour. This tree is a common lime, 11.50 metres tall with a 'crown area' of 53.16 m². The tree is directly outside his house).**

"If it was a lot smaller. I would prefer it to be cut down and replaced." **(Interviewee A4. Her overall opinion of the closest tree was 'poor. There is no tree directly outside her home but the physically closest tree is a London plane, 12.57 metres tall with a 'crown area' of 59.27 m²).**

Street B – medium trees

All four interviewees had positive overall opinions about their closest street tree.

"If the tree was taken away. If the trees are being taken and being replaced and that's sad because they're well established plane trees and they are being replaced with silver birches, yes so those two factors." **(Interviewee B3. His overall opinion of the closest tree was 'very good'. The London plane directly outside his home is 11.87 metres tall with a 'crown area' of 89.04).**

"Well, positively certainly it's a silver birch tree and I didn't put very good because it doesn't have I feel it's not very healthy. It got a big piece of its bark taken from it when it was fairly young and I feel compared with other trees it's struggling so I'm delighted to have it but I wish it hadn't had that damage because it's not as beautiful as some of the other ones. I'm very glad it's a silver birch because apart from being sticky on the cars but at least you can wash that off I mean the plane trees can be rather dense but silver birch is just lovely." **(Interviewee B1. Her overall opinion of the closest tree was 'good'. There is no tree directly outside her home but the physically closest tree is a downy birch, 9.38 metres tall with a 'crown area' of 36.41 m²).**

"Things that would change my mind would be huge roots pushing up the pavement I suppose also sticky sappy stuff coming off trees I would rather live with that then not have the tree but that would be the sort of thing that would make me tut every now and again and also we get a lot of bird poo on our cars because if you have trees you have birds but actually we would rather have the birds than not have the birds." **(Interviewee B2. Her overall opinion of the closest tree was 'good'. There is no tree directly outside her home but the physically closest tree is a silver birch, 13.73 metres tall with a 'crown area' of 53.62 m² and is located outside her neighbour's house).**

"If it was right outside my driveway and it was difficult to get in to the house, to get the car into the drive I might, I still wouldn't, I think the tree would come first for me. My neighbour for instance has got the tree right outside her she can get out but it makes it a little bit more difficult and she moans about that but I think I would actually you know my favour would go for the tree rather than a slight difficulty in parking." **(Interviewee B4. Her overall opinion of the closest tree was 'good'. There is no tree directly outside her home but the physically closest tree is a London plane, 9.73 metres tall with a 'crown area' of 47.4 m² and is located outside her neighbour's house).**

Street C – small trees

Interviewees in Street C had mixed feelings about their closest street tree with two residents having an overall opinion of good; two describing neutral opinions and one of them rating it as 'poor'.

"Probably if it was causing any damage to my property if it was causing too much damage to the pavement with the roots pushing the pavement up so that it would become a hazard that might make me change my mind. Also if it was cut back so badly at such a wrong time that it failed to look pleasing to the eye." **(Interviewee C2. Her overall opinion of the closest tree was 'very good'. The closest street tree is on the boundary with her neighbour. It is a Swedish whitebeam, 9.36 metres tall with a 'crown area' of 62.53 m²).**

"Well a number of them have had to be removed not here because of disease further down the street and they don't always seem to replace them appropriately or care for them when they replaced. So you can say that I would bewail their loss. But I also think Planners have a rather rigid approach to the sort of trees they would put in and they don't do simple things just at the bottom of the road they replace two trees that they said were diseased but they didn't get them in line so they put one to one side of the hole one to the other so they will grow crookedly if you see what I mean. It's little things like that not paying attention to not really looking after the trees but the City has been a bit better but if you plant a tree it needs very careful nurture in the first year then they can be left to their own devices." **(Interviewee C4. His overall opinion of the closest tree was 'good' although his property was located at such distances from all street trees that it is not clear which one is being described).**

"I think when I did that they hadn't pruned it. And I feel much more positive about it now. I mean it's a lovely shape it had got a little bit too big it's still a little big and although it's lovely in the spring it has white flowers on it at this time of year it has squashy berries which I cope with I wouldn't say get rid of it because of the squashy berries but my spouse doesn't like it he's always moaning that he gets them in his car and things like that. We used to have cherry trees in the road but they all got a fungus and they've all been chopped down so this tree was actually planted just before we came here so it's 20 years old. And I hope it's not going to get too much bigger because they'll end up chopping you know it's a good choice in a lot of ways but it's better since it's been pruned because as I said before it came down you'd bang your head on the branches but they have done a good job so I feel more positive about it now." **(Interviewee C3. Her overall opinion of the closest tree was 'neutral'. The closest street tree is directly outside her house and is a Swedish whitebeam, 8.49 metres tall with a 'crown area' of 48.64 m²).**

"What would make me change my mind probably would be if it was a different variety of tree. I couldn't even tell you what they are but I know in X Road for instance there's some rather beautiful trees on the pavement of those trees with paper bark, a variety of cherry but I'm not sure, but whereas I think the trees in this road are not terribly .... I feel rather neutral about them as they are not the variety of

tree I would choose. There's a huge variety of trees in this part of the world and some of them are obviously far too large for the situation, some of them are really very beautiful individual trees but the ones in this road I like them but in a sort of anonymous way, they're just trees I'm not terribly involved individually with them as species." **(Interviewee C5. Her overall opinion of the closest tree was 'neutral'. The physically closest street tree is outside her neighbour's house and is a Swedish whitebeam, 7.97 metres tall with a 'crown area' of 35.79 m²).**

"Variety of tree. Mainly. Of course one that is equally mature when they change it." **(Interviewee C1. Her overall opinion of the closest tree was 'poor. This street tree is directly outside her house and is a Swedish whitebeam, 6.75 metres tall with a 'crown area' of 24.63 m²).**

Street D – split street

Three interviews rated their closest street tree as 'good' whilst one rated theirs as 'poor'. There are only two London plane street trees growing immediately next to each other in Street D and both are of very similar size measuring 12 metres tall. The one directly outside Interviewee D1's house has a 'crown area' of 75.22 m² whilst its neighbour measures 51.04 m². All four respondents refer to these trees.

"It would change my mind I suppose if I had to park directly under it which I don't and if there are often birds nesting and if you get your car constantly covered in bird poo I think I would start getting fed up with it but I still wouldn't want it to go. I would just get fed up with it. I would also get fed up with it if it was a lime tree because of the sweet sticky stuff that comes off it." **(Interviewee D2. Her overall opinion of the closest tree was 'very good').**

"The one I've just mentioned because the nearest street tree is that big plane tree by the post box it's been pollarded a while back but it's all the suckers growing out of it and the issue of sweeping up the leaves in the autumn. Nevertheless I wouldn't want them to go for those reasons I'd still prefer it there even with those disadvantages." **(Interviewee D3. Her overall opinion of the closest tree was 'good').**

"Well I like light coming in through my windows so I think that the height of the branches probably would affect my view because I do value daylight in the house." **(Interviewee D4. Her overall opinion of the closest tree was 'good').**

"I think probably a tree in better proportion and I think far better maintenance of the trees if you like because if you look at the one outside the door as an example a) it's huge and b) it's not, it's very rarely is it kept in cropping you can hardly walk past it whippy branches come out everywhere and so the Council they just don't seem to look after the trees which is a shame." **(Interviewee D1. His overall opinion of the closest tree was 'poor').**

Factors that influence tree size perception

Interviewees had already expressed their opinion of the size of their closest tree in the householder survey and this interview question sought to explore the matter more deeply by asking the interviewees to articulate the factors that they considered when evaluating tree size. They were also posed a subsidiary question which asked whether where they were affected how they thought about the size of trees.

Presentation of these results reflects the three broad areas that interviewees described when they considered tree size with these being: the local impact of the tree; the physical dimensions of the tree; and a combination of the two.

The majority of interviewees described how the factors that influenced their perception of tree size related to the impact of the tree on their surroundings rather than the actual dimensions of tree components such as trunk diameter or tree height. Issues related particularly to the negative impacts of street trees particularly around potential root damage, blocking sunlight and views and access along the pavement.

The next most frequent response type relates to a combination of the impact of the tree and its physical dimensions. Although these residents mentioned components that describe the physical dimensions of the tree they did not talk about measurements but related particular features to the impact they might have.

Only one resident focussed on the physical dimensions remarking how tree trunks can make access along paths difficult.

Closely related to this line of enquiry was a question asking whether interviewees thought that the location of the tree was an important factor influencing their perception of tree size.

Participants had already hinted at the importance of location and this was strongly reinforced in their responses to this enquiry with each of them remarking that context is critical when evaluating tree size.

Interviewees' responses to these two lines of enquiry have been displayed next to each other in order to help analysis and a brief summary of the respondents' opinions about the size of their nearest tree is provided to place their comments in context.

Street A – large trees

Three interviewees in Street A considered the size of the nearest tree was 'just right' whilst two considered it to be 'too large'. The following quotes include each interviewee's thoughts about what they considered when evaluating tree size and about the importance of context when considering tree size.

Thoughts about what interviewees considered when evaluating tree size	The importance of context when considering tree size
Interviewee A1. Considered tree size to be 'just right'.	
"It's a tricky question. What do I think about? Well it's its coverage isn't it well I use the word majestic and so on you know something substantial well you're involved with nature you feel more connected with nature as a result of having something non-city. The trees that are only sort of 8 foot tall you know what's the point? You may as well sort of have plastic ones because then they wouldn't have leaves there is something about the scale of us in relation yes a natural thing of a significant scale around us."	*"That's quite a difficult question. Clearly in parks there's space for more variety and so on so obviously yes where you are does make a difference. There will be some streets that are too narrow to accommodate a decent size trees in which case you would have what you could fit. There is a sort of town planning aspect of that which is that if the street was a little bit wider they could accommodate bigger trees and that would be a better piece of urban layout."*
Interviewee A2. Considered tree size to be 'just right'.	
"Well why I described it as just right is because it's big enough to have a decent kind of structure it doesn't look like a toy tree it looks like a proper tree. But equally from the very top of my house we're on a steep hill I can in the winter I can see through it and over it so it doesn't completely cut out all views from there. It maintains a certain amount of bird life some of which is more interesting than others."	*"I suppose it probably does in as much as I describe this as a pretty safe area I mean I don't feel anxious that there might be someone hiding behind the tree ready to jump out on me which you know you might I guess in some other places so probably from that point of view yes. I don't know whether you are going to talk about the habits of limes later but I mean I put that as a disadvantage – are we going to talk about that later?"*
Interviewee A5. Considered tree size to be 'just right'.	
"Well the height of the tree. And sort of whether or not it is taller than the surrounding buildings you don't want it to overpower anything but I suppose the width of the trunk can tend to take	*"Yeah I think they've got to sort of be in context be appropriate to the surroundings kind of blend in and it's nice having trees in streets but you've got to think of the practicalities of them as well*

up all the pavement or does it go on to the road – that kind of thing."	*things like maintenance and sometimes they cause I don't know what it is but the roots come up and they make all the pavement break up."*
Interviewee A3. Considered tree size to be 'too large'.	
"I think about the amount of shade the tree gives and certainly if you have a garden you don't want a massive overpowering tree particularly a very dense one that's really the thing and I suppose then there's a root problem as well the larger the tree the more the roots are going to disrupt the pavements these actually don't, lime trees don't seem to do that perhaps as much as plane trees do."	*"Oh yes, the size of the house, the houses are here are quite large so they it will be appropriate to have a tree that is probably a bit taller if one was living in a place where the streets were narrower the houses were less high. You want to have trees that are reasonably in proportion to the size of the houses."*
Interviewee A4. Considered tree size to be 'too large'.	
"If you want a big tree go and live in the country".	*"Oh fine, I like big trees. Trees should be in the country. People who want big trees should live in the country."*

Street B – medium trees

Three interviewees in Street B considered the size of the nearest tree was 'just right' whilst one described it as 'too large'. The following quotes include each interviewee's thoughts about what they considered when evaluating tree size and about the importance of context when considering tree size.

Thoughts about what interviewees considered when evaluating tree size	The importance of context when considering tree size
Interviewee B1. Considered tree size to be 'just right'.	
"It's height but particularly in streets the density of the leaves I think you don't want a tree that is so solid that you don't see light through it or at last it's a great advantage if you can see light through it although plane trees are marvellous for coping in all sorts of conditions and very good for the environment and so on they can sometimes, they do need very careful cutting and I must say the people round here are brilliant they do do a marvellous job but it's very frequently it must be a costly business to keep them as they need to be."	*"Yes, yes. I mean they are hoping to put a tree in at the top of X Road on a new roundabout they have made and there the bigger the better because it's a big space to fill and that will look majestic. It would be a shame if all trees were suburban trees like cherries and things."*

Interviewee B2. Considered tree size to be 'just right'.	
"The one that I described as just right is not a small tree but is not one that drapes over the pavement and doesn't drape over the road but it's big enough to have a shape that it's pleasing to the eye. Actually the other thing that, sorry to go back, but if we had a tree that children liked to climb on I wouldn't really like that because I would fell a bit stressed about it I don't think I know of any trees around here that you could actually climb they tend not be that sort of tree but I wouldn't particularly like that kind of tree near a road."	*"Yes. The tree nearest to us is actually in our garden and it's a silver birch and it's huge and it's sort of acceptable to us because it's in our garden but a tree surgeon has told us it's far too big for where it is if it was in the street we would probably think differently about that we'd probably think it's too big but then I suppose it wouldn't then be our responsibility either and we've lopped ours to make it safer yeah I probably would think that if a tree was going to be massive well it would just make you think about a different aspect."*
Interviewee B4. Considered tree size to be 'just right'.	
"Well my tree in the front out there isn't a street tree it actually belongs in my garden and it has got too big and it is cutting out sun from my living room. But I mean it's my problem and I've just got to get it pruned so I think trees have to be pruned but they are aren't they street trees are kept in you know I suppose if a street tree did block out light from my house I might object but not other than that."	*"I love the big trees I love these big plane trees so the bigger the better as long as they are not cutting out light and as long as they are safe I like the big trees."*
Interviewee B3. Considered tree size to be 'too large'.	
"House subsidence, the effects of the roots on the pavements if not kept maintained and the impact that might have with people with visual impairments yeah, I suppose having had subsidence it's probably being attributed to trees that have had an influence."	*"Yes so in an appropriate setting and the surroundings the proximity to other trees, proximity to buildings to have a visual balance in term so of the appropriateness of the tree being where it is."*

Street C – small trees

Three interviewees in Street C considered the size of the nearest tree was 'just right' whilst one considered it to be 'too large' and one described it as 'too small'; the latter being the only interviewee to describe this phenomenon. The following quotes include each interviewee's thoughts about what they considered when evaluating tree size and about the importance of context when considering tree size.

Thoughts about what interviewees considered when evaluating tree size	The importance of context when considering tree size
Interviewee C1. Considered tree size to be 'just right'.	
"Well, they were not huge but you know let's say they were a form of flowering cherry and they're just not approved of because they're not English or British trees. I've got a picture in the other room which I'll show you later not at its best but you know and it didn't look like an orchard or anything like that it really was pretty and lots of the area had them. They were probably all planted together and probably all died together."	*"No."*
Interviewee C2. Considered tree size to be 'just right'.	
"I don't think they should be too big. If they're too big then obviously there's lots of things, apart from the fact they drop their leaves everywhere mush and as I said the damage to the property. I think getting it right is probably quite difficult from a planning point of view. When I look at that one it's a beautiful shape there are no low lying branches to cause any problems it's a just a little to high for the kids to climb all over it, it does drop sap onto the cars which doesn't bother me personally but I know it bothers some. And you don't want it too high because it will interfere with the telephone lines so yeah. That thing is disgusting right opposite with that horrible fir tree it's inappropriate but that's in someone's garden you know you wouldn't plant that in a street anyway. But I think these are perfect street trees."	*"Because obviously if you had a 60 foot tree in the middle of a pavement probably be inappropriate cutting out too much light for whoever was behind it yeah I think it is very much about appropriateness. Gauging the size of the property, the type of the property, and the type of tree you plant next to it, definitely."*
Interviewee C5. Considered tree size to be 'just right'.	
"There are a number of factors one is the amount of shade it creates the other thing is the destruction of the pavement. I could take you to streets here where there's a particular example I'm thinking of where very large trees have been planted on quite a narrow pavement and the pavement is being distorted and cracked and the trees have quite recently been felled to about that height, They were obviously far too big for that situation and from that point of view the trees in this road are not too big from the size point of view they are fine there's not a lot of shade here they are situated quite sensibly and this is one of the factors I consider quite	*"Yes very much that tree might be marvellous in a park but an enormous London plane which there are around here if that was put in this road I think it would be totally out of place. I think the trees we've got in this road the growth seems to have a limit but not in the next road they're much bigger, same sort of road, they grow that way and that way. The next road you look down it and it is totally dominated by the trees visually right away whereas this road you see the trees but they seem to be much more in the right scale to do with the houses."*

important. The only thing is if you are walking up the road you know there are two of you say and then if trees are in a certain position you can no longer walk together you've got to separate and make a detour depends on the width of the pavement particularly on the continent they seem to be rather more aware of this a lot of roads are much more spacious but this is to do with town planning and housing and so on."	
Interviewee C4. Considered tree size to be 'too small'.	
"I think you've got to think about the size the tree grows to. It's important to think about where the roots will go. Whether it is appropriate in terms of how much moisture because there's so much run off in streets it's very difficult once they've established. Just something but X Road near here, it's a street of much smaller houses, it's highly terraced with very small front gardens and there were no street trees and there was a very big campaign by the residents, we lived just round the corner, to have trees planted and to make them small trees and they did plant against the usual Council planning policy trees that were relatively small trees and I remember talking to a planning officer afterwards who said we made a mistake and won't do that again You go along that road and it has transformed that road in my judgement much for the better trees that are appropriate in size and shape for small front gardens and proximity to the houses and I can't understand why the Planning Officers now say it's a failure. You know the Council seems to have their idea of the sort of trees that ought to be appropriate and they don't consult the residents so in our road here a tree died and for some unknown reason they put in a silver birch there are no other silver birches in the road and twice it's died so why do they keep persisting with silver birch tree there when it doesn't even match the others in the road."	*"Yes. I mean we can in this road with a wide road take bigger trees than we could in my previous property now the irony is we have small trees here and plane trees in the other road."*
Interviewee C3. Considered tree size to be 'too large'.	
"I think how much light it's going to take because they are quite close to the houses here not as close as they are in some roads I know but they are quite close despite the fact my front garden's paved I'm quite keen on	*"Yes. My garden would be full of trees if I had the choice but it's just not big enough. I've got a silver birch in the back garden which was there when I got here. And it's just about far enough away from the house and just*

gardening and it's very difficult to grow certain things in my front garden because of the light it takes. So I think that does need to be said and again plane trees which were planted extensively and I mean I understand why they are just too big I mean they cause a lot of damage this tree actually is beginning to lift the pavement and again I think that is something you have to consider because of the cost and you know people are going to sue the Council if they fall over the paving and that sort of thing, and also the new trees they put down in the bottom half of the road they've actually paved right round the base of the trees with blocks which is just stupid it means the tree's not getting enough rain to the roots and the blocks are lifting so I don't know who did that and why but they clearly don't know much about trees."	*about the right size and I can see in another few years it's going to need to come down which is very sad you really have to think about these things and I hate conifers that is a conifer there which is an open habit one and I had it simply because it is evergreen but you know most of them are absolutely not acceptable."*

Street D – split street

Three interviewees in Street D considered the size of the nearest tree was 'just right' whilst one described it as 'too large'. The following quotes include each interviewee's thoughts about what they considered when evaluating tree size and about the importance of context when considering tree size.

Thoughts about what interviewees considered when evaluating tree size	The importance of context when considering tree size
Interviewee D2. Considered tree size to be 'just right'.	
"I suppose height and whether it's blocking the sun from your house or wherever you want it. Where the roots are going because obviously they do start to the closer it is to your house you perhaps worry about foundations and the way they disrupts the pavement making it difficult to push prams and that kind of thing. I would think of all those things but I'm still overpowered by the need to have something beautiful to look at."	*"I would be very happy to see a really really massive tree if it weren't in danger of falling on my house or anything else. I'm pretty happy with a fairly massive tree but yeah I like to see big trees and in a park that's obviously in keeping."*
Interviewee D3. Considered tree size to be 'just right'.	
"Well it is very big it's a plane tree I mean I think it's fine because it was obviously planted a long time ago I mean this house in	*"Yes, parks can take much bigger trees can't they and they don't have maintenance issues I mentioned are not so crucial. I suppose I*

the road was over 100 years old and so it was probably OK when it first went in but the trunk is now very big it's not an inconvenience to me but it is an inconvenience if you have a push chair, wheel chair access would be really difficult and that's partly because of what I said before the overhanging hedge and suckers make that even worse but it is a very big tree it is important that they keep pollarding and if it were to come down because it was diseased it would be much better if it was replaced with a smaller tree."	*may feel differently if I had one of those great big trees right outside my door because it might restrict some of the sunlight that's coming through the window at the moment but I think people nowadays Councils are more careful about the type of tree they plant I don't think they do plant plane trees in the streets so readily there's a huge plane tree in Bath in one of the crescents the Circle and there's a massive plane tree in the middle of a green grassy area and that's just been allowed to grow without being pollarded and it's wonderful you can't do that on the street you do have to keep them cut and they do look rather ugly when they have first been pollarded in a way."*
Interviewee D4. Considered tree size to be 'just right'.	
"It's very mature. Well I think inevitably one has to look at pavement width the type of traffic the branch height and the type of traffic that is passing along if there were vans or double-deckers or whatever and I mean around here we have a lot of pavement parking problems and inevitably some trees cause disturbance of the pavement surface so you know I think sort of good planting would take account these measures. I think they have to be proportionate to the pavement and grow as well with the house. I also think the size of the front gardens makes a lot of difference what the roads can accommodate. We have houses that are almost onto the pavement and I think it would be very difficult for there to be tree planting in those areas because I just don't think there is room to allow light into the houses and traffic to pass."	*"Yes of course I think that trees have a natural habitat too."*
Interviewee D1. Considered tree size to be 'too large'.	
"Well I think of the girths of the trunk and the spread of the branches so that you can pass by quite easily and you're not going to get hit by branches etc the root spread so it doesn't make uneven surfaces or interfere with any buildings close by that's the sort of things I guess."	*"If it was in a park in an appropriate setting then trees yes they look magnificent when they are large and uncropped."*

Residents explain who should make decisions about street trees

Residents were asked to describe who they thought should make decisions about street trees. They had previously been asked to rate the Council's tree maintenance on a scale where 1 = very poor and 5 = excellent and this information is included in brackets after every quote. Such information was requested in order to evaluate where individual's sense of responsibility lay and to gain deeper understanding about residents' wider knowledge of street trees.

Residents described the following permutations about who should make decisions in respect of street trees:

- The Council by itself
- Residents by themselves
- Residents and the Council in collaboration
- Third party professional
- Third party professional and residents in collaboration.

Two thirds of interviewees stated that residents should be actively involved in the decision making process. Within this group seven stated this should be in conjunction with the Council; one person thought it should just be the residents; and four considered that residents could make decisions jointly with a professional Arborist.

Of the remaining six who did not suggest resident involvement one thought professionals should be employed and five suggested it should be the Council by itself.

Comments made by the participants reveal a depth of thought about street trees that has not been described previously. Issues include the benefits of wider strategic management, concern about the Council's competence, concern about residents' motivations and the recognition that a particular skill was needed to manage street trees appropriately. Individual quotes are repeated below which illustrate the key points.

Street A – large trees

Interviewees in Street A held a mostly positive opinion of the Council's maintenance of the trees in their street. Two residents rated it at the maximum of '5' and one marked it as a '4'. Two of the interviewees rated it at '3'.

"Yes I think probably the Council, shit, but then they might do it in terms of whether they're going to get sued or not. I think the people in the street as a whole not the person who has the tree just outside the house because they it's a NIMBY thing that – I want to see the sun but I do like trees in the rest of the street so I think that would be a bad idea so the people in the street yes it should be it would be great if they had to talk about it but we don't talk to each other in this street so it would be a first so in that sense the Council as long as they are being motivated in the way they are doing it by the populace as a whole rather than the legal needs such as health and safety the devil word." **(Interviewee A1. Rated Council management at 5).**

"I think it probably has to be the Council because they are going to take legal responsibility for them for one thing. But I think residents associations, pressure groups like our local Amenities Society should be allowed input. Interested parties should be allowed input but eventually someone has to make the decision and I think that has to be the Council." **(Interviewee A2. Rated Council management at 5).**

"I think it should be the residents so not just the person whose house the tree is outside it should be people sort of you know have to walk past that tree or have the tree opposite their house or near their house but then I think the Council should have the responsibility for implementing those decisions." **(Interviewee A5. Rated Council management at 4).**

"I think they should be made by the local Council influenced by public opinion. I certainly think that those who have trees outside their houses should be consulted because we get vast numbers of leaves that fall in the autumn and towards the end of summer so there is constant clearing of twigs after gales we get a lot so I think we need to be consulted perhaps first of all." **(Interviewee A3. Rated Council management at 3).**

"Combination of local residents and people who understand trees." **(Interviewee A4. Rated Council management at 3).**

Street B – medium trees

All interviewees in Street B held a positive opinion of the Council's maintenance of the trees in their street with one rating it at '5' and the other three scoring it '4'.

"I think it should be the Council because I would assume that they would employ people who knew about trees and have an overall vision of not just the whole street but the whole neighbourhood and then they could manage the trees overall rather than a resident or a street of residents deciding I mean that could be a nightmare. I think it is right that people manage the tree within their gardens with advice from neighbours perhaps which sometimes happens but I think if it's on the pavement I think it should be managed overall by somebody like the Council with the expertise." **(Interviewee B2. Rated Council management at 5).**

"Well I suppose it needs to be in conjunction with the people who live in the area because you need their sympathy and concern and a bucket of water now and then sort of. But planners are trained and should know what to do and obviously they need landscape or architectural horticulturists or something to advise them on the kind of tree to plant." **(Interviewee B1. Rated Council management at 4).**

"I say it should be the decision of the residents having been informed by somebody's knowledge in terms of trees and the effect the trees have." **(Interviewee B3. Rated Council management at 4).**

"A combination but the Council probably as long as they were sympathetic which presumably they are about street trees otherwise they wouldn't be planting them or looking after them. The residents I would have said yes but I happen to know two or three people down this road who moan about the street trees so I'm not sure I would want to put it in the hands of the residents because I think my neighbour would have hers cut down if she could have her way." **(Interviewee B4. Rated Council management at 4).**

Street C – small trees

Interviewees in Street C held a variety of opinions about the Council's maintenance of the trees in their street. No resident rated it at the maximum but two interviewees rated it as '4". One person rated it '3' whilst the remaining two respondents provided scores that rated the Council's maintenance as poor.

"Ah, but then you would get lots of arguments and rows and disagreements an differences of opinions no I would probably disagree with that I would probably say that it is some other body that deals with this rather than the residents of the houses. The fact of the matter is you buy a house it's got a tree outside then don't buy it if you don't like it. So I would definitely say a separate group." **(Interviewee C2. Rated Council management at 4).**

"I think the Council should make the decision but I think if any of the people living in the road feel very strongly about it then certainly their views should be taken into account." **(Interviewee C5. Rated Council management at 4).**

"I think people – to be honest if I was going to say two other issues if I may say so people who convert their gardens to standing space if I was to say that about trees well people who live nearest and that would get the same answer and it doesn't fit so I think like all decisions they have to be the consensus." **(Interviewee C1. Rated Council management at 3).**

"The actual decisions have to be taken by the professionals because you can't in my judgement have residents insisting on their choice. It might be too expensive for the budgets compared to other species it might be inappropriate trees because of the soil or whatever, so you've got to have a degree of that but subject to that the residents must have genuine consultation their views ought to take precedent if the other factors are OK." **(Interviewee C4. Rated Council management at 2).**

"I don't think it should be the person with the tree outside their house. I think you know if you're going to have street trees someone's got to have it and I don't think there's any doubt there will be some people who say I'm not having it outside my house because that's the way things work. I mean it would be nice to say it should be the residents but again I'm not sure everyone would agree I think there are lots of people who would say they don't want that tree there because it makes a mess. I'm prepared to put up with the mess for the pleasure of having the tree so no it probably should be the Council but it needs to be someone who really needs to know what they are doing not highways and I suspect someone who knows what they are doing has taken over here recently I don't know if that is true but certainly it's made a difference here that they have been round and replaced some of the trees and looked after the one's there are better." **(Interviewee C3. Rated Council management at 1).**

Street D – split street

Three interviewees held positive opinions about the Council's maintenance and one considered the local authority's work to be very poor.

"I think it should be left because I do think it needs an overview. If you are looking at any city or any series of streets there is something bigger than just that street and I think I would prefer someone who had got the skill to be looking at it and organising it more strategically than Fred Blogs saying it's leaning into my house I'm going to chop this half off it I think that would be a bit dodgy." **(Interviewee D2. Rated Council management at 5).**

"The Council have to pay for it out of our Council taxes so finance is an issue just the person with the tree outside their house I would be worried about that more trees might disappear but I think their views ought to be taken into account so and they're not as far as I am aware I've never I don't think I've ever been consulted on maintenance of trees in a direct way." **(Interviewee D3. Rated Council management at 4).**

"Well I think residents' opinions should be taken into account but ultimately I think a decision probably has to be made by the Council and one would hope that the

person making it would actually have some knowledge of appropriate trees. So I think that the ultimate decision should be made by someone with specific skills in that area. But it would be nice if the residents' voice was heard." **(Interviewee D4. Rated Council management at 4).**

"I think the local residents should have some say in the management of the trees don't know how the Council would manage that but I guess it is important that local residents have a say in managing the trees what sort of trees go there if a tree is replaced because clearly this street if you look at old photographs there were a lot more trees in it years ago but they've been taken out and not replaced and that decision has been made by somebody somewhere that doesn't live in the locality and I think that's not right it should be done at a local decision either by our local Councillors or whatever or surveying the local population in the streets." **(Interviewee D1. Rated Council management at 1).**

The visual simulation survey

Interviewees' image preferences in the visual simulation survey

All of the interviewees undertook a visual simulation survey where they were asked to rank four images, in order of preference, from 13 separate slides (see Appendix C for the slides). Respondents were subsequently asked questions relating to their choices during the interview.

Interviewees were given as much time as necessary to complete the visual simulation and Table 22 illustrates the range of time taken by each resident to rank their preferences.

Interviewee	Time taken to complete visual simulation survey (minutes)	Mean time spent on each slide (minutes)
A1	05:41	00:26
A2	09:12	00:42
A3	07:23	00:34
A4	03:35	00:17
A5	05:32	00:26
B1	09:14	00:43
B2	07:39	00:35
B3	07:14	00:33
B4	06:02	00:28
C1	16:28	01:16
C2	03:03	00:14
C3	07:06	00:33
C4	07:37	00:35
C5	24:35	01:53
D1	04:22	00:20
D2	05:29	00:25
D3	05:58	00:28
D4	08:37	00:40

Table 22 – length of time that each interviewee took to complete the visual simulation survey

The majority of people completed the survey in less than ten minutes with two individuals, C1 and C5, taking considerably longer. The quickest participant took a mean period of 14 seconds per slide. The mean length of time taken to complete the survey was 8:03 minutes equating to a mean period of 37 seconds per slide.

At the time of preparation of the survey it was envisaged that the visual simulation survey would be a relatively silent part of the recorded interview but it proved otherwise and some interesting comments were made which revealed some of the participants' thought processes and these have been described below.

Only five interviewees made no comment at all. The remaining 13 interviewees made a range of comments and these are described below. Several themes appeared and these are described first and quotes from residents have been used to illustrate the point.

One of the themes mentioned by two interviewees was the design of the visual simulation survey including the quality of the images and their layout.

Participant A1, for example, said;

"Not sure it's very good survey technique to have them in the same sort of arrangement."

A2 mentioned the lack of shadows from the trees;

"The nature of your trees is that they have no shadows which is sort of bizarre. Sun's out, the car's got shadows but the trees spectral that they have none."

Three participants were interested in the origin of the background images used in the visual simulation all seeming to recognise their neighbourhood as this example from D2 illustrates.

"These roads look familiar, kind of, but not quite."

The combination of lack of criticism of the images and the recognition by some interviewees of the back drop suggest that the objective of maintaining realism with control over the variables was largely realised.

Interviewees made individual comments about factors that influenced their opinions about the order of their preference of the images in the visual simulation survey. C4, for example, articulated the reasoning behind his image choice in Slide M;

"I've rated that one [pointing at the pollarded tree] *quite high because I know in 3 months it will look good as they do along the adjoining road. They've got planes, and I'm not quite sure, is it beech anyway and they are regularly pollarded now. The Council's policy is changed for a long time they let them grow and they took some out because of complaints from people about roots but I think their policy now is to regularly pollard which means the roots don't grow and they don't have the problem. That's what I've been told anyway but they're big trees and they look very nice."*

C5 drew the conclusion that the images represented trees at different stages in their lives,

"One of the obvious factors is that they could be taken at different stages of growth of the trees so that I mean image making a judgement about trees in a certain position at a certain time and one of the subsequent images might have been the same thing but maybe five years later."

A1 explained that he would simply be looking for the trees he preferred,

"Well in general I am always going to choose the more mature the better basically. I'm guessing these are always going to come in the same way so it's become a sort of test now whether I can work out which are the more mature trees. Ah, I see this has a higher trunk yes that tells me it's more mature because I know about the concept of a lollipop tree I've now learnt."

Overall responses to the images

These same slides were also shown to a group of 43 professionals attending a Midland Tree Officer Association (MTOA) seminar during 2009. This was carried out to enable a comparison with the interviewees' responses and thus to provide direction for further wider investigations into the effectiveness of visual simulation surveys in Arboricultural research between different groups.

The images in the visual simulation survey depict street scenes where the only variable is the street tree. The background street image was familiar to the interviewees, because it was of Street D, but not to the MTOA respondents who

were all based in a different region. Results of the MTOA's responses are included to address whether preferences are consistent between residents familiar with the images opposed to professionals, unfamiliar with the scene.

Analysis of the visual simulation survey will proceed as follows. Firstly, significant headlines from the visual simulation survey will be reported and these will include modal responses to the image ranking and a description of the themes provided by residents during their interview about the survey.

There will then follow a more focussed analysis into some key relationships identified by the residents' responses to the visual simulation survey and their proximity to one another. Such vignettes will focus on residents' perceptions of the same tree or part of the road and will allow the integration of all the data from the householder survey and interview to enable a clearer picture and deeper understanding of residents' relationships with street trees.

Modal responses to each of the images in every slide have been calculated in order to facilitate an investigation into trends in terms of this thesis but also to aid future research in focusing on areas that appear to be important. Table 23 identifies the mode for each image in the visual simulation on a street by street basis as well as aggregating responses to provide an overall response to the images. Table 23 also includes the modal response for the MTOA research and this information is considered useful as a means of evaluating whether participants who are remote to the background images, as well as being tree care professionals, creates different responses.

The literature review has identified how images in visual simulations that contain street trees were generally preferred when compared to tree-less images and this has been repeated in this experiment. North American research has described how larger trees tended to be preferred in images but Williams' (2002) paper from Australia identified medium trees as most preferred. Interviewees in this case study describe a mix of preferences where medium sized trees have been rated most highly as frequently as the largest tree. Tree shape does not appear to have affected this outcome.

Slide	Resident	Image 1 - Small	Image 2 - None	Image 3 medium	Image 4 – Large
A	Street A mode	1[a]	3	2	4
	Street B mode	3	4	1	2
	Street C mode	3	4	2	1
	Street D mode	1[a]	4	2	2
	All interviewees	3	4	2	1
	MTOA	3	4	2	2
B	Street A mode	1[a]	3	2[a]	4
	Street B mode	1[a]	4	2	1[a]
	Street C mode	1[a]	4	2[a]	1[a]
	Street D mode	3	3[a]	1	2
	All interviewees	1[a]	4	2	1
	MTOA	3	4	2	1[a]
C	Street A mode	3	4	4	1
	Street B mode	3	4	1[a]	2
	Street C mode	3	4	2	1
	Street D mode	1	3[a]	1[a]	2
	All interviewees	3	4	2	1
	MTOA	3	4	1	1[a]
D	Street A mode	2[a]	1[a]	2	4
	Street B mode	3	4	1	1[a]
	Street C mode	1[a]	4	1[a]	4
	Street D mode	1[a]	4	1	2
	All interviewees	3	4	2	4
	MTOA	3	4	1	2
E	Street A mode	2[a]	4	1	4
	Street B mode	3	4	1	2
	Street C mode	1	4	2[a]	3[a]
	Street D mode	3	4	2	1[a]
	All interviewees	3	4	1	2
	MTOA	3	4	2	1
F	Street A mode	2[a]	1[a]	2	4
	Street B mode	3	4	1	2
	Street C mode	1[a]	4	2	4
	Street D mode	3	4	1	2
	All interviewees	3	4	2	4
	MTOA	3	4	1[a]	2
G	Street A mode	3	4	2[a]	1[a]
	Street B mode	3	4	1	2
	Street C mode	2	4	1	1[a]
	Street D mode	3	3	2	1
	All interviewees	3	4	2	1
	MTOA	3	4	1	2
H	Street A mode	2	3[a]	1	4
	Street B mode	2[a]	4	1	3
	Street C mode	3	4	1	2
	Street D mode	3	3[a]	2	1[a]
	All interviewees	2[a]	4	1	2
	MTOA	3	4	1	2

I	Street A mode	1[a]	4	2[a]	4
	Street B mode	3	4	1	2
	Street C mode	2[a]	4	1	2[a]
	Street D mode	3	3[a]	2	1[a]
	All interviewees	3	4	1	2
	MTOA	3	4	2	1
J	Street A mode	1	2	3	4
	Street B mode	1	2	4	3
	Street C mode	1	2	4	3
	Street D mode	1	3	4	2
	All interviewees	1	2	4	3
	MTOA	1	2	4	3
K	Street A mode	2[a]	4	1	3
	Street B mode	1[a]	4	1[a]	3
	Street C mode	2	4	1	3
	Street D mode	2	1[a]	1	3
	All interviewees	2	1	1	3
	MTOA	1	4	2	3
L	Street A mode	2	4	2	1
	Street B mode	2	4	3	1
	Street C mode	2	4	3	1
	Street D mode	2	4	2	1
	All interviewees	2	4	3	1
	MTOA	2	4	3	1
M	Street A mode	2	3	4	1
	Street B mode	2	3	4	1
	Street C mode	2	3	4	1
	Street D mode	2	3	4	1
	All interviewees	2	3	4	1
	MTOA	2	3	4	1

[a] Multiple modes exist. Where identical modes occur this figure represents the highest ranked modal preference.

Table 23 – modal ranking of all images from the visual simulation survey by residents in Streets A – D and participants at the Midland Tree Officer Association (MTOA) seminar held on March 10 2009

Modal preferences by the MTOA participants reflected those made by the interviewees with the tree-less images being least preferred. There were some subtle differences for the most preferred image where the MTOA respondents occasionally tended to favour the medium sized trees when the interviewees had preferred the larger trees. There were no obvious reasons for these differences and future research could investigate whether residents in the UK perceived images with street trees differently to professionals and, or, people remote to the scenes as this thesis demonstrates.

The literature has also described how tree shape can influence opinion. Slides J, K and L contained images containing the three shapes used in this thesis (see page 79 for an illustration of these) with each individual slide having a different back drop.

The spreading shape had the highest overall preference for all interviewees in each of the slides and the images with no street trees were least preferred. The MTOA participants most preferred the spreading tree in two slides and the conical shape in Slide K (the background image with the intermediate amount of vegetation). Their least preferred image in all slides was also the tree-less scene.

Slide M contained images that had been used in the Weston super Mare pilot study. Both the interviewees and the MTOA's most preferred image contained the spreading tree and the least favoured image had no street trees. It is important to note that the most favoured image by the residents in the pilot study was the columnar shaped tree which suggests that relationship to the images being viewed is important when selecting the most favoured image. As in all the other slides the least preferred image in Slide M, from all participants, was the tree-less street.

The data describes that, overall, background had little impact on choice with the same order of preference reported for each of the slides. Preference appeared to increase with tree size where the image with no street tree was least preferred overall and the larger tree was most liked.

Whilst these broad outcomes provide useful information about how residents respond to visual simulation surveys with results broadly reflecting the international literature (e.g. tree-less streets least preferred; larger trees preferred over smaller trees) closer analysis of attitudes is important to gain a deeper understanding of the factors that influence people's respondents to visual simulation surveys and whether this relationship bears any semblance to their interaction with actual street trees outside their home.

After the visual simulation survey was completed interviewees were asked a series of questions to explore the reasoning behind their image preferences and the responses are described below.

Factors that influenced interviewees' choices about the most and least favoured images

Interviewees were asked to describe the factors that influenced them about their most and least preferred images. The same analysis was used which discerned themes from the open-ended questions in the postal survey (e.g. Tables 14, 15 and 17) and the results are described in Tables 24 and 25.

Ideally it would be useful to compare perceptions of the different relationships residents can have with street trees by using identical themes in all three separate analyses. However, this was not possible because participants used different language and criteria when describing what was important to them in the real life situation of their road compared to the visual simulation survey. Such evidence implies that residents do indeed have distinctive relationships with trees depending on where they are and what they are doing.

Interviewees' perceptions of the images in the visual simulation survey were therefore influenced by specific factors which will now be described in more detail. Figures 19 and 20 illustrate the frequency of responses of the factors that influenced their decisions around ranking the highest and least preferred images based on the themes described in Tables 24 and 25.

Interviewees found several issues important relating to their favourite scenes which focussed on the presence of trees, their shape, size and frequency alongside the scale of the trees combined with the street. There were also individual comments around specific matters such as the presence of garden vegetation, for example.

Theme	Description	Indicative quotations
Trees present	Images that contained street trees were more preferred	*"... mature trees in the street like this wonderful set of trees outside here."* *"I like tree lined roads."*
Tree shape	Judgements were offered about the various tree shapes	*"Generally I don't like the very pillar like trees very vertical ones don't look right to me."* *"I certainly much prefer trees that are fairly slender or similar a rowan tree is nice."*
Softening	Street trees tended to soften the built landscape	*"...so that in the last page the trees did quite a good job in humanising a landscape."* *"I think softness of line ..."*
Garden foliage	The presence of vegetation in gardens contributed positively to preference	*"In the first set of pictures I think in a way that you could get away without trees because there's a lot of foliage in the gardens because you've got quite a green set up already."*
Scale	The size of the trees in relation to the size of their surroundings	*"I can imagine a situation where the streets are narrow and so on where you would get a problem just fitting the damn trees in."* *""I think the proportion of the size of the tree and size of the house."*
Tree frequency	The number of trees was important because of their coverage	*"... and the number of trees so there were too many crammed together."* *"The number of trees..."* *"... able to see some sky but not too much."* *"They tended to be the ones with more trees in them."*
Density	Impenetrability of the crown to light	*"...and dense trees such as limes are really not very good so some of the trees there were quite dense."*
Future – size	Consideration given to what the image would look like into the future	*"And thoughts of the damage the trees would cause when they got bigger."*
Amount of greenery	How much green, relating to vegetation, was showing in the image	*"Probably the amount of green."* *"Just the amount of greenery ..."* *"I think the amount of green from the tree..."*
Tree size	Stated specific preference about the size of trees	*""I just want mature foliage on the streets."* *"I would want them to be deciduous, big, broad, wide."*

Each theme has been assigned a longer description and indicative quotes have also been included to further aid interpretation

Table 24 – themes drawn from interviews with residents which explain the factors that influenced their opinions when choosing their favourite image from each slide.

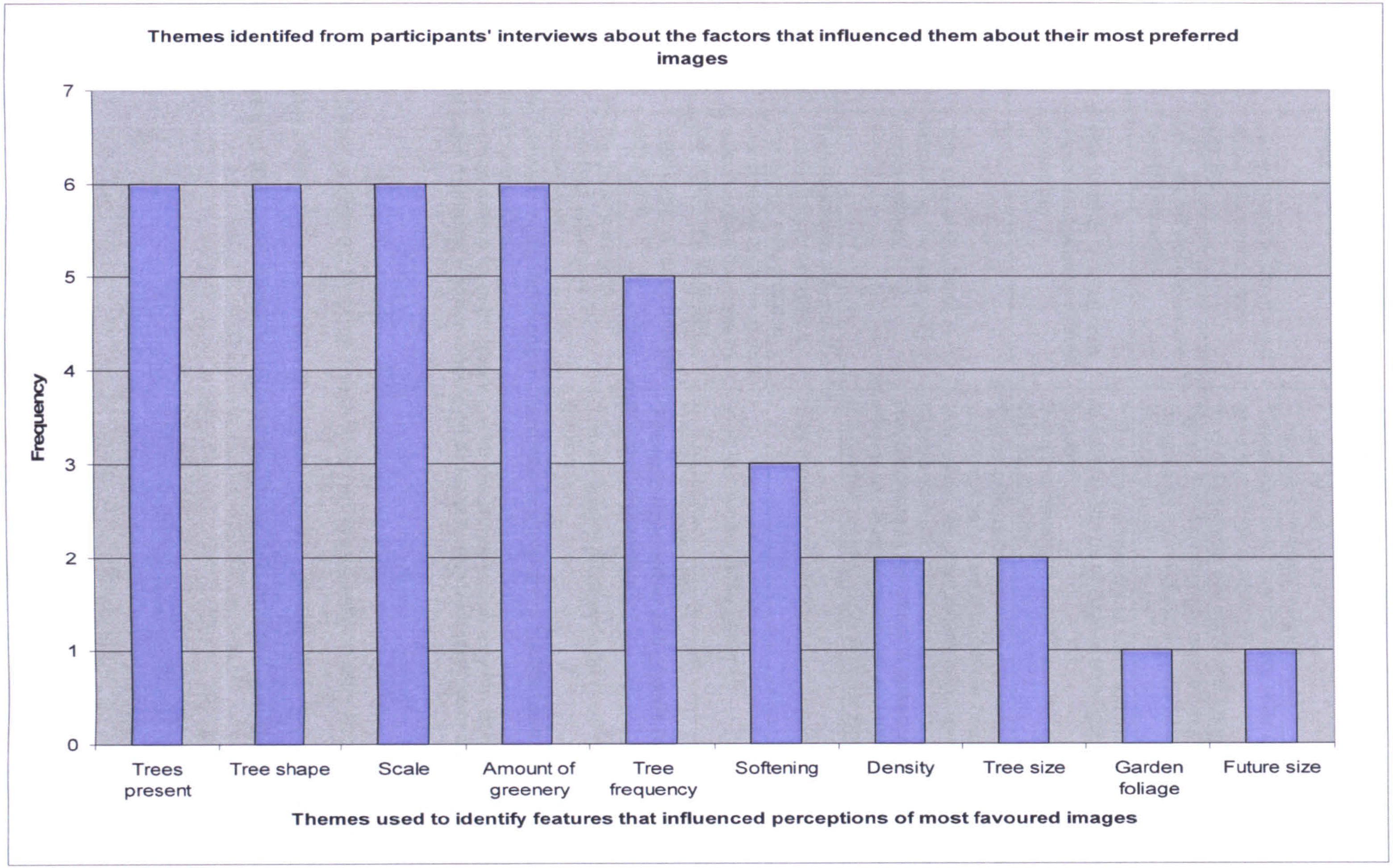


Figure 19 – summary of reasons that influenced residents' choices for their most favoured image in the visual simulation survey

Theme	Description	Indicative quotations
Trees not present	Images that lacked street trees	*"Again obviously if there were no trees it just looks bleak."* *"Usually the ones without any trees at all because I favour street trees."* *"...lack of tree cover."* *"They were all ones without trees."*
Tree shape	Judgements were offered about the various tree shapes	*"Generally I don't like the very pillar like trees very vertical ones don't look right to me."* *"And the one with the pollarded trees, absolutely horrible."*
Unrealistic images	Images did not represent real life situation	*"Some of them I thought weren't realistic in as much as the foliage was so low down into the street it wouldn't be allowed if you see what I mean."*
Tree frequency	The number of trees was important because of their coverage	*""The one's where there were too many trees too many I like to have a little bit of decent sized gap between trees to see houses."* *"I like the ones with more trees but not necessarily the ones with most trees."*
Scale	The size of the trees in relation to the size of their surroundings	*"Some of those ones were really the trees dominated the street so totally – obstructed the houses."* *"And again the ones where trees were planted had been either allowed to grow too tall or not kept to size or were inappropriate to the street in question in other words very often when they were too tall and thin they seemed to create, they weren't harmonious with the street."*
Tree damage	Consideration given to the damage that the trees in the image would cause	*"The thoughts of all those roots underground."*
Tree nuisance	Consideration given to the nuisance that the trees in the image would cause	*"And the leaves in the gutters."*
Barren	Lack of trees made images look bleak	*"The lack of greenery."* *"I thought they looked kind of quite barren and bare without any sort of greenery."*
Garden vegetation lacking	The lack of trees in gardens affected preference	*"Usually where there were no trees on the pavement trees in garden."*

Each theme has been assigned a longer description and indicative quotes have also been included to further aid interpretation

Table 25 – themes drawn from interviews with residents which explain the factors that influenced their opinions when choosing their least favourite image from each slide.

With the least preferred images there was high agreement with scenes lacking street trees being the most frequently cited reason for disliking the photograph. Other themes mirrored those found for the favoured images but in lesser numbers (Figure 20).

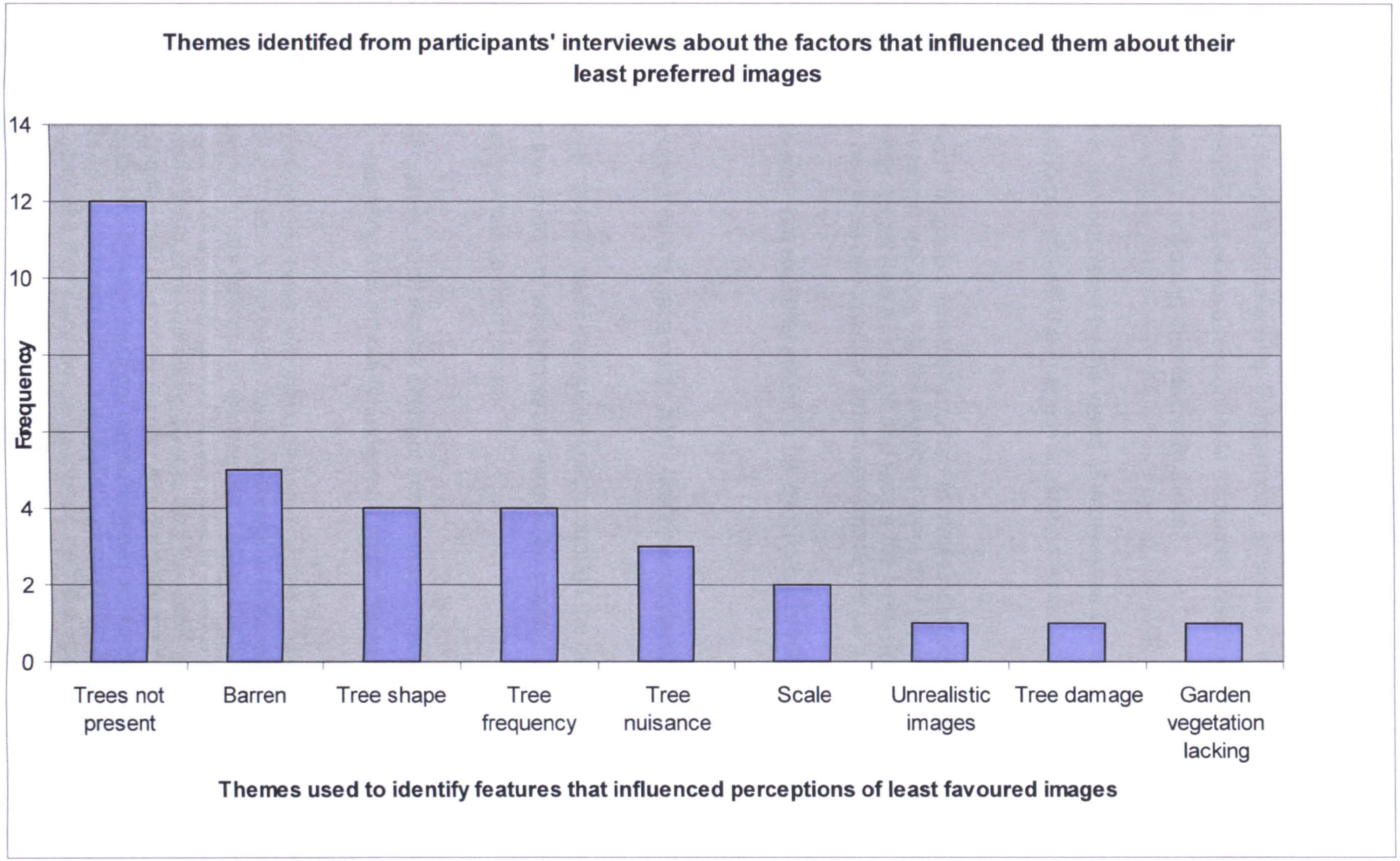


Figure 20 - summary of reasons that influenced residents' choices for their least favoured image in the visual simulation survey

Language used by residents describes a subtle difference between the issues such as 'impact' and 'suitability'. Impact tends to be a vocalisation of practical problems, transposed from personal experiences, whereas suitability is a reflection of the purely visual analysis of the scene. Furthermore, analysis of this area has required careful interpretation because respondents frequently described the things that they did not like when mentioning their favourite slides.

An example is demonstrated by the views of interviewee C2 who found it easier to describe his choices around the images he most preferred by saying what he did not like,

"I thought about things like whether you had to duck under branches when walking along the pavement and how big the shadows were that were cast on the ground so I looked at head height next to a trunk and where the leaves started. And just whether you had clear vision of the street and where the cars were parked."

These things were not explicitly stated in his description of his least favourite images,

"That had no trees on the pavements and I like trees on pavements."

It would appear that C2 made careful selections around the detail about what he would like in the context of wanting street trees to be present but was better able to articulate that by what he didn't want.

The following quotes, each from a different interviewee, provide more detail about the complex reasoning that residents underwent when making their images choices.

"Right it's obviously the ones with trees. But also getting a balance between the size and shape of it. If there's too much foliage although it looks very nice it's not actually practical because it cuts light out of the houses. I mean that's been the trouble with the tree I've got outside my house which has actually been pruned very well this year but it hadn't been done for about 5 years and the lower branches were much lower and it shaded that part of my garden and cut quite a lot out of the house because I've got two trees in my front garden anyway and it did make it very dark but they've been and pruned it this year and it's much much better so the canopy's that much higher. But that's also influenced because I like trees that shape rather I like trees that are rounded rather than triangular I don't like conifers. So, that's what made me put a certain rank."

"The appropriateness of the tree to the street. I'm in favour of street trees but some of the trees seemed inappropriate to the setting so the very tall ones seemed out of place and in the narrower streets very bushy ones seemed out of place."

"I think the amount of green from the tree but without it sort of overshadowing the road too much."

"I guess it was the contrast between not having trees and having trees and where we haven't got trees it looks a bit stark and it did look better with the trees and I guess it again comes down to proportion so that the ones that either didn't have trees or with trees that just didn't look right."

"Generally I don't like the very pillar like trees very vertical ones don't look right to me. Some of them I thought weren't realistic in as much as the foliage was so low down into the street it wouldn't be allowed if you see what I mean. Generally I prefer more rounder shape foliage as much as possible but obviously this is restrained by the streets. And I also don't like the pyramids I don't go for pyramids either, it looks odd and unnatural and doesn't make things look natural."

Interviewees' responses to these questions show that although common themes exist they overlay a high degree of individuality between neighbouring residents which has become a topic throughout this research.

<u>Were interviewees' image preferences influenced by residents' own experiences of street trees?</u>

The visual simulation survey raises several issues. Overall, results are similar to that described by other researchers with larger trees tending to be preferred (Kalmbach & Kielbaso, 1979) and scenes without street trees generally liked least (e.g. Schroeder & Cannon, 1983).

Interviewing the visual simulation survey participants enabled a deeper analysis of the factors that influenced image choices and the following quotations are used to help demonstrate the findings. Results from the Midland Tree Officer Association's (MTOA) seminar are also described where appropriate to help illustrate any points.

A key issue was whether the participants' verbal preference of their actual relationship with street trees matched their photo selection preference. It would

seem that only Kalmbach & Kielbaso (1979) had investigated this link and they had noted that,

"Of the 49 people verbally preferring existing small trees, 52% selected a majority of large tree scenes."

Such results suggest that the contents of images can present different compatibility issues than those in the 'real world' situation. For example, trees in photographs do not drop leaves that need raking up and this attribute could well be not considered or even dismissed when viewers evaluate images.

In order to evaluate the extent to which the perspective of the viewer influences the choice of images in visual simulation surveys interviewees were asked to state whether their own experiences of street trees influenced their choices and just over four fifths stated that it did. Two of the responses to this question are shown below indicating very clearly how they considered that they superimposed themselves into the scenes. Both expressed factors that were unique to themselves illustrating further the richness and breadth of the variability of attitudes to street trees,

"Yes I felt that I was being a viewer but I also thought now what would I be thinking if I lived in the houses at the side and particularly when there are lovely big fluffy trees outside that can cut the light from the windows and bedrooms and so on. You know there are different points of view depending whether you are living in it or walking down it necessarily."

"I suppose in the back of mind it was also if the horizons were blocked. We might also have suckers come out the bottom and the pavements blocked because we've got that situation just over the road here at the moment."

One participant explicitly expressed that he focussed on the aesthetics of the scenes in the images, which he revealed was inevitable due to his career in the Arts.

Overall, interviewees were divided into three camps about whether their own experiences of street trees influenced their image choices.

Eleven residents were clear that there was a direct link as these quotes illustrate;

"Yes, definitely because we are lucky enough to have them. And you know that does make a big difference. If you've got them they've got to be looked after you can't just let them grow."

"Yes I did. I thought there were trees, I have to walk the dog everyday so there are trees that I have to duck under to avoid low branches that are hanging over pavements so I thought about that. I walk him late at night so I thought about the shadows."

"Yes because they looked very familiar those roads looked very familiar to the ones I lived. There are down sides to trees but I still prefer to have them."

Three of the residents thought that their experiences had influenced their choices but in more of a subconscious way;

"Not deliberately but I dare say but that informed what I thought but I wasn't thinking consciously about it."

"Not foremost but it did influence my opinion."

Four residents stated that their experiences had no influence over their choices;

"No, purely visual, purely aesthetic."

Interviewees' remarks about this question further illustrate the diversity of responses towards the ranking of images in this visual simulation survey.

With so many participants describing how their actual street tree experiences were reflected in their image choice it was important to test if this was the case. Such a finding has important implications because it addresses the validity of visual simulation survey methods where the individuals' circumstances were not taken into account. For example, is there a subconscious difference in the way people view images and real scenes even though they might think there is not.

The following vignette explores this concept in detail by considering interviewees with low overall opinions of street trees, where it was established earlier that this group is more likely to prefer street trees to be small.

Table 26 identifies key characteristics of this group of respondents revealing that overall; they like living in their street; they recognise the value in the presence of street trees and their attractiveness; but most think the tree outside their home is too large; and it is split about whether they are considered too near or too close to their home.

Interviewee	Street	I like living in my street	Trees growing in the pavement make streets nicer places to live	Tree size opinion – closest tree	Tree size opinion – whole street	Tree proximity	Attractiveness
A3	A	Agree	Agree	Too large	Too large	Too near	Somewhat attractive
A4	A	Strongly agree	Neither agree nor disagree	Too large	Too large	Just right	Very attractive
C1	B	Agree	Strongly agree	Just right	Just right	Just right	Somewhat attractive
D1	D	Strongly agree	Agree	Too large	Too large	Too near	Somewhat attractive

Table 26 – perceptions of Interviewees with low overall opinion of their closest street tree about their street and its trees taken from the *householder survey*

Residents were asked identical questions during the interview to elicit issues that were considered important to understand the processes they used to make their decisions.

Three of this group fully agreed that their own experiences of street trees influenced their image choices whereas C1 was not so sure. Each of their responses to this are quoted below,

A3 - *"Yes, important to see other houses."*
A4 - *"Absolutely yes"*, and added after a prompt that it was the over-riding feature when looking at the images.
C1 - *"No, not as much as I would have thought."*
D1 – *"Yes I did."*

Overall this group favoured the presence of street trees in the scenes although their reasoning highlighted further the issue of variability between residents. A3 described

that the most preferred images were those with smaller trees that were spaced out reflecting his opinions of the street trees in his road. A3 also explicitly illustrated his thinking by introducing his real life situation,

"I think the proportion of the size of the tree and size of the house...I certainly much prefer trees that are fairly slender or similar - a rowan tree is nice but just next to it is this massive lime tree which is very dense and dense trees such as limes are really not very good so some of the trees there were quite dense although I don't think there were any lime trees in those illustrations So it's the size density yes and the number of trees so there were too many crammed together."

This point was reinforced when he described the factors that influenced him about his least liked scenes,

"The one's where there were too many trees too many I like to have a little bit of decent sized gap between trees to see houses they don't look overwhelming. Some of those ones were really the trees dominated the street so totally – obstructed the houses."

A4 and C1 were both brief in their responses to these questions. A4 confirmed her concerns about the presence of street trees and the damage that they might cause to her property with her favoured images based on,

"Space. And thoughts of the damage the trees would cause when they got bigger."

and the least preferred images were influenced by,

"The thoughts of all those roots underground. And the leaves in the gutters."

C1's responses were difficult to interpret but were based around her concept of the amount of greenery although this was not explained in any more depth.

Responses by D1 were particularly interesting, revealing a contradictory position. On the one hand he was particularly unhappy with the tree outside his home and yet he could see that images containing street trees looked better. Torn between these two positions he determined that the issue of proportionality was critical. Describing his favoured images he said,

"I suppose the proportion of the trees to the area because I think the road looks better with them than without them it was the proportion of the trees."

A point reiterated when describing the reason behind his least favoured images,

"I guess it was the contrast between not having trees and having trees and where we haven't got trees it looks a bit stark and it did look better with the trees and I guess it again comes down to proportion so that the ones that either didn't have trees or with trees that just didn't look right."

Proportionality thus appears to describe a happy medium between having street trees but not ones that are incompatible with your lifestyle.

<u>What did interviewees think that other people might make of their image ratings?</u>

To be able to effectively answer this question it was necessary to be able to understand the interviewees' overall position in regard to the images because without such insight comparisons could not be made.

Overall, 15 interviewees favoured the presence of images with trees; one preferred no street trees; and two of the interviewees did not answer the question. From this insight it is possible to understand the relationship that residents have with other members of their community more meaningfully.

Three of the residents stated quite boldly that they did not care what other people thought of their choices.

For the interviewees that favoured trees in their images their answers reveal a sophisticated understanding of the complex issues around street tree perception. Of particular interest is the description by the interviewees residents that their choices would not be mirrored by residents that disliked street trees as these quotes from different residents demonstrate:

"Someone who clearly likes trees and doesn't mind having the lime dripping onto cars and stuff. It would have to be."

"If you didn't like trees you would disagree with my choices."

"I tend to go for overgrown, as a gardener I quite like things to be on the border of overgrown so a lot of people I suspect would think I wanted too much foliage, I guess."

"I'm sure there's going to be varying opinions. Not everybody likes street trees because they do have disadvantages in terms of things like people with disability, wheelchair access, pushchairs, roots damaging houses so I would imagine some people wouldn't really like my choices."

"Those that haven't got trees will disapprove those that have got trees would approve."

These quotes indicate that residents understand how the annoying features of street trees are experienced in their community. It could be argued that they comment more about that than the fact that their choices are likely to be approved in their community rather than disapproved of because of the general consensus that street trees are valued.

Although it must be recognised that the number of interviewees is low there are some clear trends shown in these results which may help to point future research into areas where there are some attributes that appear to be common for all residents particularly around the presence of trees, their impact, the scale of the components within the scene and tree shape. Further research could focus on how these affect preference.

Residents' relationships with street trees: a deeper analysis through the use of vignettes

Research has sought to understand residents' previously identified relationships with street trees, namely

- The relationship a resident may have when regarding the overall street scene.
- The relationship a resident may have when in their house or carrying out house related activities.
- The relationship a resident may have with street trees in a visual simulation situation.

Furthermore, this thesis has also set out to investigate these relationships in detail so to achieve this it is necessary to integrate the results from the householder survey, the interview and the visual simulation survey in conjunction with the physical layout of the street, residents' homes and the spatial relationship with street trees.

A series of four vignettes, one from each of the streets, follows which describe how residents in close proximity perceive nearby street trees using all the information collected in the research. Participants in these vignettes have been identified by having contrasting perceptions and or living close to each other and therefore to the same street trees.

A closer analysis of interviewees' preferences in the visual simulation survey is illustrated in Table 27 which presents the results of the visual simulation survey in detail where each interviewee's favoured and least favoured image, from each slide, being reported. These are shown with details drawn from the householder survey enabling an integration of perceptions about issues relating to the closest street tree (such as size perception and overall opinion) and trees in the neighbourhood (including general opinion and perception of size).

Such information has been critical in isolating participants for the vignettes enabling a comparison of different perceptions. Residents' perceptions of street trees are therefore described in more detail below focusing on residents that are close to each other, in order to evaluate opinions about the same subset of street trees, and have different perceptions to evaluate why differences exist.

Visual simulation analysis

Key to the symbols used in the tables below:

Symbol	Meaning
L	Largest tree
M	Medium tree
S	Smallest tree
None	No tree present

Tree shape	Meaning
C	Columnar
P	Pyramid
S	Spreading

Street A – large trees

Interviewee		Spreading tree Slides			Columnar tree slides			Pyramid tree slides			All tree shape slides			Closest street tree		Neighbourhood street trees	
		A	D	G	B	E	H	C	F	I	J	K	L	Overall opinion	Tree size opinion	Overall opinion	Tree size opinion
A1	1ST choice	L	L	L	L	L	M	L	L	L	S	P	S	Very good	Just right	Strongly agree	Just right
	Last choice	None	None	None	None	None	None	None	None	None	None	None	None				
A2	1ST choice	L	L	L	S	M	M	L	L	M	S	S	S	Very good	Very good	Strongly agree	Just right
	Last choice	M	None	S	L	L	L	M	None	None	P	None	None				
A3	1ST choice	None	None	S	None	M	M	None	None	S	None	C	C	Poor	Too large	Agree	Too large
	Last choice	L	L	L	L	N	L	L	L	L	P	None	None				
A4	1ST choice	S	None	None	L	S	None	L	None	None	C	None	None	Poor	Too large	Neutral	Too large
	Last choice	L	L	L	M	L	L	M	L	L	P	C	S				
A5	1ST choice	S	S	M	S	M	M	M	S	S	S	S	S	Good	Just right	Strongly agree	Just right
	Last choice	L	L	None	L	None	None	None	L	L	P	None	None				

Street B – medium trees

Interviewee		Spreading tree Slides			Columnar tree slides			Pyramid tree slides			All tree shape slides			Closest street tree		Neighbourhood street trees	
		A	D	G	B	E	H	C	F	I	J	K	L	Overall opinion	Tree size opinion	Overall opinion	Tree size opinion
B1	1ST choice	M	M	M	S	S	M	M	M	M	S	S	S	Good	Just right	Strongly agree	Just right
	Last choice	None	None	None	None	None	None	None	None	None	P	None	None				
B2	1ST choice	S	L	S	S	M	M	S	M	M	C	P	C	Good	Just right	Agree	Just right
	Last choice	None	None	None	None	None	None	None	None	None	None	None	None				
B3	1ST choice	M	M	M	L	M	M	M	M	M	S	P	S	Very good	Too large	Strongly agree	Just right
	Last choice	None	None	None	None	None	None	None	None	None	None	None	None				
B4	1ST choice	L	L	L	L	M	L	L	L	L	P	S	S	Good	Just right	Strongly agree	Just right
	Last choice	None	None	None	None	None	None	None	None	None	C	None	None				

Street C – small trees

Interviewee		Spreading tree slides			Columnar tree slides			Pyramid tree slides			All tree shape slides			Closest street tree		Neighbourhood street trees	
		A	D	G	B	E	H	C	F	I	J	K	L	Overall opinion	Tree size opinion	Overall opinion	Tree size opinion
C1	1ST choice	L	L	L	L	L	L	L	M	L	S	P	S	Poor	Just right	Strongly agree	Just right
	Last choice	None	None	None	None	None	None	None	None	None	None	S	None				
C2	1ST choice	L	M	L	L	M	M	L	L	M	S	S	P	Very good	Just right	Strongly agree	Just right
	Last choice	None	None	None	None	None	None	None	None	None	None	None	None				
C3	1ST choice	M	M	M	M	S	M	M	M	M	S	S	S	Neutral	Too large	Agree	Just right
	Last choice	None	None	None	None	None	None	None	None	None	None	None	None				
C4	1ST choice	L	S	M	S	S	M	L	S	S	S	S	S	Good	-	Strongly agree	Just right
	Last choice	None	L	None	L	L	L	None	L	M	None	None	None				
C5	1ST choice	S	S	M	S	S	M	None	S	M	C	None	None	Neutral	Just right	Agree	Just right
	Last choice	L	L	None	L	L	None	L	L	None	S	P	S				

Street D – split street

Interviewee		Spreading tree slides			Columnar tree slides			Pyramid tree slides			All tree shape slides			Closest street tree		Neighbourhood street trees	
		A	D	G	B	E	H	C	F	I	J	K	L	Overall opinion	Tree size opinion	Overall opinion	Tree size opinion
D1	1ST choice	S	S	S	S	S	S	S	S	S	C	None	S	Poor	Too large	Agree	Too large
	Last choice	M	L	M	M	M	M	M	L	M	P	P	None				
D2	1ST choice	L	M	L	M	M	L	M	M	L	S	S	S	Very good	Just right	Strongly agree	Just right
	Last choice	None	None	None	None	None	None	None	None	None	None	None	None				
D3	1ST choice	M	M	M	M	M	M	M	M	M	S	None	None	Good	Just right	Agree	Just right
	Last choice	None	None	S	S	S	S	S	None	S	C	S	P				
D4	1ST choice	S	S	L	M	M	L	S	S	L	S	S	S	Good	Just right	Strongly agree	Just right
	Last choice	None	None	None	None	None	None	None	None	None	None	None	None				

Table 27 - Results of the visual simulation survey described in detail with each interviewee's favoured and least favoured image, from each slide, being reported.

Selection of participants for the vignettes

The following describes how participants were selected for the vignettes. The key criterion was that residents had to be in close proximity so that perceptions could be evaluated about the same street trees. Secondly, participants needed to express diverse opinions of street trees to enable an evaluation of the reasons behind such differences to understand whether it is possible to isolate important factors. Finally, it was considered preferable that the participants had been interviewed because these residents had provided the most in-depth information.

Three residents were selected from Street A, each of which had been interviewed and were clustered around four large trees in the northern end of the road. Two of these held very positive opinions of their closest street tree and the trees in their neighbourhood whilst the other resident was more negative.

Two interviewees from Street B were selected due to similar relationships with their nearest street tree including proximity, tree size and species.

The two residents selected for street C live opposite each other near the middle of their road. They both appreciate the street trees in their neighbourhood but have different opinions of their closest street tree.

Two residents were selected in Street D who live on opposite does of the road to each other but close to the only two street trees in their road. They also have opposing views about living next to these trees.

These vignettes will be described on a street by street basis. A detailed summary of each of the participants will be provided, along with an image and map illustrating their location. Information will be drawn from the householder survey, the interview and the visual simulation survey and will be integrated wherever possible in order to gain an in-depth understanding of attitudes to street trees where they live. For ease of reference participants in these vignettes will be identified by the code used earlier in Table 22.

Street A vignette – large trees

Residents A1, A2 and A4 are located in the northern section of the road. A1 and A2 are both on the western side of the street whilst A4 lives opposite them. Plate 17 plots their relative position and the location of each of the street trees near their home and this information is supplemented by the photograph illustrating the northern view along the road.

Table 28 provides demographic information about each of these residents. A1 and A2 have similar backgrounds whilst A4 is a considerably older female. They have all lived in the area long enough to have experienced the same seasonal issues and pruning regimes from the local council.

Resident	Gender	Age	Years lived in the street	House status	Salary	Education
A1	Male	54 years	25	Owner	>£45,000	Graduate
A2	Male	55 years	10	Owner	> £45,000	Graduate
A4	Female	83 years	7	Owner	>£25,000 - £35,000	Graduate

Table 28 – summary of the demographic data for the participants in the vignette from Street A

Key data about the trees in this part of the street are shown in Table 29. These are all tall specimens with the London plane trees being the largest.

Tree	Species	DBH	Tree height	Crown area
T1	Common lime	0.36	10.25	59.7
T2	Common lime	0.50	11.50	53.16
T3	Common lime	0.50	11.151	61.70
T4	Common lime	0.44	11.19	69.98
T5	London plane	0.53	13.47	82.26
T6	London plane	0.68	12.57	82.26

Table 29 – species and size data of the street trees growing close to the residents in the Street A vignette. All sizes are in metres.

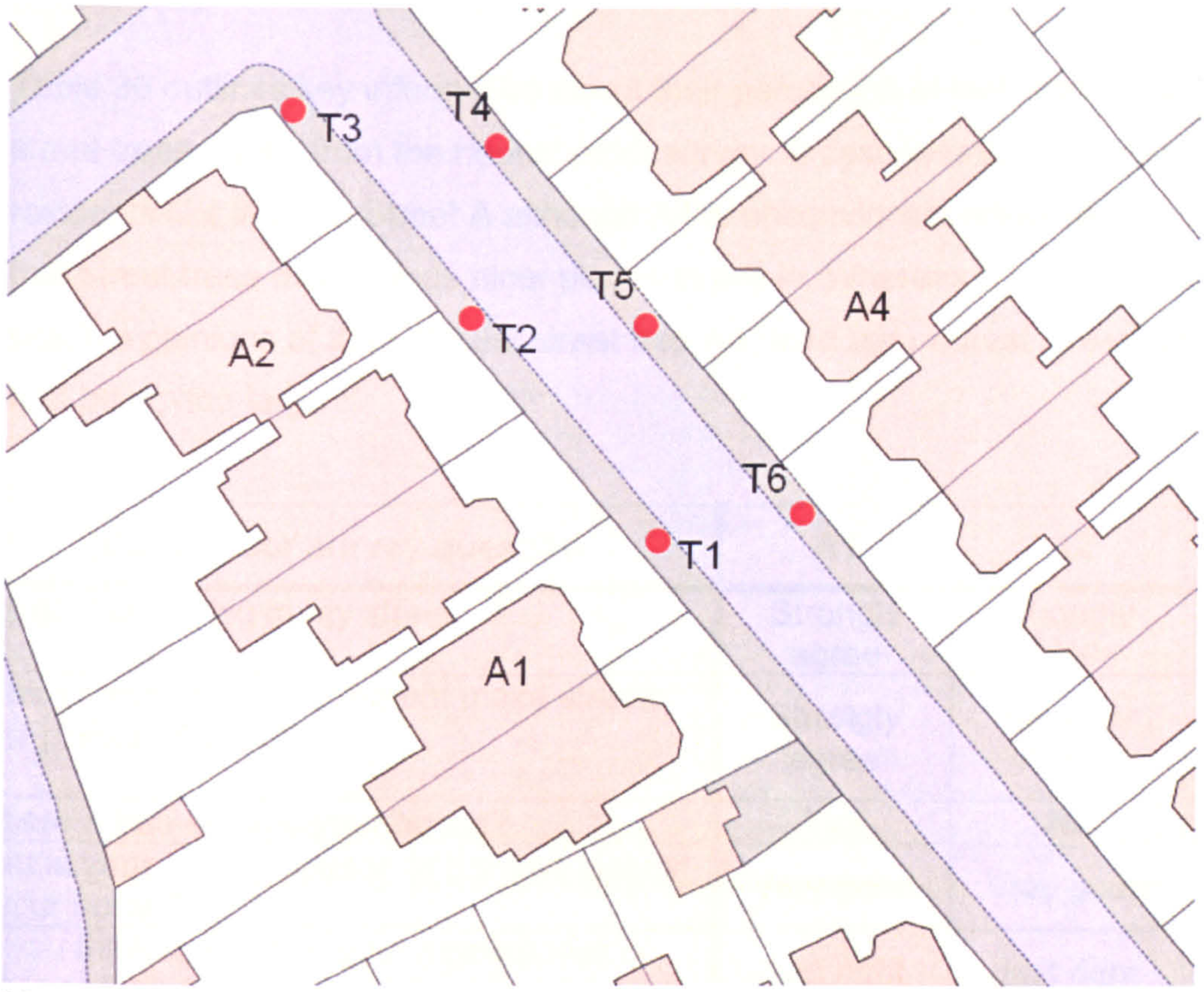


Plate 17 - the relative position and location of each of the street trees in the Street A vignette. This information is supplemented by the photograph illustrating the northern view along the road.

Table 30 outlines key information about their perception of their street and the local street trees drawn from the householder survey. It describes how this set of residents like living in Street A although A4 is unconvinced, unlike like the other two, that street trees make roads nicer places to live in. Whereas A1 and A2 hold very positive opinions of their closest street tree A4 rated her nearest street tree 'poor' and being 'too large'.

Householder survey question	A1	A2	A4
Overall, I like living in my street	Strongly agree	Strongly Agree	Strongly agree
Trees growing in the pavement make streets nicer places to live in	Strongly agree	Strongly Agree	Neither agree nor disagree
Is there a tree outside your house?	Yes	No	Yes
What is your overall opinion of the tree closest to your home?	Very good	Very good	Poor
Do you think the size of your nearest tree is ...?	Just right	Just right	Too large
Which one of the following answers best describes how you feel about the distance between your home and the nearest street tree?	Just right	Just right	Just right
The size of the trees in my street are generally	Just right	Just right	Too large
Do you feel that the trees in your street generally grow	Good rate	Good rate	Too fast
Do you feel that the look of the trees in your street is generally	Very attractive	Very attractive	Very attractive
How well do you think the Council maintains the trees in your street?	5	5	3

Table 30 - key information about residents' perception in the Street A vignette of their street and the local street trees drawn from the householder survey.

The following section provides an in-depth investigation of these three residents' relationships with the trees near their home.

Firstly it is important to understand each of their spatial relationships with the trees near their home. The householder survey asked residents to state whether they had a tree directly outside their home or not rather than relying on the researcher's physical inspection of the roads to determine this. A1 stated that there was a tree directly outside his house and an inspection on the ground shows that tree T1 is in

front of his home. A2 described having no tree outside his house and this is reflected on the ground but T2 is relatively close by being directly outside his neighbour's home. A4 described having a tree outside her home but Plate 17 indicates that although her house is equidistant from two trees neither is directly outside her home.

Information such as this is important because it suggests that residents cast their net wide in terms of factors that influence their home and street trees do not always have to be directly outside someone's house to be considered as being within their sphere of influence. When evaluating residents' relationships with street trees it appears that it is firstly important to allow residents to describe how they perceive their physical proximity to the trees.

Closer evaluation will now follow about these residents' relationships with street trees.

Relationship with trees in their street

These residents' responses to the householder survey, reinforced with data from the follow up interview and visual simulation survey indicate that their perceptions of trees in each of these relationships is too complex and intertwined to be separated. A1 and A2 have very positive opinions of their closest street tree and these same feelings are transposed onto trees in their neighbourhood. Equally, A4 has a negative perception of her nearest street tree and this opinion is extended to the trees in her street. From these three residents A4 is the only one to mention that street trees barely contributed to her positive opinion about living in her street.

Despite these differences in perception there are areas of agreement particularly around street trees' attractiveness, a common theme throughout the literature.

In the interview residents were asked to describe things that would make them alter their overall opinion of the tree and the tree's size was the single common theme between all three. As the following quotes demonstrate, however, each had a different perspective about this.

A1 described two factors that would change his overall opinion of 'very good' about his nearest street tree. One involved getting rid of it completely whilst the other related to changing in its size,

"If the scale of it was reduced. It's at an appropriate scale it works really well. If it was cut, pruned too regularly. It's pruned at about the right amount."

A2 also described how changes in size would reflect his overall opinion of 'very good' but his main concern was to prevent it getting any bigger,

"Well if it was never trimmed and started to cut out huge amounts of light it would no longer be an asset I mean it's a lime and lime trees will grow into full sized trees which is not possible in that setting so I accept it has to be pruned and pollarded and so on. It's the only way to maintain it."

A4 succinctly described that making it *"a lot smaller"* would please her or having it replaced with a smaller specimen.

These issues fit neatly with two of the remaining interview questions where participants were asked to explain what they thought about when asked to consider tree size.

None of these three interviewees explicitly discussed tree dimensions but focused more on what appears to be a sense involving scale, with each individual having different ideas about what was acceptable although they related to previous comments and statements.

A1 was particularly focused on large trees stating regularly a preference for them and he articulated this as a 'feeling' rather than an absolute,

"It's a tricky question. What do I think about? Well it's its coverage isn't it well I use the word majestic and so on you know something substantial well you're involved with nature you feel more connected with nature as a result of having something non-city. The trees that are only sort of 8 foot tall you know what's the point? You may as well sort of have plastic ones because then they wouldn't have leaves there is something about the scale of us in relation yes a natural thing of a significant scale around us."

A2 described a similar view to A1 but used the word 'toy' as a pejorative description of small trees compared to A1's use of the 'plastic tree' concept. A2 tempered this with the practical need that trees should not block his view,

"Well why I described it as just right is because it's big enough to have a decent kind of structure it doesn't look like a toy tree it looks like a proper tree. But equally from the very top of my house we're on a steep hill I can in the winter I can see through it and over it so it doesn't completely cut out all views from there. It maintains a certain amount of bird life some of which is more interesting than others I have seen a pied woodpecker in the tree out here not the very nearest one but the one on the other side of the road which is nice and I suspect unusual."

A4 did not define what she meant by big although it was clear the trees outside her house fit that category. Her main issue did not appear to be against big trees but where they were planted as these words from her explain,

"I like big trees. Trees should be in the country. People who want trees should live in the country."

Tree size matching its location (context) was also an important issue for A1 and A2. This applied even to A1 who was the strongest advocate for large trees although his solution was about changing urban landscapes to fit in big trees whereas A2 expected trees to fit the landscape as these quotes from both illustrate;

"Clearly in parks there's space for more variety and so on so obviously yes where you are does make a difference. There will be some streets that are too narrow to accommodate a decent size trees in which case you would have what you could fit. There is a sort of town planning aspect of that which is that if the street was a little bit wider they could accommodate bigger trees and that would be a better piece of urban layout." (A1)

"It's not practical to have big trees in roads because there would be no roots left. Or maybe there would be no road left. Unless you are suggesting we get rid of cars altogether and just have nice windy grass paths up and down and between the houses which is a somewhat utopian future given present circumstances." (A2)

Residents were asked in the interview to explain who they thought should make the decisions about street trees. This question was posed to investigate how they perceived theirs, and fellow residents, personal role in the care of street trees. It

also related to issues beyond day-to-day experiences by enquiring whether an understanding of strategic street tree management issues existed.

The two interviewees with the most positive view of the trees in their road and near their home (A1 and A2) both expressed the view that the Council should have ultimate responsibility but recognised that the local community should be involved in decision making. A1 was adamant that it should not be down to the person with the tree outside their house because they would make selfish decisions.

A4 did not mention the Council at all in her response which was a reflection of her unsatisfactory dealings with them when trying to have the tree pruned more regularly to keep it smaller,

"Combination of local residents and people who understand trees."

Visual simulation survey response

These three residents did not unanimously agree on most and least preferred images in the visual simulation survey. Each of these interviewees had also stated during the interview that their choices reflected their experiences of street trees and the following analysis addresses whether these differences originate because of the residents' relationships with the actual trees in their street.

Reactions to the Slides A - I

Most and least preferred images in these slides could be considered largely predictable for participants A1 and A4 when evaluated against their responses to the householder survey and interview. These two were also most emphatic that their images choices reflected their experiences of street trees.

A1 had described explicitly that he prefers larger trees and that street trees enhance roads and he directly related his personal experiences with the images,

"Lushness, greenness, mature trees in the street like this wonderful set of trees outside here. I don't like lollipop trees."

Furthermore, whilst carrying out the visual simulation survey A1 stated,

"Well in general I am always going to choose the more mature the better basically."

However, despite this bold assertion A1 does temper his opinion noting that the scale of the street is important and that one size does not fit all.

"I just want mature foliage on the streets. It's probably slightly difficult because these are big trees and the houses are substantial and stuff so it all works well in scale OK. I can imagine a situation where the streets are narrow and so on where you would get a problem just fitting the damn trees in so I noticed a bit north of here where they've had to do this, what's it called, where you clean off the trees and they've now put those trees are inconvenient in the street but I would still rather have them. I think they should change the law so you can't sue people for trees causing subsidence – it would be much easier. And also I think some people, there is a little bit of a gap in this street, and I think they probably don't want a tree there actually they probably like the only bit of sunlight but I'd rather have trees because I like trees."

This reasoning is demonstrated when he explains, during the visual simulation survey, his choice for Slide H,

"Of course they've become a bit spindly and disappeared off the top so 3 [referring to image 3 which is the medium size tree] *looks best."*

A1's straightforward reaction to explaining his reasoning behind his least favoured images is understandable in this context where he simply said *"No trees."*

A4 holds much more negative opinions about street trees and her ranking of images in the visual simulation survey tends to reflect this outlook. Her preferred images tended to contain scenes with no street trees or the smallest specimens. However, on two occasions she selected the largest tree as her most favoured (Slides B and C) but there is no reason provided for these choices.

During the visual simulation survey she provided some clues for her decisions with her consideration of future growth and what this means to her,

"The trouble is these trees grow. Really I like that but in a few years time it will be bigger and we don't want it to be bigger. The trees are going to grow and I am not a big fan of big trees."

Later on, when discussing her preferred images the consequence of large trees came to the fore where two specific concerns were raised,

"Space. And thoughts of the damage the trees would cause when they got bigger."

Such views were reiterated when asked to explain reasons for her least preferred images,

"The thoughts of all those roots underground. And the leaves in the gutters."

Unlike A1, with whom he had similar positive opinions, A2's image choices are far more difficult to label. This may be because he viewed the images remotely to his real life experiences as he explained when asked whether he thought about his own experiences of street trees when were making his image choices,

"Not deliberately but I dare say but that informed what I thought but I wasn't thinking consciously about it."

In Slides A, D and G he rated the largest tree as his most preferred but his least favoured images included the medium, small and no street tree scenes demonstrating a seeming lack of consistency. With the columnar shaped tree these opinions were reversed with the largest specimen rated least favourite and the small to medium tree most preferred. The larger pyramid shaped tree was generally most preferred and he least preferred scenes with no street trees although on one occasion he least favoured the medium sized tree.

It has been possible to an extent to discern A2's image choices from the interview. Of these three residents he was particularly interested in the composition of the images making two insightful comments when completing the visual simulation survey.

"Chosen quite nice streets so looks good empty as well as full. Not all streets do if you know what I mean... The nature of your trees is that they have no shadows which is sort of bizarre. Sun's out, the car's got shadows but the trees spectral that they are have none. Trying to work out where that is. Are you allowed to tell me?"

This familiarity with the background images was mentioned again later when he said,

"Because the first picture is very much like, well it is just round the corner, I know where it is, so I like these streets anyway..."

Issues that affected his most preferred images were related to realism as this comment explains,

"Some of them I thought weren't realistic in as much as the foliage was so low down into the street it wouldn't be allowed if you see what I mean."

This helps explain the seeming inconsistent approach where he favours the largest tree and least prefers the medium sized tree in slides A and C, for example.

Slides J, K and L investigated tree shape preference. A4 continued her approach of rating the absence of street trees highly so it is not possible to understand her tree shape preferences. A1 and A2 both preferred the spreading shaped tree, which mirrors the examples described in the literature where tree shape preference has tended to reflect dominant tree shapes familiar to observers (e.g. Sommer & Summitt, 1995).

A2 was particular about his favoured tree shapes as these comments illustrate,

"Generally I don't like the very pillar like trees very vertical ones don't look right to me... Generally I prefer more rounder shape foliage as much as possible but obviously this is restrained by the streets. And I also don't like the pyramids I don't go for pyramids either, it looks odd and unnatural and doesn't make things look natural."

Slide M, which was used in the Weston super Mare pilot study, received the most consistent ratings from all participants including those from the MTOA survey and these opinions were repeated by A1 and A2 who preferred the spreading tree and least preferred no tree present. A4, on the other hand preferred the pollarded street

tree and least preferred the columnar specimen. This is consistent with her other image choices and her dislike of large trees.

Street B vignette – medium trees

Residents B1 and B2 live in the central part of Street B separated by an intersecting roadway. B1 is situated on the western side of the street and B2 the eastern side. Plate 18 plots their relative position and the location of each of the street trees near their home and this information is supplemented by the photographs.

Table 31 provides background information about both residents; Table 32 describes the street trees; and Table 33 outlines key information about their perception of their street and the local street trees drawn from the householder survey.

Resident	Gender	Age	Years lived in the street	House status	Salary	Education
B1	Female	67 years	34	Owner	£18-25,000	Further education
B2	Female	42 years	2.5	Owner	>£45,000	Graduate

Table 31 - Summary of the demographic data for the participants in the vignette from Street B

These female residents have slightly different backgrounds with B1 having lived in the street for much longer than B2 and will be more familiar with the seasonal changes of the tree and the Council's pruning regime.

Key data about the two trees closest to these interviewees' homes are shown in Table 32. These are typical trees found in this section of Street B.

Tree	Species	DBH	Tree height	Crown area
T1	Downy birch	0.18	9.38	36.41
T2	Silver birch	0.17	13.73	53.62

Table 32– species and size data of the street trees growing close to the residents in the Street B vignette. All sizes are in metres.

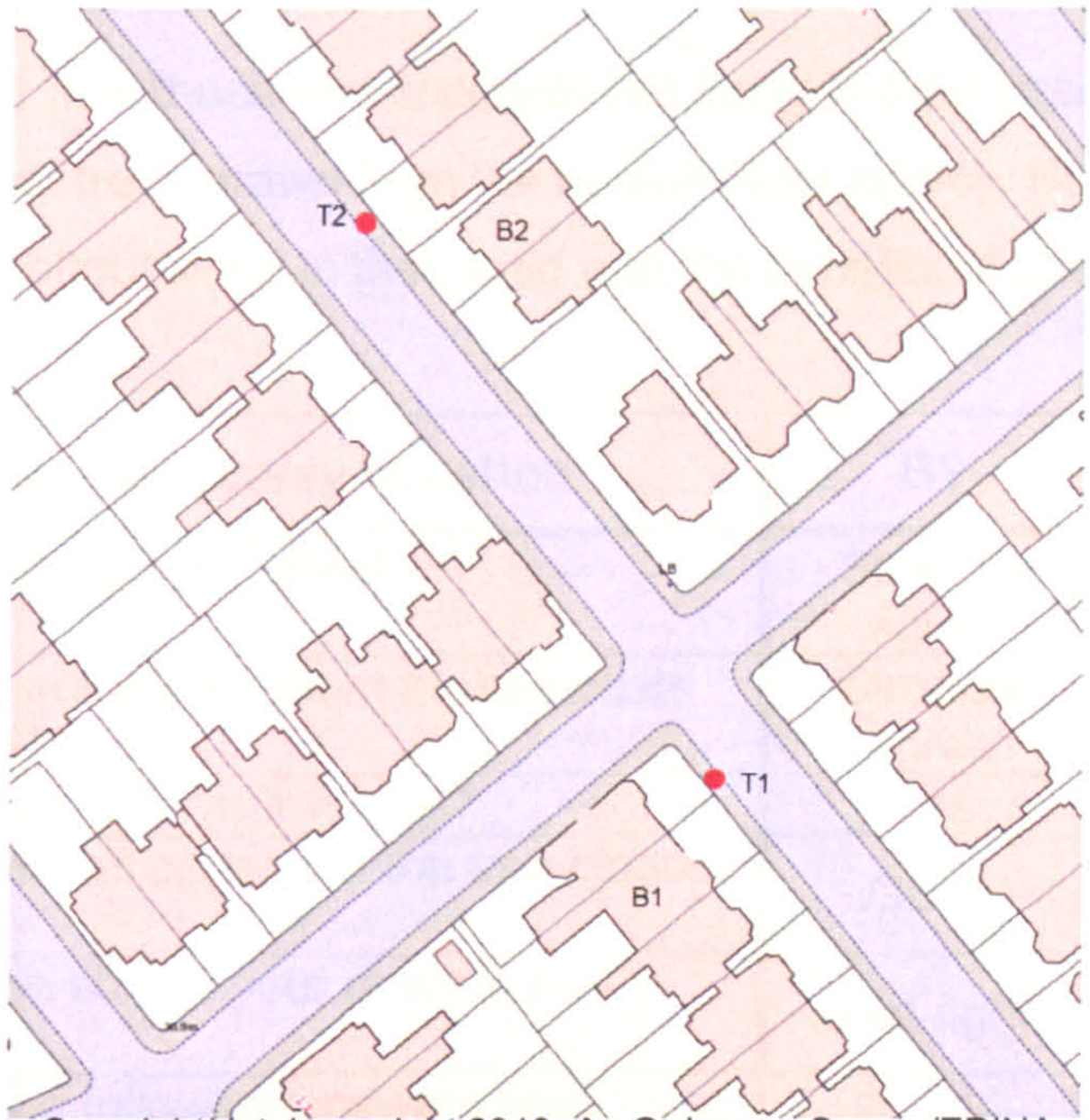


Plate 18 - the relative position and location of each of the street trees in the Street B vignette. This information is supplemented by the photograph illustrating the southern view along the road (top image) and northern view (bottom image).

Table 33 describes how these two residents like living in their street and general perceptions of street trees drawn from the householder survey. Both residents have quite similar views about living in their road and the benefits of street trees.

Householder survey question	B1	B2
Overall, I like living in my street	Strongly agree	Strongly Agree
Trees growing in the pavement make streets nicer places to live in	Strongly agree	Agree
Is there a tree outside your house?	Yes	Yes
What is your overall opinion of the tree closest to your home?	Good	Good
Do you think the size of your nearest tree is ...?	Just right	Just right
Which one of the following answers best describes how you feel about the distance between your home and the nearest street tree?	Just right	Just right
The size of the trees in my street are generally	Just right	Just right
Do you feel that the trees in your street generally grow	Good rate	No opinion
Do you feel that the look of the trees in your street is generally	Very attractive	Very attractive
How well do you think the Council maintains the trees in your street?	4	5

Table 33 - Key information about residents' perception in the Street B vignette of their street and the local street trees drawn from the householder survey.

Based on data from the householder survey both these residents have a positive relationship with their closest street tree and the trees in their street. The following analysis will investigate their perceptions of these relationships in more depth focusing on their interviews and visual simulation survey results.

B1 portrayed a sophisticated understanding of her closest tree describing how its health and species characteristics affected her relationship with it. Initially she explained in the interview how the presence of street trees contributed significantly to why she liked living in her streets mentioning particularly how they complemented vegetation in people's gardens to create 'height', an important visual aspect for her in her street's landscape,

"Visually overwhelmingly because although there are gardens of various amounts of foliage I think the street trees certainly give the height, green height in the road so very important."

When asked to discuss the important features of her closest tree B1 provided a degree of detail that demonstrated a detailed level of knowledge and insight about tree health and species characteristics. This is her response to the question about what issues would make her change her overall opinion of 'good' to her closest street tree,

"Well, positively certainly it's a silver birch tree and I didn't put very good because it doesn't have I feel it's not very healthy. It got a big piece of its bark taken from it when it was fairly young and I feel compared with other trees it's struggling so I'm delighted t have it but I wish it hadn't had that damage because it's not as beautiful as some of the other ones. I'm very glad it's a silver birch because apart from being sticky on the cars but at least you can wash that off I mean the plane trees can be rather dense but silver birch is just lovely. "

Trees were also important to B2 in her opinion of living in Street B especially the visual benefit they brought. She was so affected by these trees that she was able to recount her first visit to the street three and a half years previously,

"When we first drove up this street when we knew the house was on the market which was only three and half years ago it just struck you that there were a lot of, I think there were quite a lot of trees in the area, but in this road there are quite a lot of quite big trees and in people's gardens some of them have been taken down in the last three years but it sort of struck you a but like an avenue and it, in the middle of a city, it just had a really nice feel about it visually. It felt like treat to have so many trees on a residential street."

B2 went on to describe how trees can cause tangible annoyances which might make her lower her overall opinion of 'good' but equally demonstrated that compromises were necessary to live alongside trees satisfactorily,

"Things that would change my mind would be huge roots pushing up the pavement I suppose also sticky sappy stuff coming off trees I would rather live with that then not have the tree but that would be the sort of thing that would make me tut every now and again and also we get a lot of bird poo on our cars because if you have trees you have birds but actually we would rather have the birds than not have the birds."

Both residents agreed that the size of the tree closest to their home was 'just right' but they both had quite different opinions about what they felt when thinking about tree size. B1, for example, mentioned height but then went on to describe how

important the impact of shading was. She also recognised a related factor around the management needs of trees and costs.

"It's height but particularly in streets the density of the leaves I think you don't want a tree that is so solid that you don't see light through it or at last it's a great advantage if you can see light through it although plane trees are marvellous for coping in all sorts of conditions and very good for the environment and so on they can sometimes, they do need very careful cutting and I must say the people round here are brilliant they do do a marvellous job but it's very frequently it must be a costly business to keep them as they need to be."

B2 did not mention specific tree dimensions but articulated how her opinion of visual attractiveness was influenced by tree size. She also mentioned the issue of low branches being in the way and was the only person to have considered children climbing the trees and having accidents. Overall, B2 was focussed on functions of tree size rather than actual dimensions,

"The one that I described as just right is not a small tree but is not one that drapes over the pavement and doesn't drape over the road but it's big enough to have a shape that it's pleasing to the eye. Actually the other thing that, sorry to go back, but if we had a tree that children liked to climb on I wouldn't really like that because I would fell a bit stressed about it I don't think I know of any trees around here that you could actually climb they tend not be that sort of tree but I wouldn't particularly like that kind of tree near a road."

When asked whether context affected her attitude to tree size B2 made an interesting reference to her own tree in the front garden explaining that she might feel differently about it if it was in the street,

"The tree nearest to us is actually in our garden and it's a silver birch and it's huge and it's sort of acceptable to us because it's in our garden but a tree surgeon has told us it's far too big for where it is if it was in the street we would probably think differently about that we'd probably think it's too big..."

Both B1 and B2 agreed that the local authority should have the major management control over street trees. B1 was more in favour of involving local residents because of the need to share a common goal but recognised that expert management was necessary. B2 also recognised the need for expert management and added that it was important to manage the street trees strategically, having a vision for the neighbourhood,

"I think it should be the Council because I would assume that they would employ people who knew about trees and have an overall vision of not just the whole street but the whole neighbourhood and then they could manage the trees overall rather than a resident or a street of residents deciding I mean that could be a nightmare. I think it is right that people manage the tree within their gardens with advice from neighbours perhaps which sometimes happens but I think if it's on the pavement I think it should be managed overall by somebody like the Council with the expertise."

Visual simulation survey response

These two residents unanimously chose the image without street trees as their least favoured scene on all but one occasion by B1 in slide J and the largest tree was only most favoured once, by B2 in slide D. Both of these interviewees had also stated during the interview that their choices reflected their experiences of street trees. B1 explained how her perception of the images were made by combining her visual assessment of the photographs but closely linked to practical issues of living in a neighbourhood with street trees,

"Yes I felt that I was being a viewer but I also thought now what would I be thinking if I lived in the houses at the side and particularly when there are lovely big fluffy trees outside but can cut the light from the windows and bedrooms and so. You know there are different points of view depending whether you are living in it or walking down it necessarily."

B2 was more pragmatic about her approach,

"I have to walk the dog everyday so there are trees that I have to duck under to avoid low branches that are hanging over pavements so I thought about that. I walk him late at night so I thought about the shadows."

B1 and B2 explained how they had specific needs met with the images that contained street trees compared with those without. B1 described three separate factors that were important to her. Such reasoning has also been used elsewhere by other interviewees but what is becoming evident is that whilst residents use the same words they actually have different meaning. A sense of 'proportion' is thus important for B1,

"I think softness of line able to see some sky but not too much and proportion with the buildings in the street."

However, her image choices reflect generally larger trees then are seen below by D1 and slightly smaller than A1 mentioned above.

B2, on the other hand, described how she considered the very practical matter of whether the trees allowed easy walking along the pavement,

"I thought about things like whether you had to duck under branches when walking along the pavement and how big the shadows were that were cast on the ground so I looked at head height next to a trunk and where the leaves started."

However, later on B2 did express concern about whether her image ratings were consistent by mentioning that on some occasions her image choice was based on simply whether she liked the look of it,

"You know when I said that I felt that if I wasn't being consistent, I'm not being because these trees drape over the pavement and yet I just like the way it looks better, but perhaps on a practical level if I was physically walking down the street everyday that would be easier, you know, you wouldn't have to watch branches."

Notwithstanding this concern both of these residents in Street B were consistent that their least favoured scenes contained no street trees.

Slides J, K and L sought residents' opinions on tree shape. B1 consistently rated the spreading tree as her most favourite image. She provided an insight into her perceptions of tree shape which explain her rating in Slide J which was the only occasion that least referred image contained a tree (the pyramid shape) during the post interview discussion. Her reaction suggests that this was a surprise to her,

"I was fascinated to see myself that I reacted against conical, coniferous type shapes in the pictures, visually and maybe they have the connotation of, you know, just the sort of conifer, but I hadn't sort of thought of it like myself like that because, you know. Because also the thing is if it were to be coniferous it is much less changeable and that's so lovely with trees because they are different all through the year, aren't they, they give you a different environment, but if it was conifers you are stuck with them."

B2 was less consistent abut preferred tree shape and this quote explains why,

"The shapes of the trees sometimes I preferred the narrower ones and sometimes I preferred the bushier ones."

Slide M, previously used in the Weston super Mare pilot study, elicited identical responses which mirrored the modal responses of all participants where the spreading tree was favoured and the tree-less street least preferred.

Street C vignette – small trees

Residents C2 and C3 live in the northern part of Street C on opposite sides of the road. C2 is situated on the western side of the street and C3 the eastern side. Plate 19 plots their relative position and the location of each of the street trees near their home and this information is supplemented by the photographs.

Table 34 provides background information about both residents; Table 35 describes the street trees; and Table 36 outlines key information about their perception of their street and the local street trees drawn from the householder survey.

Resident	Gender	Age	Years lived in the street	House status	Salary	Education
C2	Female	43 years	3	Owner	>£45,000	Post-graduate
C3	Female	57 years	20	Owner	>£45,000	Post-graduate

Table 34 - Summary of the demographic data for the participants in the vignette from Street C

These female residents have very similar backgrounds with C3 having lived in the street for much longer than C2 and will therefore be more familiar with the seasonal changes of the tree and the Council's pruning regime.

Key data about the two trees closest to these interviewees' homes are shown in Table 35. These are typical trees found in this section of Street C.

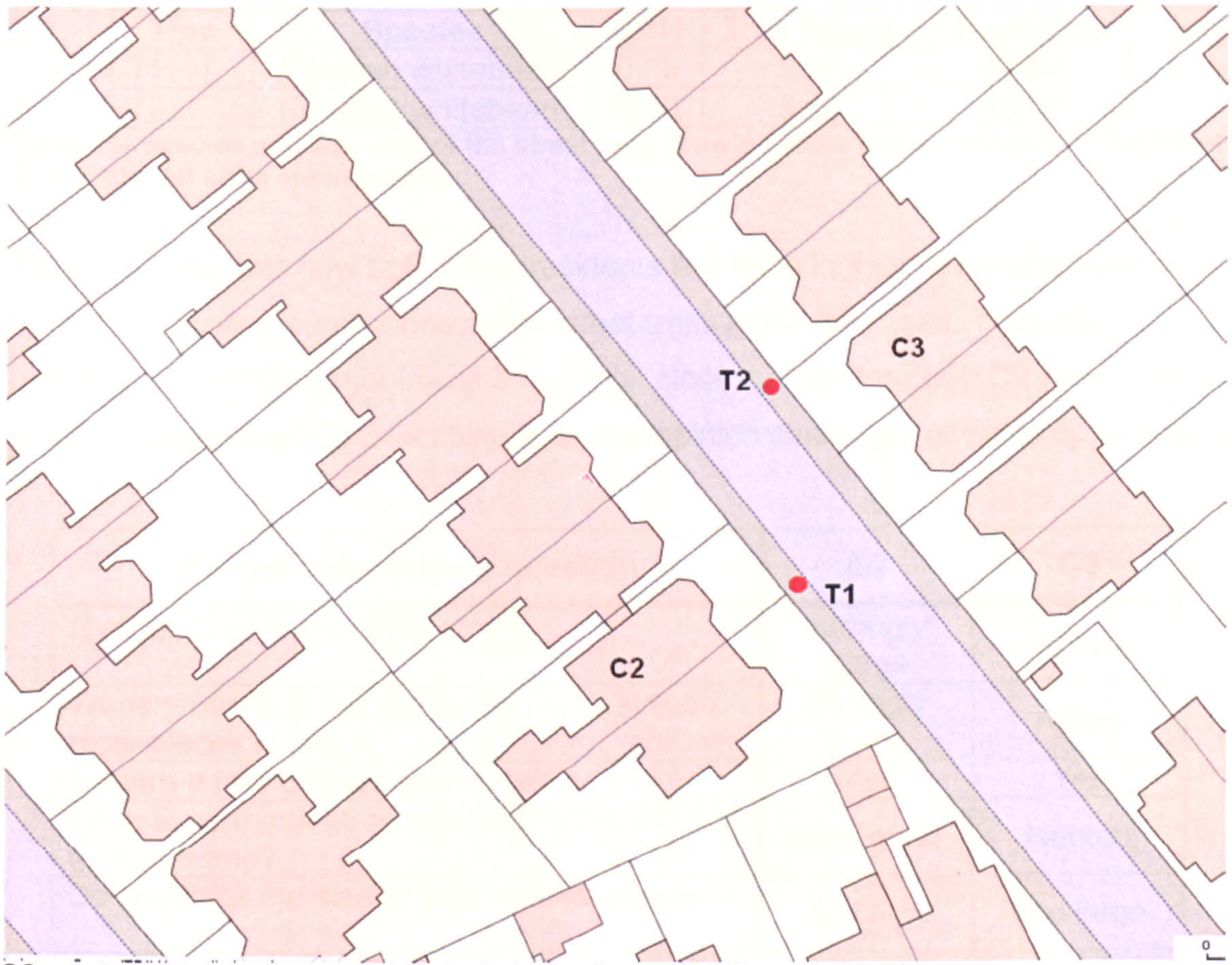


Plate 19 - the relative position and location of each of the street trees in the Street C vignette. This information is supplemented by the photograph illustrating the northern view along the road.

Tree	Species	DBH	Tree height	Crown area
T1	Swedish whitebeam	0.35	9.36	62.53
T2	Swedish whitebeam	0.40	8.49	48.64

Table 35– species and size data of the street trees growing close to the residents in the Street C vignette. All sizes are in metres.

Table 36 describes how both these residents like living in their street and have identically positive perceptions about street trees along their road. They do, however, have different opinions about their closest street tree with C2 have a very positive opinion and C3 describing a neutral opinion seemingly affected by its size.

Householder survey question	C2	C3
Overall, I like living in my street	Strongly agree	Agree
Trees growing in the pavement make streets nicer places to live in	Strongly agree	Agree
Is there a tree outside your house?	Yes	Yes
What is your overall opinion of the tree closest to your home?	Very good	Neutral
Do you think the size of your nearest tree is ...?	Just right	Too large
Which one of the following answers best describes how you feel about the distance between your home and the nearest street tree?	Just right	Just right
The size of the trees in my street are generally	Just right	Just right
Do you feel that the trees in your street generally grow	Good rate	Good rate
Do you feel that the look of the trees in your street is generally	Very attractive	Somewhat attractive
How well do you think the Council maintains the trees in your street?	4	1

Table 36 - Key information about residents' perception in the Street C vignette of their street and the local street trees drawn from the householder survey.

The following analysis will investigate their perceptions of these relationships in more depth focusing on their interviews and visual simulation survey results.

C2 really liked living in her road and street trees contributed to this feeling but they were not as important as other features of the street,

"I think they contribute quite a lot. The thing is this is a really nice wide road that's probably the most important bit to me I don't like narrow streets. So the fact that it's

a nice wide road with beautiful period properties contributes a lot but the trees make a big difference because it does attract birds and we've got rowan trees so we get red green and colour and they just make the place much brighter and I hate it when I go round and see them trimming."

C3 described how street trees contributed significantly to the positive way she felt about living in her street because they helped to prevent the conversion of front gardens into off-street parking, hence protecting vegetation in gardens, which appears to be more important to her than the contribution made by street trees,

"Enormously because of the parking problems here. A lot of people including ourselves, although it was done before we came here have converted their front gardens into parking. Some of them have converted the entire garden into parking so that would leave the street looking very grey if there weren't street trees as well. I mean some people have tried very hard to preserve garden around the outside myself – I planted both the trees in my garden but not everybody feels like that so I think if it weren't for our street trees it would be an increasing problem that the street would become less and less green."

C2 explained how her overall opinion of her closest street tree would change negatively from 'good' for two different reasons. Firstly, if it started causing physical damage to property due to roots or if it was badly pruned,

"Probably if it was causing any damage to my property if it was causing too much damage to the pavement with the roots pushing the pavement up so that it would become a hazard that might make me change my mind. Also if it was cut back so badly at such a wrong time that it failed to look pleasing to the eye."

C3 explained how things had actually changed to make her alter her opinion since she had completed the householder survey,

"I think when I did that they hadn't pruned it. And I feel much more positive about it now. I mean it's a lovely shape it had got a little bit too big it's still a little big and although it's lovely in the spring it has white flowers on it at this time of year it has squashy berries which I cope with I wouldn't say get rid of it because of the squashy berries but my husband doesn't like it he's always moaning that he gets them in his car and things like that. We used to have cherry trees in the road but they all got a fungus and they've all been chopped down so this tree was actually planted just before we came here so it's 20 years old. And I hope it's not going to get too much bigger because they'll end up chopping you know it's a good choice in a lot of ways but it's better since it's been pruned because as I said before it came down you'd bang your head on the branches but they have done a good job so I feel more positive about it now."

C2 had quite clear opinions about factors that influenced her opinion of tree size which generally related to potential tangible annoyances. Too big was not considered as a measurable dimension but rather the impact of tree attributes,

"I don't think they should be too big. If they're too big then obviously there's lots of things, apart from the fact they drop their leaves everywhere mush and as I said the damage to the property. I think getting it right is probably quite difficult from a planning point of view. When I look at that one it's a beautiful shape there are no low lying branches to cause any problems it's a just a little to high for the kids to climb all over it, it does drop sap onto the cars which doesn't bother me personally but I know it bothers some. And you don't want it too high because it will interfere with the telephone lines so yeah. That thing is disgusting right opposite with that horrible fir tree it's inappropriate but that's in someone's garden you know you wouldn't plant that in a street anyway. But I think these are perfect street trees."

C3 described similarly relevant issues focusing on the impact of the tree rather than a measurable dimension,

"I think how much light it's going to take because they are quite close to the houses here not as close as they are in some roads I know but they are quite close despite the fact my front garden's paved I'm quite keen on gardening and it's very difficult to grow certain things in my front garden because of the light it takes. So I think that does need to be said and again plane trees which were planted extensively and I mean I understand why they are just too big I mean they cause a lot of damage this tree actually is beginning to lift the pavement and again I think that is something you have to consider because of the cost and you know people are going to sue the Council if they fall over the paving and that sort of thing."

When asked to consider whether context was important both reaffirmed their opinions immediately above describing how the impact of the tree is important. Thus C2 suggested a careful analysis balancing the tree size with spatial features of the property and street,

"...obviously if you had a 60 foot tree in the middle of a pavement probably be inappropriate cutting out too much light for whoever was behind it yeah I think it is very much about appropriateness. Gauging the size of the property, the type of the property, and the type of tree you plant next to it, definitely."

C3 explained how her property was too small for plenty of trees and that it was inevitable that a birch tree in her garden would need to be felled in the future when it grew too big,

"My garden would be full of trees if I had the choice but it's just not big enough. I've got a silver birch in the back garden which was there when I got here. And it's just about far enough away from the house and just about the right size and I can see in another few years it's going to need to come down which is very sad you really have to think about these things..."

Both C2 and C3 agreed that the person with the tree outside their house should not be responsible for decisions about its management. They recognised the potential for disgruntled residents to cause tree removal so appreciate the fact it is in 'independent' hands.

C2 explains her view as thus,

"You would get lots of arguments and rows and disagreements and differences of opinions if the person with the tree made the decisions. No I would probably disagree with that I would probably say that it is some other body that deals with this rather than the residents of the houses. The fact of the matter is you buy a house it's got a tree outside then don't buy it if you don't like it. So I would definitely say a separate group."

C3 also recognised the potential for conflict,

"I don't think it should be the person with the tree outside their house. I think you know if you're going to have street trees someone's got to have it and I don't think there's any doubt there will be some people who say I'm not having it outside my house because that's the way things work. I mean it would be nice to say it should be the residents but again I'm not sure everyone would agree I think there are lots of people who would say they don't want that tree there because it makes a mess. I'm prepared to put up with the mess for the pleasure of having the tree so no it probably should be the Council but it needs to be someone who really needs to know what they are doing not highways and I suspect someone who knows what they are doing has taken over in the City recently I don't know if that is true but certainly it's made a difference here that they have been round and replaced some of the trees and looked after the one's there are better."

Visual simulation survey response

Interviewees C2 and C3 viewed the slides from different perspectives. C2 explained that she had considered them in a "*purely visual*" context and mentioned later during the post-interview discussion that,

"I mean those pictures; I didn't look at any of the practical aspects I just looked at the pictures for what they were really."

C3 was quite clear that her viewing perspective of the slides was based on her experiences,

"Yes, definitely because we are lucky enough to have them. And you know that does make a big difference."

Despite these different perspectives they both unanimously chose the image without street trees as their least favoured scene in all the slides. C2 concisely explained her reasoning behind this ranking,

"The bareness of them all. The lack of trees, the lack of greenery.

C3 used similar language explaining the tree-less streets were bleak.

Slides A - I

C2 and C3 did have different opinions about their favourite images. C3 did not prefer the larger tree in any of the images compared to C2 who rated the largest tree highest on five occasions. C3 tended to favour the medium sized tree.

C2 based her decisions solely on the amount of green whereas C3 rated the trees by considering the impact the trees would have on nearby property,

"Right it's obviously the ones with trees. But also getting a balance between the size and shape. If there's too much foliage although it looks very nice it's not actually practical because it cuts light out of the houses. I mean that's been the trouble with the tree I've got outside my house which has actually been pruned very well this year but it hadn't been done for about 5 years and the lower branches were much lower and it shaded that part of my garden and cut quite a lot out of the house because I've got two trees in my front garden anyway and it did make it very dark but they've been and pruned it this year and it's much much better so the canopy's that much higher."

Slides J, K and L

C3 did not provide any details about tree shape but she favoured the spreading tree on two occasions and the pyramid shape C2, on the other hand, stated explicitly that she preferred a particular shape,

"But that's also influenced because I like trees that shape rather I like trees that are rounded rather than triangular I don't like conifers. So, that's what made me put a certain rank."

Slide M

Both of these interviewees rated the spreading tree highest and the tree-less street least in accordance with the majority of people that viewed these slides that did not live in the street.

Street D vignette – split street

Residents D1 and D2 live on opposite sides of the road approximately in its centre. Plate 20 plots their relative position and the location of each of the street trees near their home and this information is supplemented by the photographs.

Table 37 provides background information about both residents; Table 38 describes the street trees; and Table 39 outlines key information about their perception of their street and the local street trees drawn from the householder survey.

Resident	Gender	Age	Years lived in the street	House status	Salary	Education
D1	Male	50 years	2	Owner	>£45,000	Graduate
D2	Female	48 years	8	Owner	> £45,000	Post-graduate

Table 37 - Summary of the demographic data for the participants in the vignette from Street D

Both residents have similar backgrounds although D2 has lived in the street for much longer and therefore has more understanding of seasonal factors than D1.

Residents D1 and D2 in Street D. This image shows the difference in proximity between these two residents with this street tree. This London plane tree is 11.76 m tall with a crown area of 51.04 m². A feature of this tree is the growth from the trunk (epicormic growth) which limits access along the pavement and an interviewee in Street D raised this as a particular concern. The crown of the tree is also relatively small for a tree of this size revealing the extent of the regular pruning it experiences. Its size can be compared with the London plane tree in Plate 13 which is similar in height but has almost three times the crown area.

Plate 20 – the relative position and location of each of the street trees in the Street D vignette. This information is supplemented by the photograph illustrating the northern view along the road.

Key data about the two trees in this part of the street are shown in Table 38. These are all tall specimens with the London plane trees being the largest.

Tree	Species	DBH	Tree height	Crown area
T1	London plane	0.70	12.28	75.22
T2	London plane	0.80	11.76	51.04

Table 38– species and size data of the street trees growing close to the residents in the Street D vignette. All sizes are in metres.

Table 39 describes how these two residents like living in their street. D2 believes more strongly than D1 that street trees make roads nicer places to live in but they both have opposing opinions about the street trees near their home.

Householder survey question	D1	D2
Overall, I like living in my street	Strongly agree	Strongly Agree
Trees growing in the pavement make streets nicer places to live in	Agree	Strongly Agree
Is there a tree outside your house?	Yes	Yes
What is your overall opinion of the tree closest to your home?	Poor	Very good
Do you think the size of your nearest tree is ...?	Too large	Just right
Which one of the following answers best describes how you feel about the distance between your home and the nearest street tree?	Too near	Just right
The size of the trees in my street are generally	Too large	Just right
Do you feel that the trees in your street generally grow	Too fast	Good rate
Do you feel that the look of the trees in your street is generally	Somewhat attractive	Very attractive
How well do you think the Council maintains the trees in your street?	1	5

Table 39 - Key information about residents' perception in the Street D vignette of their street and the local street trees drawn from the householder survey.

Spatial issues appear to affect their perception with D1 stating that it was 'too large' and 'too near' his home but with D2 claiming its size and distance from her home was 'just right'.

Their answers to the survey's open ended questions reveal further reasoning. In both cases these residents agreed that street trees enhanced the street scene with D1 stating that,

"A pleasant leafy road in the suburbs can be uplifting in the urban environment. It helps to break-up the monotony of buildings and roads and generally improves the ambience of the area."

Resident D2 was much more talkative in her explanation,

"I can't have enough of 'em! (trees that is). I work from home and sit here in my office looking out onto the street. Directly across the road is a large plane tree - the antics of the magpies and rooks that battle to nest in it makes great entertainment. I consider that a street without trees is devoid of character. In our last house (just up the road) we had the most beautiful flowering cherry trees on both sides of the road. They were an absolute picture in spring - and definitely something that we looked forward to.

I accept that there are some down-sides to street trees - in particular the sap and bird mess that falls onto parked cars and the way that the tree roots push up and destroy the roads and pavements but I think that these problems are minor when compared to the life of a tree over many years and is perhaps more to do with planning their planting better in the first place.

Street trees! Bring 'em on!"

When discussing the tree closest to them it becomes clear why Resident D1, whose house the tree is outside, rates his opinion of the tree as 'poor',

"The tree is very tall and overpowers the house. Its girth makes it difficult for pedestrians to use the pavement and the roots have severely distorted the pavement making the surface uneven and poor drainage causing large puddles during rain. Also the roots have undermined the gate pillars causing them to lean and to begin to crack. There is some concern that this may have an effect on the house. The Council are aware of these concerns but fail to address them."

Resident D2, on the other side of the road, explains why her opinion is more positive,

"We are lucky to have a large and beautiful tree close enough to our house to appreciate, but not so close that its roots affect our property or that it casts too much

shade. The autumn leaf-drop is a bit of a pain but it is so temporary and of course it is just a part of nature's natural cycle. And of course there is much pleasure to be had scrunching and kicking your way through a pile of leaves on the pavement. The tree closest to us also acts as a useful pin board that loads of people use to advertise their lost cat or a jumble sale etc etc."

More information came to light during the interviews. During the visual simulation survey Resident D1 recognised that street trees made the roads look better but was particularly interested in the issue of how this could be achieved stating how '... *the proportion of the trees'* was crucial. D1 had already confirmed in the postal survey that his closest tree was too large and this interview statement provided further evidence of his views. Moreover, he was quite open that his opinions of the visual simulation survey images were influenced by his experiences of this tree.

Resident D2 reaffirmed her preference for large trees in her image choices in the visual simulation but also that size does have limits,

"I prefer to see a mature tree – it's nice that there's one there but I prefer it mature but I think there comes a point if they start to meet over the top I don't like it. They got too much."

When the focus was on the factors that would make interviewees change their mind about the tree Resident D1 again mentioned the issue of proportion before confirming that he would like the tree removed and replaced with something smaller that would also be actively managed.

Resident D2's positive opinion would lessen if she faced some nuisance but that would still not force her to want it removed,

"It would change my mind I suppose if I had to park directly under it which I don't and if there are often birds nesting and if you get your car constantly covered in bird poo I think I would start getting fed up with it but I still wouldn't want it to go. I would just get fed up with it. I would also get fed up with it if it was a lime tree because of the sweet sticky stuff that comes off it."

When questioned more closely about their perceptions of tree size both D1 and D2 were influenced by both the physical attributes such as height and trunk diameter but also as importantly by the functions of tree size such as blocking the sun or causing root damage.

Resident D1 said,

"Well I think of the girths of the trunk and the spread of the branches so that you can pass by quite easily and you're not going to get hit by branches etc the root spread so it doesn't make uneven surfaces or interfere with any buildings close by that's the sort of things I guess."

Resident D2 said,

"I suppose height and whether it's blocking the sun from your house or wherever you want it. Where the roots are going because obviously they do start to the closer it is to your house you perhaps worry about foundations and the way they disrupts the pavement making it difficult to push prams and that kind of thing. I would think of all those things but I'm still overpowered by the need to have something beautiful to look at."

In the case of this particular London plane tree it is possible that these residents would swap opinions of it if they were to exchange houses.

Visual simulation survey responses

Both D1 and D2 provided consistent choices when ranking the images in the visual simulation survey. Their choices were quite different but they did reflect their previously discussed issues relating to these trees.

D1, who had a poor opinion of his nearest street tree, yet had described important benefits provided by street trees, favoured the smallest tree size in all the slides A – I. He explained these image choices which reflected his viewpoint that smaller trees were better,

"I suppose the proportion of the trees to the area because I think the road looks better with them than without them. It was the proportion of the trees."

D1 reiterated his sense of proportion influenced his least favoured image choice,

"I guess it was the contrast between not having trees and having trees and where we haven't got trees it looks a bit stark and it did look better with the trees and I guess it again comes down to proportion so that the ones that either didn't have trees or with trees that just didn't look right."

D2's perspective was very positive towards street trees and she consistently rated the image with no trees as her least favourite. Her favoured images were divided between the medium and large sized specimens and her explanation provides an eloquent explanation for this,

"Yes I like tree lined roads and I like the trees to be leafy so I would want them to be deciduous, big, broad, wide rather than fir trees whatever that were sticky up and pokey and I suppose I prefer to see a mature tree – it's nice that there's one there but I prefer it mature but I think there comes a point if they start to meet over the top I don't like it. They got too much."

Although she has stated that she likes large trees this explanation describes that she has a limit once tree canopies start to meet over the road. This is evident in most of her most preferred selections although it is difficult to link her explanation to her response to Slide D. However, this suggests that residents have perceptions that are affected by seemingly subtle differences in image composition suggesting a complexity in decision making that has yet to be explored in-depth in the Arboricultural literature.

Both D1 and D2 described simply and succinctly that they drew on their own experiences of living with street trees when making their selections in the visual simulation survey.

Slides J, K and L – shape preference

D1 does not appear to be influenced by tree shape but rather the impact of the tree in each scene which explains his seemingly inconsistent choices. For example, he chose three different street tree scenarios as his most favoured image. He did rate the pyramid tree least favourite on two occasions but this could be as much about proportion as shape.

D2 on the other hand was emphatic in her favourite tree shape choosing the spreading shape on all three occasions. Her pleasure in street trees was re-affirmed when she selected no street tree present as her least favoured scene in all three images.

Slide M

Similarly to other residents dissatisfied with their nearest street tree D1 did not support the dominant trend of favouring the spreading tree by ranking the columnar tree as his most preferred and he rated the pollard tree last ahead of the no tree present image. D2 followed the trend with this slide rating the spreading tree highest and the no tree present lowest.

Discussion

Addressing the challenges

The literature review highlighted three early challenges to the research which have proven to be tightly woven together namely:

- Is it valid to generalise the results of surveys to other communities?
- Lack of knowledge about UK residents' perceptions of street trees is acute and limits understanding of this relationship
- The reliance on quantitative methods means that there is a limited understanding of the deeper values that residents have towards street trees

Evidence, particularly in the area of residents' own description of positive and negative themes compared to those from a generic list based on North American research, supports the concerns expressed throughout the literature that residents in different communities do have different perceptions of street trees and that extrapolating results beyond the research area is inappropriate.

Such evidence supports the conclusions drawn by Schroeder *et al* (2006) who identified important differences in street tree perception between UK and USA residents and Plate 1 demonstrates the variability of the physical, spatial and architectural layout of street scenes. Further research would be useful to understand the extent to which the perceptions of the residents in this case study extends into other neighbourhoods in the UK.

Although differences exist in the detail of street tree perception general trends appear to be present, not least the generally positive opinion in which street trees are held and the high importance of visual aesthetics.

Residents in Streets A – D generally described a very positive opinion of the street trees in their neighbourhood supporting the recent findings of Flannigan (2005) and Booth (2005, 2006) that UK residents in tree-lined streets are more likely to perceive nearby trees positively than negatively.

The final area of concern related to the quantitative focus of previous research in this field and the subsequent shortage of in-depth understanding of residents' relationships with street trees. The methodology used in this research was not purely qualitative because of the need to build an understanding of the most basic of information so established data collection techniques were followed (e.g. Schroeder & Ruffolo, 1996). However, the inclusion of open ended questions in the householder survey alongside the interviews allowed for more insight into residents' deeper values and attitudes. Of particular importance was the much finer level of detail that this approach has introduced helping to increase understanding of residents' deeper values towards street trees.

Although additional research is needed to reveal more information behind each of these three challenges it is anticipated that the results from this study will assist future efforts having established some key concepts both in terms of understanding how UK residents perceive street trees but also ways in which to extract that information.

Residents' perceptions of street trees in context with the three identified relationships

Results have demonstrated a significant variability in the way that residents perceive street trees borne, it would seem, from the unique perspective of the individual. Such uniqueness is further amplified because each person interacts with trees in a myriad of different ways whether it is as a landmark (e.g. Lynch, 1960); as an image in a visual simulation survey (Kalmbach & Kielbaso, 1979); as a neighbourhood tree (Schroeder & Ruffolo, 1996); or as a fixture growing outside their home (Sommer *et al,* 1989).

Despite this variability and the consistent request from researchers not to generalise findings beyond their point of origin (due to inevitable differences in cultural, climatic and geographical factors) there appears to be an underlying trend that street trees enhance where they are growing because intangible benefits outweigh tangible annoyances (Schroeder *et al,* 2006).

A comprehensive generalisation of detailed perceptions would therefore continue to be inappropriate yet recognition of similarities between residents, such as the high regard in which street trees are held; alongside their aesthetic contribution to the street scene, would now, with the growing list of research, seem to be apt. Such a position would reflect suggestions that street trees are a key feature of urban nature (Kaplan, 1983) where research has illustrated that people generally perceive the natural landscape positively (e.g. Kaplan & Kaplan, 1989).

Research supports this growing data. Table 40 summarises the data, using modal responses from closed questions in the householder survey, residents' responses about trees in their street and their closest street tree and identifies a positive perception of street trees close to people's homes and along their street.

Survey question	Modal response
Neighbourhood street trees	
Do you feel that the look of the trees in your street is generally…?	Very attractive
The size of the trees in my street are generally…?	Just right
Do you feel that the trees in your street generally grow?	Good rate
Trees growing in the pavement make streets nicer places to live in?	Strongly agree
Closest street tree	
What is your overall opinion of the tree closest to your home?	Good
If there is a tree directly outside your house do you think its size is …?	Just right
If there is no tree outside you house is the size of the tree nearest to your house …?	Just right
Which one of the following answers best describes how you feel about the distance between your home and the nearest street tree?	Just right

Table 40 – modal perceptions, from the householder survey, outlining key opinions about street trees in general and the closest street tree

However, this data conceals the important point that 'compatibility' between residents and street trees becomes much more fragile as their proximity increases. This is most explicitly explained when comparing the frequency of positive and negative themes (drawn from the data in Tables 14, 15 and 17) made between street trees in general and the tree closest to respondents' home in the householder survey illustrated in Figure 18.

Wider understanding of the in-depth issues behind this reduction in tolerance would be helpful for Local Authorities, who have to manage both the trees and residents' expectations, rather than relying, as the literature suggests they currently do, on the inaccurate perception epitomised by the negative phrase *'I love trees but...'*. Rather street trees appear to positively influence many residents' lifestyles and in some cases at a profound level where one resident, for example, explained how their presence had been a deciding factor in their decision to live there.

It therefore seems more appropriate to suggest that there is, generally, widespread support for street trees but punctuated with local accents wholly dependent on the spatial, cultural, climatic and geographical factors of the area under assessment.

Local research is a key component of this approach, necessary to determine the extent and weight of the potentially large number of tree attributes in separate neighbourhoods; and combined with the use of qualitative methodologies in order to reveal in-depth values held by residents. Such localness is demonstrated below where quotes from the residents in Streets A – D are used to illustrate their interaction with the street trees and to summarise the key findings of this research.

The key feature of the research was investigating whether residents had different perceptions of street trees depending on their relationship at that time. Three such relationships had been identified:

- The relationship a resident may have when regarding the overall street scene.

- The relationship a resident may have when in their house or carrying out house related activities.
- The relationship a resident may have with street trees in a visual simulation situation.

The results have shown how the language used by residents to describe their experiences of trees in all three different relationships illustrates a high degree of understanding of what it is like to live with street trees and what benefits and annoyances this brings to people.

A good example of the localness of perception is described by this resident's strong approval for street trees relating specifically to their presence reducing possibilities for front garden conversions into off-road car parking spaces. Such reasoning indicates a preference for a vegetated landscape with street trees complementing that objective, but also with them having a very specific role to play.

"A lot of people including ourselves, although it was done before we came here have converted their front gardens into parking. Some of them have converted the entire garden into parking so that would leave the street looking very grey if there weren't street trees as well. I mean some people have tried very hard to preserve garden around the outside myself – I planted both the trees in my garden but not everybody feels like that so I think if it weren't for our street trees it would be an increasing problem that the street would become less and less green."

Such an opinion reveals the place that street trees have within the milieu of this individual's ideal landscape emphasising the issue of 'compatibility' and the diversity of factors that influence it. Crucially, this statement demonstrates how residents are able to express their perception of street trees by balancing their good and bad attributes in the different settings examined throughout this research including their closest street tree; living in a tree lined street; and viewing images containing street trees (which is described in more detail later). Each of these scenarios affords different demands on each individual and these have been reflected in the ways in which the residents have described their relationships.

Demonstration of this has only been made possible by firstly isolating the different relationships and then giving the same residents the opportunity to explain their

reactions to these separate scenarios. Such an integrated and qualitative approach enables existing knowledge to be extended thereby providing a greater understanding of residents' relationships with street trees.

Deeper understanding of the factors that cause people to respond to street trees has revealed tree attributes whose significance has barely been recognised. For example, the extent that street trees affected people's senses was described by residents in the householder survey who were attracted to street trees because of their colour, smell and sound; factors that are rarely described in the literature (e.g. Kaufman & Lohr, 2004) and is an important area for future research.

Street trees were also strongly associated with 'natural' factors covering a diverse range of matters including rural life, harmony with nature and a connection with the changing seasons. Street trees reminded people of living in rural areas as well as acting as an urban surrogate for the countryside. Many of these residents particularly associated street trees with birdlife able to name birds and describe their life cycle. Respondents identified a simple relationship describing in various ways how street trees were a 'connection' to nature by physically bringing it 'closer'.

As one resident put it,

"City streets need trees to bring a feeling of nature into the city."

Participants did not provide a fully articulated explanation of 'nature' but some key features were closely associated with it. 'Wildlife', for example was seen as important particularly in relation to birds. For example, one respondent described how street trees,

"...attract birds and I find bird singing to be relaxing."

Another recognised in their interview how street trees provided a valuable habitat for birds,

"In some sense we need our greenery we really need our greenery and we are very aware that there's not a huge amount of bird life around and we need our birdlife we have lost a lot, it's not there."

Street trees therefore had important roles to play themselves, particularly as attractive features in their own right, but also because they contribute to other essential aspects of urban living. But even this issue demonstrated that people have to balance positive and negative elements of each of these attributes as this resident revealed during her interview,

"And also we get a lot of bird poo on our cars because if you have trees you have birds but actually we would rather have the birds than not have the birds."

Birds, as an associated feature of street trees, have not been described in the street tree literature and yet for residents in Streets A – D it was a relatively important feature of living near street trees.

Another related, intangible issue relates to residents' meeting a need to connect with the countryside. For example, this Street A resident described during her interview how street trees were an important positive factor about living in the street because she likes greenery and grew up in a rural area;

"...as I grew up in a rural area so it's quite nice to have trees and stuff like that around."

A resident in Street D described similar emotions in the householder survey,

"They are a constant reminder of my happy youth growing up in semi-rural village in Gloucester."

Such reasoning offers an indication of ways in which residents form their opinions of street trees and it is described by several respondents, who link street trees to rural life, as these quotes from the householder survey reveal,

"Trees reduce the feeling of living in an urban inner city area as they are associated with rural areas."

"Makes the street feel more rural."

"Gives impression of countryside."

"It brings a bit of countryside into the city."

It is not known whether these residents had been rural dwellers, and this link between perception and background has not been explored in any depth in the street tree literature, but these statements appear to reflect positive cultural associations of countryside living and the importance of trees in that context.

Strong associations with the changing seasons were also reported indicating how street trees provided a link to natural cycles that would otherwise be difficult to achieve in the city and which appear to be very important for these urban residents' quality of life. Further investigation of the importance of street trees as a component towards meeting these needs would appear to be worthwhile especially with commentators suggesting that people are *'losing direct contact with the land'* (e.g. Simson, 2008). Examples of residents' descriptions of these issues are used below to illustrate these points.

This particular resident described a sophisticated level of understanding about the environmental issues addressed by street trees alongside important and intangible personal factors,

"Trees reduce the feeling of living in an urban inner city area as they are associated with rural areas. Trees provide a splash of colour amongst the generally drab colours of buildings. Trees encourage wildlife especially birds which creates a more natural environment. Large mature trees lining the road give a feeling of old fashioned elegance. Trees help to prevent urban heat island effect. Trees help to prevent flooding by intercepting rainfall."

The following passage from a near neighbour to the resident quoted immediately above demonstrates both the variability and similarities between residents. This respondent also describes very personal factors about the benefits of street trees alongside wider environmental impacts and yet there is a difference. For example,

this resident describes far deeper and more personal associations with the presence of the street tree such as feeling 'protected and shielded',

"Gives privacy, are nice to look at, bring birds to the city. Gives a sense of seasons to the city - you can see the changing leaves - green in summer, autumnal reds, oranges and yellows, fall in winter, budding in spring - adds life and variety to the street. Also, helps combat climate change by soaking up CO2 from cars. Make you feel protected and shielded. Gives individuality to houses. Makes you feel positive, happy, calm. Green a very calming colour. Dappled tree trunks. Screen you from neighbours - v important in crowded city. Let you watch the birds outside - pigeons roosting on the branches. Very good for birds, insects - local habitat."

These quotes emphasise how street trees appear to have less impact on aspects relating to contemporary matters such as climate change mitigation and adaptation or pollution absorption with residents having greater understanding and interest in intangible issues, such as their aesthetics as this final example illustrates,

"Look nicer than a 'bare' street with no trees - it is the colours during every season, smell of the pollen in summer and rustle of the leaves when the wind blows. Trees are a sign of the seasons which is nice to see."

Residents in Streets A - D also held very positive opinions about their neighbourhood with the most important contributing factor being the lack of traffic. Residents were therefore in the position, described by Appleyard & Lintell (1982), of having greater environmental awareness than residents living in busier streets. Evidence of this greater interaction within their street is provided by several residents, including this respondent in Street B,

"I love living in my street! It's fairly quiet, it's pretty and peaceful. I like the fact there are lots of families living in the street. It's very close to a variety of shops, pubs and restaurants. It's an easy walk into city centre. I like that it's tree lined and the tree outside my house is lovely and is a deep red all year round. We have a yearly street party."

It may be that this factor of 'liveability' is an important component contributing to street tree satisfaction. Residents in busier roads may have lower overall opinions of street trees. However, it is necessary to point out that the residents in Hitchmough & Bonugli's (1997) survey were also very satisfied about living in their street and yet

did not want street trees. Further analysis of this aspect of the relationship between residents and street trees would be an important extension of this research.

This generally positive acceptance of street trees as part of daily urban life also seems to offer relief for bodies seeking to enhance urban life by improving the landscape through the introduction of vegetation. It would seem that residents already understand the benefits of street trees but they have not yet had opportunities to share these opinions with contemporary policy makers, who themselves appear to be concentrating on an agenda to educate the public about the environmental benefits of street trees (e.g. Trees and Design Action Group, 2010; Britt & Johnston, 2008). Wider research would redress this shortfall in information sharing between residents and policy makers.

In addition, policy makers may consider additional research when considering the purpose and method of statutory protection of trees. The current emphasis on 'visual amenity' (Town and Country Planning Act, 1990) would be too narrow for these respondents suggesting that a review of guidance would be worthwhile.

Exceptions to the positive perception of street trees exist. Hitchmough & Bonugli (1997) found that most respondents in their study of Scottish residents' attitudes to street trees did not see such trees as important in improving the quality of their street. These residents lived in tree-less streets and it is useful to compare their responses with residents in Street D who themselves considered that they lived in a tree-less street and furthermore had no desire for street trees to be added. The only participant to disagree that trees growing in the pavement make streets nicer places to live in was a Street D resident. These two separate studies appear to be the only such examples in the literature that considered tree-less streets and although limited in extent describe an important area for future research.

This matter opens two important, yet barely discussed issues in the street tree literature. Firstly the evidence suggests that factors for not wanting street trees may be as equally dependent on local issues as for those that want street trees. For example, Hitchmough & Bonugli's (1997) residents rated features such as no litter, improved street lighting and smooth surfaces as most important in making streets

more liveable yet the residents in Street D rated street trees as important components of a liveable street.

There was also mixed agreement about reasons for not planting street trees. A majority of Street D residents described how existing trees and vegetation in their own front garden made additional street trees unnecessary. Unlike Street D residents the Scottish respondents were particularly worried that new trees would be a waste of money because they would be vandalised. A proportion within both different groups shared the opinion that street trees would cause damage to their property and that their pavements were too narrow to add street trees.

Additionally, people might choose to avoid living in tree-lined streets, a view seemingly only ever suggested by Schroeder *et al* (2006). Interviewing residents in tree-lined streets suggests an inevitable high satisfaction rate whilst residents who do not live in such streets would have different perceptions, perhaps preferring them to remain tree-less. Unfortunately none of the interviewees in my research had claimed to live in a tree-less street so it was not possible to investigate this issue any deeper.

However, experience indicates that not all residents in tree-less streets want them to remain that way. The visual simulation method has enabled the development of a practical off-shoot where residents living in tree-less streets, within the author's Local Authority, were approached with photographs (similar to those used in the pilot study and the visual simulation survey) to investigate whether they would consider the planting of new trees. Where this was trialled the majority of residents supported tree planting. The development of this technique to support tree planting initiatives would therefore seem to be a worthwhile area for future research.

One of the clearer things to emerge from the results is the seemingly delicate balance that exists between the benefits and annoyances of street trees. Manifestation of this is straightforward to report through describing residents' overall opinion of street trees and the results have shown a generally positive perception. However, such basic analysis fails to explain the enormous subtleties that exist

within this decision making process with each individual seemingly portraying a unique tolerance to the various factors.

Analysis of responses to annoyance and benefit lists offer the promise of deeper understanding of this factor (e.g. Sommer *et al,* 1993a; Gorman, 2004) but the evidence gathered in the research in this thesis suggests that whilst residents are able to complete these lists they are not necessarily a reflection of what they find important (e.g. see Tables 18 and 19); which tends to be far more about local influences and is more sophisticated than can be incorporated into a generic list as the descriptions of residents below testifies.

This example from a female resident in Street B exemplifies this point as she explained, during the interview, how her opinion about the tree outside her house had changed from 'neutral' in the householder survey to 'good' more recently,

I mean that's been the trouble with the tree I've got outside my house which has actually been pruned very well this year but it hadn't been done for about 5 years and the lower branches were much lower and it shaded that part of my garden and cut quite a lot out of the house because I've got two trees in my front garden anyway and it did make it very dark but they've been and pruned it this year and it's much, much better so the canopy's that much higher. But that's also influenced because I like trees that shape rather I like trees that are rounded rather than triangular I don't like conifers. So, that's what made me put a certain rank.

Such a response highlights how relatively simple measures such as pruning low branches can be taken to enhance residents' opinions of street trees whilst demonstrating a limitation of the quantitative method which would not have revealed this residents' true perception of this tree. Furthermore, this response identifies the tangible annoyances which directly impact people's quality of life and how some residents who may currently have a positive opinion of nearby street trees could alter if circumstances changed.

In another interview a resident spoke about the tree in her front garden explaining how their ownership of it gave them a more relaxed perspective over its annoying attributes,

"Our tree at the front, we really love it, but the birds love it and it drops a slightly sticky stuff, all the time, but for some reason because it is our tree we just sort of think oh well we love the tree, and it is just part of living with the tree. And I think if that tree was the other side of our front wall we would probably moan about it more because it wouldn't be our tree any more."

Other seemingly mundane aspects of city life such as the car parking location can also influence how people feel about street trees although in this case, described during the interview, it would not be enough to wish the tree removed,

"It would change my mind I suppose if I had to park directly under it which I don't and if there are often birds nesting and if you get your car constantly covered in bird poo I think I would start getting fed up with it but I still wouldn't want it to go. I would just get fed up with it. I would also get fed up with it if it was a lime tree because of the sweet sticky stuff that comes off it."

The desire to retain street trees, despite their potential to negatively affect people's quality of life, was described by several residents because the intangible benefits they received outweighed the tangible annoyances. The following quote from the interview emphasises this point,

"I suppose height and whether it's blocking the sun from your house or wherever you want it. Where the roots are going because obviously they do start to the closer it is to your house you perhaps worry about foundations and the way they disrupts the pavement making it difficult to push prams and that kind of thing. I would think of all those things but I'm still overpowered by the need to have something beautiful to look at."

A resident in Street D who lived on the other side of the road to the two London planes was very clear that her very high opinion of these street trees would probably be different if the trees were outside her house.

Residents' spatial relationship with street trees

One of the key areas investigated by this research has been the influence of the spatial factors of street trees including the existence of trees in the street, the proximity of the tree to the home and specifically the consideration of the size of residents' closest tree and the trees in their road. Perceptions describe a complex topic despite the consistent opinions described in Table 40 for example.

For example, there was no universal agreement about what constituted a tree-lined road or when a tree was outside a person's property. Residents in Street D, which only contained two trees, did not unanimously agree whether their street contained trees, with there being an almost equal division between those that thought they lived in a tree-lined street and those that did not.

An observer might reasonably consider that there would be clustering of opinions depending on people's proximity to the two street trees but this did not happen (see Map 5). There is thus no obvious explanation for this outcome but it might be explained by residents having different perceptions of their neighbourhood either only considering what is immediately close by or having a broader view of what constitutes their street, by perhaps having a wider perspective of their neighbourhood. Either way this is a factor that needs to be considered in future research.

The householder survey also asked participants to state whether they had a tree outside their house and the results do not reflect the views that an independent observer might reasonably make. There were quite a few residents who claimed trees outside their home even when a physical inspection showed otherwise. Again, there is no obvious explanation other than that described above which was used to explain why some residents thought they lived in a tree lined road. Additionally, some residents described the tree that caused them most nuisances rather than the closest specimen.

What appears to be a significant issue of residents' perceptions of tree size, that has not yet been described in the literature, is that people do not only consider tree size as a dimension, such as trunk diameter, but also as a function. So rather than there being physically identifiable tree size bands, such as 'medium' or 'large', size is dependent on what effect the tree is having on the individual. Residents who enjoy living near to a street tree are therefore more likely to consider its size as 'just right' whereas homeowners with a more negative perception are more likely to think the tree is 'too large', irrespective of actual size.

There follows examples from two residents in Street A with differing opinions about their closest street tree to illustrate this point.

The resident with an overall opinion of 'poor' described how the only way to improve this perception was to make the tree smaller. Despite the practical concerns about the damage the roots from this large tree might do to her property there was also an issue about the matter of context,

"I like big trees. Trees should be in the country. People who want trees should live in the country."

Such a response reveals important issues. Methodologically it demonstrates an opinion that could not be discerned from a quantitative approach particularly because this atypical opinion of disapproving of nature in the city could not be articulated. Such a discovery provides further evidence about the richness and diversity of people's opinions of street trees. Moreover, this resident described that the street trees in her road were 'very attractive' but this component of her overall perception did not override this particular viewpoint.

Furthermore, these strong opinions also manifested themselves in the visual simulation survey where she revealed strong views about her least preferred images, which tended to be the scenes with the largest trees explained by this comment,

"Space. And thoughts of the damage the trees would cause when they got bigger."

Another important element was her conviction that people who lived alongside street trees would endorse these negative views whilst those who did not would not understand,

"Those that haven't got trees will disapprove those that have got trees would approve."

In contrast, her neighbour immediately across the road rated his (similarly sized) nearest tree as 'very good' and that it was also a significant component of his

positive opinion of living in his street. This resident also emphasised how important its size was in making that opinion which was clearly expressed during the visual simulation where he stated,

"I just want mature foliage on the streets."

He explained his image choices as such,

"Well in general I am always going to choose the more mature the better basically. I'm guessing these are always going to come in the same way so it's become a sort of test now whether I can work out which are the more mature trees."

When describing why he might change his opinion of this tree (which was rated as 'very good' in the householder survey) he mentioned how he would disapprove if it was made smaller,

"If the scale of it was reduced. It's at an appropriate scale it works really well. If it was cut, pruned too regularly."

Despite these very positive assertions this resident was also aware of the negative impacts of living near large trees. He did not appreciate related, tangible annoyances such as bird mess and honeydew and recognised that tree size preference could be related to the scale of the particular landscape,

"Clearly in parks there's space for more variety and so on so obviously yes where you are does make a difference. There will be some streets that are too narrow to accommodate a decent size trees in which case you would have what you could fit. There is a sort of town planning aspect of that which is that if the street was a little bit wider they could accommodate bigger trees and that would be a better piece of urban layout."

These close neighbours therefore share the same landscape but have very different opinions about the role that street trees play reflecting the complex needs of the individual. Both strongly like living in their street but for one this is despite the trees whilst for the other they are a key component.

The concept of large trees being more appropriate in the countryside was also proposed by a resident in Street D who preferred images containing trees except if they completely blocked the horizon which she thought was too much in a town but would be satisfactory in the country;

"I like the ones with more trees but not necessarily the ones with most trees. When the horizon's completely blocked I don't like that very much in a town it might have been more acceptable in the countryside if you were driving through sometimes you know you get a whole arching across the road but sometimes in those the horizons completely blocked out and I thought that's a bit too much for a town."

Such a functional perspective suggests that existing tools (e.g. Helliwell, 2004) and approach (e.g. Trees and Design Action Group, 2010) used by tree work professionals to quantify tree size is out of step with the public who have a far more complex perception of it than merely the measurement of dimensions; dependent it would seem on each individual's tolerance of annoying attributes, which has already been described as a multifaceted issue. Further investigation of this issue is necessary to determine whether this perception of the spatial qualities of street trees is a wider phenomenon and if so its implications for urban forest managers.

Evidence to support this complexity has been provided by Barro *et al* (1997) who recorded the spontaneous comments of volunteers working on a historical tree data logging programme,

"...trees were described in emotional terms, sometimes as if the were family members, unique unto themselves with many stories to tell. It is as if people felt compelled to communicate the idea that a tree's size is more than its diameter, crown spread and height. A tree's size increases with its importance in memories, its uniqueness and its special meanings to the people who know it."

Research suggests the converse view that the size of a tree increases with the amount of irritation it causes should be added to Barro *et al's* claim.

Allied to this issue about tree size is the factor of context revealed most strongly when discussed during the interviews. Residents were clear that their opinion of tree size was also related to the context in which the tree was growing with larger trees being more appropriate in parkland type settings than a residential street, for

example. Such views appear to relate strongly to the conclusions drawn above that tree size perception, in the urban setting, is related to compatibility.

Investigating the values held by urban residents towards street trees is an important way of understanding the basis for their specific concerns, both positive and negative, which in turn can help to improve management decisions.

Results from this survey support existing understanding of the very personal and powerful forces which people feel towards urban trees (e.g. Dwyer *et al,* 1991). The strong values and emotions that residents displayed have not been typically described in the UK context but these results suggest that such feelings are not dissimilar to those found elsewhere in the world (Schroeder *et al,* 2006) and for other environments such as rural forests (Vining & Tyler, 1999).

Research strongly suggests that understanding the values that people have towards the urban forest, including the street tree component, is critical if professionals are to manage the resource optimally,

"In sum, urban trees are living, breathing organisms with which people feel a strong relationship, and in our planning and management we should not just think of them just as air conditioners, providers of shade, and ornaments in the urban system. Failure to recognise the deep significance of trees to urbanites will most likely result in less effort being given to tree planting, care and protection then the public desires." (Dwyer *et al,* 1991)

Residents in this research were able and willing to share their values displaying equally a passion for street trees alongside a more pragmatic understanding of the reality of living alongside them. Such views were not always consistent changing subtly between when considering trees that were close to their home or the street scene in general.

Although not consistent across all participants residents are therefore willing to adapt their values of street trees depending on where the street tree is. In other words tree-lined streets achieved a high degree of support but individual trees outside people's houses were rated less positively more often. Reasons for this

appear to be centred on residents placing their values around their home and home related activities above those of the nearest street tree.

Importantly, it appears that for most residents the advantages of street trees begin to recede as their annoying physical attributes advance into their private space. This aspect of the research reveals an area of conflict for residents who in order to maximise their own welfare desire to live in tree-lined streets and yet may wish other members of the community to bear the brunt of tree nuisance.

Notwithstanding, the evidence provided by these residents does not support the professional view that residents *per se* do not like trees close to their home rather that only a few whose values around their home are significantly affected by the presence of nearby trees make their views known. It is also important to note that residents with a high opinion of their closest street tree, and street trees in general, are not immune to the issue of compatibility with the majority of these stating that their perceptions would worsen if factors were to change especially around the issue of physical damage to their property.

It would seem that the residents in the case study hold street trees in high regard expressing a similar level of importance as residents in more rural locations with both identifying similarly rich and diverse relationships around the impact on their personal worlds, their local community and their 'remote' world e.g. visual simulations (Henwood & Pidgeon, 2001). Sheets & Manzer (1991) noted how street trees increased the perceived value of the street and it seems that this is reflected by the residents in Streets A –D; although this is likely to be linked to other factors such as lack of traffic and other complex interactions.

Understanding residents' perceptions of street tree attributes is therefore critical because many of these features contribute to the acceptance of, or resistance to, street tree management practices and policies. This research has offered an insight into the complexities of UK residents' perceptions of street trees and has highlighted values that residents find important, which should be considered by tree managers and future investigations.

Better awareness of residents' relationships with street trees will better equip urban tree managers to establish policies that are mutually beneficial for its trees and residents; raise awareness of potential conflicts; and contribute towards clear strategic direction.

A significant methodological issue was the matter of the inherent variability in this type of field research meaning that generalising these results is inappropriate although the methodology is considered relevant for providing a deeper understanding of residents' values and attitudes.

Limitations

There are several limitations to this study. The most obvious issue relates to the generalisability of the study caused in part by the qualitative nature of the data collection but also more importantly is the recognition that the variables are so wide-ranging between each individual that meaningful comparisons are just not possible.

Furthermore, although the study area was selected for its layout and street tree population the demographic features of the participants in the case study area are not typical of the UK population. The generally high level of education might be an important factor influencing the results. Ethnic backgrounds were not collected in the householder survey which could also provide useful information.

Whilst efforts were made to keep variables to a minimum it is simply not possible to achieve this because of the unknown, but potentially limitless different perspectives that each participant can have with each tree alongside the fact that residents interact with different trees in different ways.

Interviewees were also self-selected meaning that the representativeness of their views is unknown. Their numbers were also relatively small.

The participants' knowledge of the research's objectives offered the possibility of the residents guessing the survey's aims thereby directing their answers without regard to their real feelings about the content of the individual images or questions.

Potential issues about the validity of the contents of annoyance/benefits lists are an important methodological point and an important area for future research.

Conclusion

This thesis has revealed that a complex, generally positive, relationship exists between urban residents, the road in which they live and the street trees growing within it. Such a relationship describes how street trees are considered as significant territorial symbols of residents' home life offering a wide ranging list of benefits meeting their spiritual, aesthetic and practical needs. Such detailed information about residents' relationships with street trees has not been sought before and this thesis has initiated a process for addressing this deficit in knowledge, thereby helping to guide future policy, so that urban tree management more accurately reflects residents' needs.

Results have described the significance of the street tree to residents as the representation of a complex array of personal and environmental values providing knowledge that is crucial to understanding. The depth of these benefits from street trees can be so intensely experienced that they expose the current arboricultural approach as outdated and removed from urban dwellers' expectations.

In the context of this backdrop the findings from this thesis are revelatory, for the arboricultural mindset, in that arboricultural practice in the UK tends to focus on the environmental, biological, legal and maintenance issues of street trees rather than the needs of the people who live alongside them. This casts into doubt existing arboricultural custom and practice thereby indicating the need for wholesale changes in management and strategy. Evidence for such change is most clearly manifested from the evaluation of residents' perceptions of tree size.

Such was the perceived dominance of the trees' physical characteristics on residents' relationships with street trees, exemplified in this thesis by size, that this dictated the whole experimental design of the thesis. It had been theorised that tree dimension would correlate with overall tree satisfaction and subsequently streets with different sized trees were carefully selected to test this hypothesis. And yet any such outcome was summarily dismissed by residents who expressed a far more sophisticated approach regarding the overall significance and performance of trees that was not simply related to size.

A key area of change for urban tree management thus includes the need for the arboricultural industry to have a greater awareness of residents' perception of trees which is more complex than consideration of simple dimensions. Successful transference of such knowledge to arborists and landscape architects is crucial in order that it can be incorporated into planting schemes, or existing maintenance programmes, thereby maximising the benefits received by residents. Such a need is growing in importance because of the likely future negative impact of climate change on urban residents which is increasing the desire to plant trees in urban situations, near to people's homes, to take advantage of their ameliorating effects such as temperature reduction and pollution absorption.

Subsequently, a strategy is necessary to address this 'distance in understanding' by introducing arboriculturists and other related professions to a closer understanding of the generally complex but meaningful relationship that many residents have with their nearby street trees based on the outcomes of this research. Accordingly this thesis directs practicing arboriculturists and other professionals managing urban landscapes to a more holistic approach recognising that residents have strong opinions about street trees that are multi-faceted and frequently profound.

Further research is essential especially to understand more fully residents' psychological and spatial relationships with street trees and the development of a multi-disciplinary approach engaging, for example, landscape architects and environmental psychologists, alongside arboriculturists, will contribute to meeting that objective.

There is a pressing need for arboriculturists to investigate, systematically, the relationships that residents have with street trees in all areas of the UK, involving a range of cultural and social dimensions, rather than relying on their random interactions with residents whose representativeness of wider perceptions is unknown. This thesis provides the tools for arborists to develop this aspect of their work to ensure that residents' experiences match their needs and values.

In order to address misunderstandings by arboriculturists of residents' opinions about nearby trees it will be necessary to develop a closer bond between residents and urban tree managers at a local level. 'Friends' and other volunteer groups for parks and open spaces contribute positively to their management and a similar arrangement around street trees would bring improved understanding between residents and tree management professionals alongside the opportunity for the enhancement of community cohesion in participating streets. Such a need for open and ongoing dialogue between professionals and residents has emerged as an important theme from the thesis and its adoption will help to improve this aspect of urban living.

Here, visual simulations can have an important role to play by assisting residents' decision making around selecting tree types for new planting schemes. New developments for example will be designed to include street trees but the exact type could be chosen by the new inhabitants from visual simulations once residents have had time to develop their relationship between the street and their home. Having the opportunity to select the tree type will enhance the positive relationship between it and the local residents ensuring that the deep and meaningful relationship that people can have with street trees is nurtured from the beginning.

An area for significant development within the arboricultural industry is therefore the recognition, and understanding, of the complexity of residents' interactions with street trees; notably around the physical features of the trees which tend to be obvious and visible, and which can contribute to any dissatisfaction; as opposed to other ethereal qualities of the street trees which tend to be positive and profound but much less evident. Because these ethereal tree benefits are not generally explicit to the professional observer this thesis demonstrates that this should not mean that they are ignored but instead should be celebrated.

Arboriculturists need to engage with other disciplines to exploit this new understanding and to ensure that current urban tree management and future planting schemes reflect the complex needs of residents and thus maximise opportunities to enhance quality of life in urban areas. Additionally, the tendency of UK arboriculturists to judge people's perceptions based on public complaints rather

than from more systematic methods leads to increasing divergence in understanding between professionals and residents and must be addressed.

Residents have expressed strong opinions about street trees demonstrating a relationship that is both complex and profound. This thesis adds to the understanding of such relationships and will therefore help to better equip urban tree managers and allied professionals to establish policies that are mutually beneficial for trees and citizens; raise awareness of potential conflicts; and contribute towards clear strategic direction for street tree planting and maintenance.

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Appendices

Appendix A: Householder survey and introduction letter

Dear Resident

Survey about your street and street trees

Please find attached a survey referring to your opinion of the street where you live *and* about street trees.

The questionnaire forms part of a research programme undertaken by the School of Architecture, University of Central England in Birmingham. This research is examining the relationship of people to their local environment and it is hoped that your answers will aid our understanding of the design and management of local environments. Understanding what people like will help future urban projects to create a high quality standard of living whilst responding to local wishes.

This questionnaire is designed to identify the general attitudes towards street trees and will be linked to additional work which uses computer simulations to produce street tree scenarios.

The information regarding health, income and education are important to us since personal circumstances of residents can affect the ways that trees are valued. None of the information in any of the questionnaires will be attributable to any individual and all information is treated as confidential and will be held securely. Information will not be passed onto any other person. However if you prefer not to answer these questions please leave them blank.

Follow up work is planned and, through the questionnaire, we also hope to identify those who are happy to become more involved in the research and are prepared to be interviewed. Such interviews help us to understand the fine detail regarding how residents value street trees so are extremely important. If you are happy to be further involved then please respond at the end of the questionnaire.

If you require more surveys please photocopy the survey form delivered to your property.

Yours faithfully

John Flannigan,
Research Student, University of Central England

University of Central England in Birmingham
Birmingham School of Architecture
Corporation Street, Gosta Green, Birmingham, B4 7DX **t:** 0121 331 5130/5110 **f:** 0121 331 5114

EVALUATING YOUR LOCAL ENVIRONMENT

The following questions refer to your opinion of the street where you live *and* about street trees.

Some questions will ask you to choose from a list of answers.

Some questions will ask you to explain your opinion in more detail. If there is not enough space in the box please continue on another sheet but be careful to write the Question Number before you start.

The questionnaire should not take long to fill out.

SECTION 1

1. Overall, I like living in my street

☐ Strongly disagree ☐ Disagree ☐ Neither agree nor disagree ☐ Agree ☐Strongly agree

2. Please describe in your own words how you feel about living in the street describing both good and bad points.

3. **Trees growing in the pavement make streets nicer places to live in**

☐ Strongly disagree ☐ Disagree ☐ Neither agree nor disagree ☐ Agree ☐Strongly agree

4. **Please describe the reason for your response to question 3, giving some detail regarding the things that influence your opinion of street trees.**

5. Are there trees in the pavement near to your home?

☐ yes ☐ no

If **YES** please continue to answer the following questions. Please do **NOT** answer questions 17, 18 and 19.

If **NO** please proceed straight to question 15 and then continue to answer all questions.

6. a). Is there a tree outside your house?

☐ yes ☐ no

b). If there is a tree directly outside your house do you think its size is ...?

☐ too small ☐ just right ☐ too large ☐ no opinion

c). If there is NO tree outside you house is the size of the tree nearest to your house ...?

☐ too small ☐ just right ☐ too large ☐ no opinion

7. What is your overall opinion of the tree closest to your home?

☐ very good ☐ good ☐ neutral ☐ poor ☐ very poor

8. Which is your favourite season for living with trees in your street?

☐ summer ☐ autumn ☐ winter ☐ spring

9. The size of the trees in my street are generally

☐ too small ☐ just right ☐ too large ☐ no opinion

10. Do you feel that the trees in your street generally grow

☐ too fast ☐ too slow ☐ good rate ☐ no opinion

11. Do you feel that the look of the trees in your street is generally

☐ very unattractive ☐ somewhat unattractive

☐ somewhat attractive ☐ very attractive ☐ no opinion

12. Which one of the following answers best describes how you feel about the distance between your home and the nearest street tree?

☐ too near ☐ just right ☐ too far ☐ no opinion

13. How well do you think the Council maintains the trees in your street?

Please circle a score below where 5 is excellent and 1 is very poor. 0 is no opinion

5 4 3 2 1 0

14. Please describe the things that influence your overall opinion of the tree closest to your home.

15. Here are some of the BENEFITS that street trees can provide. Please tick the degree of benefit which describes how YOU feel about street trees.

TYPE OF BENEFIT	DEGREE OF BENEFIT PROVIDED BY STREET TREES				
	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Enhances look of garden and home					
Increases sense of home and family					
Brings nature closer – birds etc					
Increases property value					
Pleasing to the eye					
Increases sense of community					
Provides spiritual values					
Autumn colour					
Filters pollutants from the air					
Increases privacy					
Slows wind speed					
Reduces noise					
Screens unwanted views					
Flowers on tree					
Cools home in summer					
Gives shade in garden					
Gives shade in home					
Other:					
Other:					
Other:					
Other:					

16. Here are some of the ANNOYANCES that street trees can provide. Please tick the degree of annoyances which describes how YOU feel about street trees.

TYPE OF ANNOYANCE	DEGREE OF ANNOYANCE PROVIDED BY STREET TREES				
	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Sap/sticky liquid dripping from tree					
Causes allergies					
Attracts annoying insects					
Actual root damage to property, pavement, drive, wall, drains etc					
Fear of root damage to property, pavement, drive, wall, drains etc					
Branches or suckers grow from base obstructing access					
General debris such as sticks or seeds fall from tree					
Flowers fall from tree					
Fallen leaves in autumn					
Leaves fall continuously throughout summer					
Falling limbs					
Blocks street light					
Reduces personal safety by limiting visibility					
Blocks view from property					
Blocks sun into home					
Blocks sun to garden					
Branches overhang garden					
Fearful tree might fall over in storms					
Fearful branches might fall off in storms					
Other:					
Other:					
Other:					

This section applies if there are NO trees in the pavement near your home.

If you have trees near your home please proceed to section 2 to answers question about yourself.

17. Would you like a tree planted in the pavement directly outside your house?
☐ Yes ☐ No

If **YES** please only answer question 18 and then proceed to section 2

If **NO** please only answer question 19 and then proceed to section 2

18. If you answered **YES** to question 17, and would like a tree planted in the pavement outside your house, please list your reasons, in order of importance.

1	
2	
3	
4	
5	

19. If you answered **NO** to question 17, because you do not want a tree planted in the pavement outside your house, please list your reasons, in order of importance.

1	
2	
3	
4	
5	

Section 2 - About yourself

20. How long have you occupied this house? _____ years

21. Have you lived in a street with trees in the pavement before living here?

☐ yes ☐ no

a. If yes, for how long? _____years

22. Do you: ☐ own ☐ rent

23. Are you: ☐ male ☐ female

24. Your age:_____ years

25. Does your age limit you in **vigorous** activities such as running, lifting heavy objects or participating in strenuous sports?

☐ Yes, limited a lot ☐ Yes, limited a little

☐ No, not limited at all ☐ Prefer not to answer

26. Does your age limit you in **moderate** activities such as moving a table, pushing a vacuum cleaner, bowling or gardening?

☐ Yes, limited a lot ☐ Yes, limited a little

☐ No, not limited at all ☐ Prefer not to answer

27. In general, would you say your health is

☐ Poor ☐ Fair ☐ Good ☐ Very Good ☐ Excellent

28. Does your health limit you in **vigorous** activities such as running, lifting heavy objects, participating in strenuous sports?

☐ Yes, limited a lot ☐ Yes, limited a little

☐ No, not limited at all ☐ Prefer not to answer

29. Does your health limit you in **moderate** activities such as moving a table, pushing a vacuum cleaner, bowling, playing golf or gardening?

☐ Yes, limited a lot ☐ Yes, limited a little

☐ No, not limited at all ☐ Prefer not to answer

30. What is your approximate gross (before taxes) annual **household** income?

☐ £12,000 or less ☐ £12,001– 18,000 ☐ £18,001– 25,000

☐ £25,001 – 35,000 ☐ £35,001- 45,000 ☐ £45,001 or more

31. Your education (Please tick box of highest level you have completed)

☐ No formal qualifications ☐ GCSE/CSE/'O' level

☐ 'A' level ☐ Further Education (HND, BTEC etc)
☐ Graduate ☐ Post-graduate

32. Do you have any other comments about street trees that you would like make?

Thank you for your assistance!
Please return this questionnaire in the enclosed pre paid envelope

Appendix B: Interview introduction letter and interview script and questions

Dear Sir/Madam

Survey of residents' attitudes to street trees

I would like to thank you for completing a survey about street trees last summer.

At the end of that survey you also kindly agreed to a follow up interview and I am now writing to ask if you would still like to do so. Such interviews help us to understand the fine detail regarding how residents value street trees so are extremely important. The interview should only take 30 minutes.

None of the information from the interview will be attributable to any individual and all information is treated as confidential and will be held securely. Information will not be passed onto any other person.

If you are still interested please let me know when it will be most convenient for you to be interviewed by me, in your home, on the attached form and return it in the stamped addressed envelope.

I will be publishing the results of this research during 2009.

I look forward to hearing more about your opinions of street trees.

Yours faithfully

John Flannigan,
Research Student, University of Central England

University of Central England in Birmingham
Birmingham School of Architecture
Corporation Street, Gosta Green, Birmingham, B4 7DX t: 0121 331 5130/5110 f: 0121 331 5114

Interview dates and times

In order to take up as little of your time as possible it would really help if you could tick any of the boxes that are a convenient time for you to be interviewed. I will then write again with a time and date for the interview.

Date	9 am – mid-day	1.00 pm – 5.00 pm	6.00 pm – 8.00 pm
28 July			
1 August			
2 August			
3 August			
4 August			
8 August			
9 August			
10 August			
29 August			
30 August			
31 August			
1 September			
If any of these dates are inconvenient please provide an alternative below.			

Please put a X in the box if you would not like to be interviewed ☐

Please return this sheet in the stamp addressed envelope as quickly as possible.

Thank you again for your assistance with this research.

Interview script and questions

1. Thank you for agreeing to be interviewed and helping with this research.

2. I would appreciate your permission to record the interview.

3. During the interview I will read from this script to make sure that the survey is undertaken consistently with all participants. There is quite a lot of information so please feel free to ask me to repeat anything if it is not clear.

4. The interview should not take more than 30 minutes.

5. I would like to emphasise that none of the information from the interview will be attributable to you and all information is treated as confidential and will be held securely.

6. When the survey is over I will be happy to chat informally about the research if you want.

7. The interview is divided into 3 sections:
   Firstly you will be asked to undertake a small photo survey
   We will then talk briefly about that
   I will finish by asking a few questions about your opinion of street trees

8. The first part of the interview is to ask you to look at a series of slides.
   Each slide contains four images and you are asked to rank the individual images in order of preference.
   Please use this sheet **[hand over answer sheet]** to record your answers.
   The example at the top of the sheet is there to help if you need it.
   Otherwise I can go through the process with you if you wish **[only ask if participant has difficulty understanding what is required].**
   Please let me know when you have finished

9. I would now like to ask you some questions about these photographs.

   e. Could you please describe to me what influenced you most about the images you ranked as most preferred?

   f. Could you please describe to me what influenced you most about the images you ranked as least preferred?

   g. Can you explain whether you thought about your own experiences of street trees when you were making your choices?

   h. What do you think other people might make of your choices?

   [Neighbours, family, different city, different country]

10. I would now like to ask you some other questions about street trees.

    i. In the earlier survey you described that you

    [insert response]

    liked living in your street.

    Could you please describe how much street trees contributed to that opinion?

    j. In the earlier survey you described your overall opinion of the nearest tree to you as

    [insert response]

    Can you describe the things that would make you change your mind?

    [e.g. either way – adding or removing a tree; changing health; damage]

    k. In the earlier survey you described how the size of the tree nearest to you was

    [insert tree size]

    Can you tell me what you think about when asked to consider tree size?

    [e.g. just height, height and spread]

    l. Does where you are affect how you think about the size of trees?

    [e.g. would a 60 foot high tree in a park be 'just right', but 'too large' outside your house?]
    [you labelled your tree as being "" away from your house]

    m. Who do you think should make the decisions about managing street trees, and why?

    [e.g. felling it, pruning it, new planting]
    [the person with the tree outside their home, residents throughout the street or the Council]

Thank you very much for participating in this survey.

This is part of a wide ranging study and I expect to have results available for publication early next year.

Appendix C
Visual simulation images including an example of the residents' pilot study (Slide M) and the professional pilot study

Image 1

Image 2

Image 3

Image 4

Slide A

Image 1

Image 3

Image 4

Slide B

Image 1

Image 2

Image 3

Image 4

Slide C

Image 1

Image 2

Image 3

Image 4

Slide D

Image 1

Image 2

Image 3

Slide E

Image 4

Image 1

Image 2

Image 3

Slide F

Image 4

Image 1

Image 2

Image 3

Image 4

Slide G

Image 1

Image 2

Image 3

Image 4

Slide H

Image 1

Image 2

Image 3

Image 4

Slide I

Image 1

Image 2

Image 3

Image 4

Slide J

Image 1

Image 2

Image 3

Image 4

Slide K

Image 1

Image 2

Image 3

Image 4

Slide L

Image 1

Image 2

Image 3

Image 4

Slide M

Image 1

Image 2

Image 3

Image 4

Example – Test Case 2

X273

Appendix D – example of the answer sheet for the visual simulation survey

Visual simulation survey

Please rank the images in each slide in order of preference.

In the example shown below 'Image 3' is most preferred, 'Image 4' is preferred next, 'Image 1' is ranked third and 'Image 2' is liked least.

SLIDE	Image 1	Image 2	Image 3	Image 4
Example	3	4	1	2
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				

Appendix E

Published papers derived from the householder survey pilot study:

Flannigan, J. (2005) An evaluation of residents attitudes to street trees in southwest England, *Arboricultural Journal,* Vol 28, pp 219 – 241

Schroeder, H.W., Flannigan, J.D. & Coles, R. (2006) Residents' attitudes toward street trees in UK and USA communities, *Arboriculture and Urban Forestry*, Vol 32, pp 236 - 246

Arboricultural Journal 2005, Vol. 28, pp. 219–241

Printed in Great Britain

AN EVALUATION OF RESIDENTS' ATTITUDES TO STREET TREES IN SOUTHWEST ENGLAND

John Flannigan

Summary

The majority of research into attitudes to street trees close to residents' homes has been undertaken in the USA, where a generally positive attitude towards such trees exists. Limited UK research thus far suggests less positive attitudes to street trees, which is reinforced by anecdotal reports from professional Arboriculturists who describe negative opinions by residents to nearby trees. Residents from three case study areas in southwest England were questioned about their attitudes to nearby street trees using the survey method developed by North American researchers (SOMMER *et al.*, 1989; SCHROEDER and RUFFOLO, 1996). The survey assessed residents' overall opinion of the trees, attitude to pruning regimes and the Council's maintenance, satisfaction with the benefits and annoyance they receive from the trees, the trees' size, shape, and growth rate. Two case studies considered regularly pollarded street trees and one case study used non-pollarded trees. Residents had a generally good overall opinion of the tree near their home irrespective of tree type, rating visual attractiveness as the highest benefit and raking fallen leaves in autumn as the most annoying feature. Annoyances were rated less highly overall than benefits. Demographic factors appeared to have little influence on attitudes to trees although evidence was collected that found when physical ability is negatively affected by age overall opinion of nearby street trees reduces. No resident reported that the tree outside their home was too small or grew too slowly, suggesting that residents preferred smaller trees.

Keywords: Street trees • benefits • annoyances • residents' perceptions • pollarded trees • tree size

Introduction

Professional Arboriculturists in the UK have expressed the opinion that residents appear to dislike trees near their property (BAKER, 1984; CLOUSTON

Corresponding address: North Somerset Council, Weston Court, Oldmixon Crescent, Weston super Mare. E-mail: john.flannigan@n-somerset.gov.uk

and STANSFIELD, 1981; *HORTICULTURE WEEK*, 1994; ANON, 2003; *DAILY MIRROR*, 2004; RISELEY, 1969) summed up by DOBSON and PATCH'S (1997) observation of a seemingly well used phrase used by residents, 'I love trees but...*Not-in-my-back-yard*'.

Researchers in the UK describe a similarly negative outlook. HITCHMOUGH and BONUGLI'S (1997) survey of Scottish residents' attitudes to trees being planted in their street found little support for tree planting, while GILBERT'S (1996) analysis of tree survival rates on selected development sites in Sheffield over two decades sites observed that,

'A proportion of tree losses (3–35 per cent) were a delayed result of damage incurred during construction but the majority were removed as a result of complaints, or direct action, by the residents...The majority of people questioned put a higher value on sunlight in their rooms, on their patios, washing lines and gardens than the presence of a nearby tree.'

These observations are in direct contrast to the North American literature where visual simulation surveys (KALMBACH and KIELBASO, 1979; SCHROEDER and CANNON, 1983; SHEETS and MANZER, 1991) and questionnaire surveys (SOMMER *et al.*, 1989, 1990; SCHROEDER and RUFFOLO, 1996) have shown widespread support for street trees including residents where trees are directly outside their homes. Positive responses for street trees are reported because they: are aesthetically pleasing in their own right (SCHROEDER and RUFFOLO, 1996), enhance the neighbourhood (KALMBACH and KIELBASO, 1979, SCHROEDER and CANNON, 1983), and help in improving the quality of life (SHEETS and MANZER, 1991). Such positive attitudes exist despite the recognition of annoying features including fallen leaves and debris (SOMMER and SOMMER, 1989; SOMMER *et al.*, 1989, 1990; SCHROEDER and RUFFOLO, 1996).

Such seemingly different attitudes to street trees in the UK confirm the concerns of researchers (e.g. SOMMER *et al.*, 1990; SCHROEDER and RUFFOLO, 1996) who have cautioned against interpreting their results with other populations where cultural or climatic differences may exist. FRASER and KENNEY (2000) reported a wide variation in responses to urban trees from participants from four different ethnic backgrounds, which they attributed to the historical landscapes of their cultural origin; while HITCHMOUGH and BONUGLI (1997) concluded that there was a cultural bias against street tree planting from the Scottish respondents to their street tree survey. WILLIAMS (2002) noted that few surveys about attitudes to street trees exist outside North America but in surveying the attitudes of Melbourne residents found that they preferred smaller, globular trees, at odds with North American results. Taking these findings into account, the evidence thus far offers the possibility that there is a specific cultural bias amongst UK residents to strongly disapprove of trees near their property.

Whilst there might be wide variation in attitudes to specific tree issues caused by cultural or climatic factors, it would seem to be rather extraordinary

that the body of research documenting people's highly positive responses to vegetation, including trees, (e.g. KAPLAN and KAPLAN, 1989; ULRICH, 1984; LEATHER *et al.*, 1995) would not apply in the UK. Moreover, several researchers have hypothesized that evolutionary factors common to all humans create an inborn affinity for nature (HEERWAGEN and ORIANS, 1993), which is consistent with SOMMER and SUMMIT'S (1995, 1996, 1997, 1999) findings of similar attitudes toward tree shapes across diverse international communities. Researchers (NATIONAL URBAN FORESTRY UNIT, 1998; DWYER *et al.*, 1992) have also described a range of social, economical, environmental and health benefits that trees provide to humans that should equally apply to the UK.

Anecdotal information about residents' distress at street tree felling, the existence of statutory tree protection legislation (ANON, 1990) and the ongoing fascination of the media with gardening suggest that there is a body of opinion in the UK that supports trees and vegetation. This is reinforced by Government initiatives, such as Home Zones (ANON, 2000) and non-Government organisations, such as Living Streets (FRANKLIN and CONNOLLY, 2004); that promote the many positive effects of tree planting in streets, close to people's homes.

It is clear that more in-depth investigations of UK residents' attitudes toward street trees is necessary. Such information would help to inform arborists about species selection and management options favoured by local communities, would inform community leaders about the value of the urban forest, and thus to realise the positive value that access to vegetation provides to the whole community as a part of urban living (COLES and CASERIO, 2004).

This paper considers these issues and undertakes a survey of the attitudes of UK residents to street trees using three case study sites selected from within the Unitary Authorities of Torbay and North Somerset.

Methods

Survey methods and methodology

SOMMER *et al.* (1989, 1990) and SCHROEDER and RUFFOLO (1996) have given guidance as to appropriate methods for surveying and evaluating residents' attitudes to street trees. To reflect local circumstances in the UK minor modifications were made to the SCHROEDER and RUFFOLO (1996) survey method. These included removing a section relating to wildlife, which was not relevant to the UK communities surveyed, and adding additional more specific questions about root damage and shade related annoyances (Appendix A). All questions referred to a single, specific tree in front of the person's home. By using a similar survey the opportunity also arose to compare

attitudes to street trees between residents in the USA and UK (SCHROEDER and FLANNIGAN, 2005).

This survey asked individual homeowners to rate a list of benefits and annoyances in reference to the particular tree in front of their home. The survey also enquired about people's satisfaction with the tree through the relationship between tree characteristics (e.g. species and growth rate) and management techniques.

Respondents were asked to describe their overall opinion of the tree outside their home rated on a five-point scale (Excellent = 5 points, Very good = 4, Good = 3, Poor = 2, Very poor = 1). Specific attitudes towards the tree were also sought such as whether they wanted it removed; whether they experienced some nuisance but wanted the tree retained or the tree caused no trouble at all. Participants were also asked to give their opinion about the local authority's management of the tree outside their home and about their reaction to the pruning regime for the tree outside their house, because pruning is such an integral element of pollarded street trees, and a potentially contentious issue with non-pollarded trees.

Respondents were also asked to provide basic demographic information such as income, educational attainment and age. One factor cited for causing potentially low opinions of trees is physical infirmity (SOMMER *et al.*, 1989), caused by age or ill health, which inevitably makes it difficult to deal with removing tree debris. However, questioning residents specifically about their physical ability and comparing that with overall opinion of trees, does not appear to have been undertaken previously. Participants were therefore asked to state whether their age or health affected their physical ability and to what degree (Appendix A).

Survey forms, containing a pre-paid return envelope and a cover letter explaining that the aims of the survey were to increase knowledge about street trees in the area, were then mailed to residents with street trees directly outside their homes within two local authorities, North Somerset Council and Torbay Council in the south west of the UK.

The tree-lined streets in North Somerset are characterised by pollarded trees (Figure 1) pruned on a four-year rotation. The survey was mailed to residents in sixteen streets with a pollarded tree outside their home (a random sample of 20% of all such streets in the District) resulting in 119 surveys posted.

Two separate surveys were undertaken in Torbay. One survey was posted to all 22 properties adjacent to regularly pollarded street trees to gain a comparison in attitude to residents living in North Somerset with similar trees. The Torbay Arboricultural manager also selected two additional streets, characterised by an apparently high proportion of residents dissatisfied with their non-pollarded, larger street trees (Figure 2). Seventy-one questionnaires were posted to residents with a tree outside their house in these two streets.

FIGURE 1. *Platanus x hispanica* Meunchh street trees, pollarded one week before the photograph was taken, growing in 1.0m wide grass verge, 2.8 m from the property boundary and about 9.0 m away from their nearest house. They are all currently about 8 metres tall, with a diameter at breast height (1.3 m) in the region of 0.50 m and a minimum crown spread of 3 m.

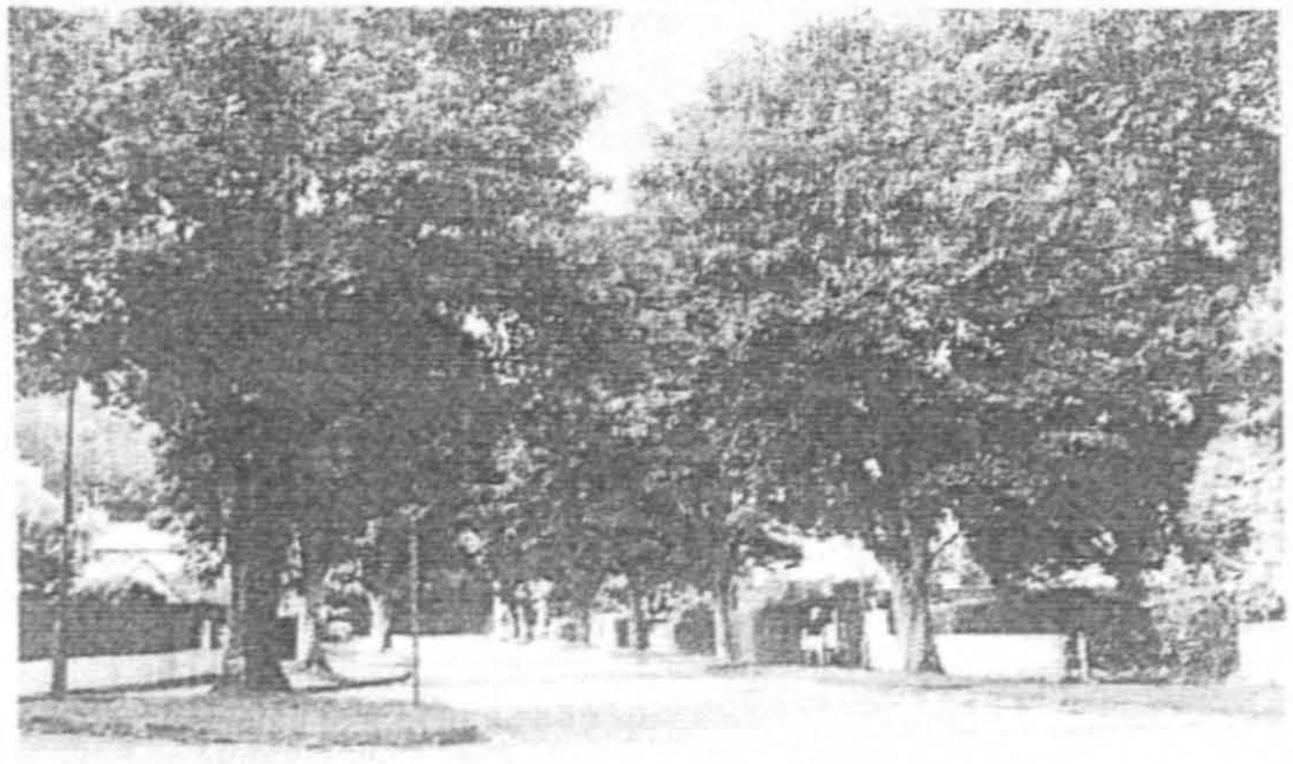

FIGURE 2. *Acer platanoides* 'Crimson King'. These trees are lapsed pollards growing in 1.2 m wide grass verge, separated from the property boundary by 1.2 m wide tarmac footway. They are about 15 m away from their nearest dwelling and are all approximately 12 metres tall with a diameter at breast height (1.3 m) in the region of 0.50m.

Hence, three case study sites, two characterised by pollarded trees and one by mature trees were investigated.

Statistical Methods

Statistical tests were performed using SPSS statistical software (Version 10). No assumptions were made about the direction of any differences that might occur between groups.

Mann Whitney tests were performed on data collected from the case studies with pollarded trees using a significance level of $p = 0.05$. The data collected from the surveys of residents with non-pollarded trees in Torbay were excluded from this statistical analysis because respondents were not selected randomly.

Correlation calculations (Spearman's rho) were carried out between both respondents' age and health and their ability to undertake physical tasks to test the assumption that these factors were linked. Due to the relatively small size of each sample all responses were combined for this particular analysis. Significant correlations ($p < 0.05$) would indicate whether participants responded to these questions genuinely.

A response to data relating to tree species characteristics is discussed separately.

Results

Response rates were high indicating significant interest in the subject. North Somerset had 63% (N = 75) returned, Torbay pollards response rate was 59% (N = 13) and Torbay non-pollarded trees also had a response rate of 59% (N = 42).

Participants were asked to answer basic background questions about themselves (Table 1). With the exception of Torbay pollards, where more female respondents participated, gender participation was fairly even. Older residents tended to dominate with only 13% of all those that answered the question being below 40 years old. Too few people revealed their income to allow meaningful analysis. Just over 58% of participants continued with further education and beyond.

Statistical analysis of the demographic data revealed that the only statistically significant difference between the pollarded areas was length of residency ($p = 0.013$), where North Somerset residents' median habitation was 8.5 years compared with 2 years for Torbay pollard residents. The median for Torbay non-pollard residents was 11 years.

TABLE 1. Demographic details of participating residents from North Somerset and Torbay with either a pollarded or non-pollarded tree outside their property.

		Case study					
		North Somerset pollard[a]		Torbay pollard[b]		Torbay non-pollard[c]	
		Count	%	Count	%	Count	%
Gender	Male	30	46.9	2	18.2	19	51.4
	Female	34	53.1	9	81.8	18	48.6
Total		64	100.0	11	100.0	37	100.0
Own/rent	Own	65	92.9	12	92.3	36	97.3
	Rent	5	7.1	1	7.7	1	2.7
Total		70	100.0	13	100.0	37	100.0
Respondent's age	20–29	2	3.0	2	18.2	0	0
	30–39	5	7.5	1	9.1	5	13.5
	40–49	19	28.4	4	36.4	4	10.8
	50–59	18	26.9	2	18.2	13	35.1
	60+	23	34.3	2	18.2	15	40.5
Total		67	100.0	11	100.0	37	100.0
Income	£12,000 or less	12	33.3	3	75.0	3	27.3
	£12,001–18,000	6	16.7	0	0	0	0
	£18,001–25,000	4	11.1	0	0	1	9.1
	£25,001–30,000	2	5.6	1	25.0	3	27.3
	£30,000–40,000	4	11.1	0	0	0	0
	£40,000 or more	8	22.2	0	0	4	36.4
Total		36	100.0	4	100.0	11	100.0
Level of education	GCSE/O level/CSE	15	30.0	6	46.2	8	24.2
	'A' level	6	12.0	0	0	5	15.2
	Further education	11	22.0	2	15.4	6	18.2
	Graduate	6	12.0	2	15.4	4	12.1
	Post-graduate	12	24.0	3	23.1	10	30.3
Total		50	100.0	13	100.0	33	100.0

[a]N = 75
[b]N = 13
[c]N = 42

Overall opinion

The mean score for overall opinion of the tree outside their home was above 'Good' (North Somerset = 3.39, sd = 1.1; Torbay pollards = 4.15, sd = 0.98; Torbay non-pollards = 3.78, sd = 1.06). There was a significant difference between Districts in the overall opinion of residents with pollarded trees outside their homes ($p = 0.018$). North Somerset residents appreciated their trees less overall with a median score of 3.00 ('good') compared to 4.00 ('very good') for the Torbay pollard population.

Age and health factors

In response to questions regarding age, older people were more likely than younger people to say that age limited their ability to engage in both moderate and vigorous physical activity. A significant correlation was found between age and its affect on ability to undertake moderate physical tasks (rho = 0.418, n = 115, $p < 0.001$) and vigorous physical tasks (rho = 0.640, n = 103, $p < 0.001$). People with poorer health were also more likely to say that their health limited their ability to engage in both moderate and vigorous activity. A significant negative correlation was found between self-assessed 'general health' and the inability to undertake moderate physical tasks (rho = –0.653, n = 109, $p < 0.001$) and vigorous physical tasks (rho = –0.694, n = 110, $p < 0.001$).

There was also a significant negative correlation between increasing age and (self-assessed) good health (rho = –0.333, n = 115, $p < 0.001$).

Despite the fact that the respondents from all three surveys lived immediately adjacent to street trees, and bore the brunt of any annoyances, including autumn leaf fall (the highest rated annoyance), overall opinion across all survey areas did not correlate with either age ($p = 0.376$) or general health ($p = 0.142$). No significant correlations were found between overall opinion and whether health affected people's ability to undertake either vigorous activity (rho = –0.163, n = 106, $p = 0.095$) or moderate activity (rho = –0.186, n = 105, $p = 0.057$).

Significant negative correlations were found, however, between overall opinion and whether age affected people's ability to undertake either vigorous tasks (rho = –0.254, n = 106, $p = 0.009$) or moderate tasks (rho = –0.281, n = 106, $p = 0.004$).

One explanation for this difference might be that less healthy residents are, generally, not expected to clear up tree debris or deal with other tree annoyances and can therefore appreciate or disapprove of the tree as they see fit. For example, those patients whom ULRICH (1984) reported as recovering from surgery more quickly because of their view of vegetation did not have responsibility for its maintenance. Older residents, on the other hand, might not typically be excused the chore of tidying up after nearby trees on age alone and therefore could develop a more negative opinion of it as they age and maintenance tasks becomes more physically onerous. There is a possible complex interpretation of this, but the key indication is that age, as indicated by the ability to undertake vigorous and moderate exercise, may have an effect on the opinion of street trees and warrants further study.

It is important to note that a Kruskal Wallis test showed no significant relationship between overall opinion of the tree and length of residence in North Somerset (df = 4, $p = 0.674$), Torbay pollards (df = 4, $p = 0.816$) and Torbay non-pollards (df = 4, $p = 0.567$). The effect of age on tree appreciation is clearly one factor that requires further investigation.

Residents were also asked to provide more detail about their feelings towards the tree outside their home (Figure 3).

None of the Torbay residents surveyed with pollarded trees outside their home wanted the tree removed. Just over 15% of North Somerset residents and 21% of Torbay non-pollard residents wanted their tree removed, supporting the idea that living near trees can cause extreme negative reactions, although the overwhelming majority of residents with a street tree outside their home liked it being there, even when it caused some nuisance.

Tree benefits and annoyances

Residents also rated a range of benefits and annoyances attributable to the tree outside their home.

Benefits

'Pleasing to the eye' was rated as the most important benefit for all participants, irrespective of the type of tree outside their home (Figure 4). The complementary visual effect, 'enhances look of garden and home' was

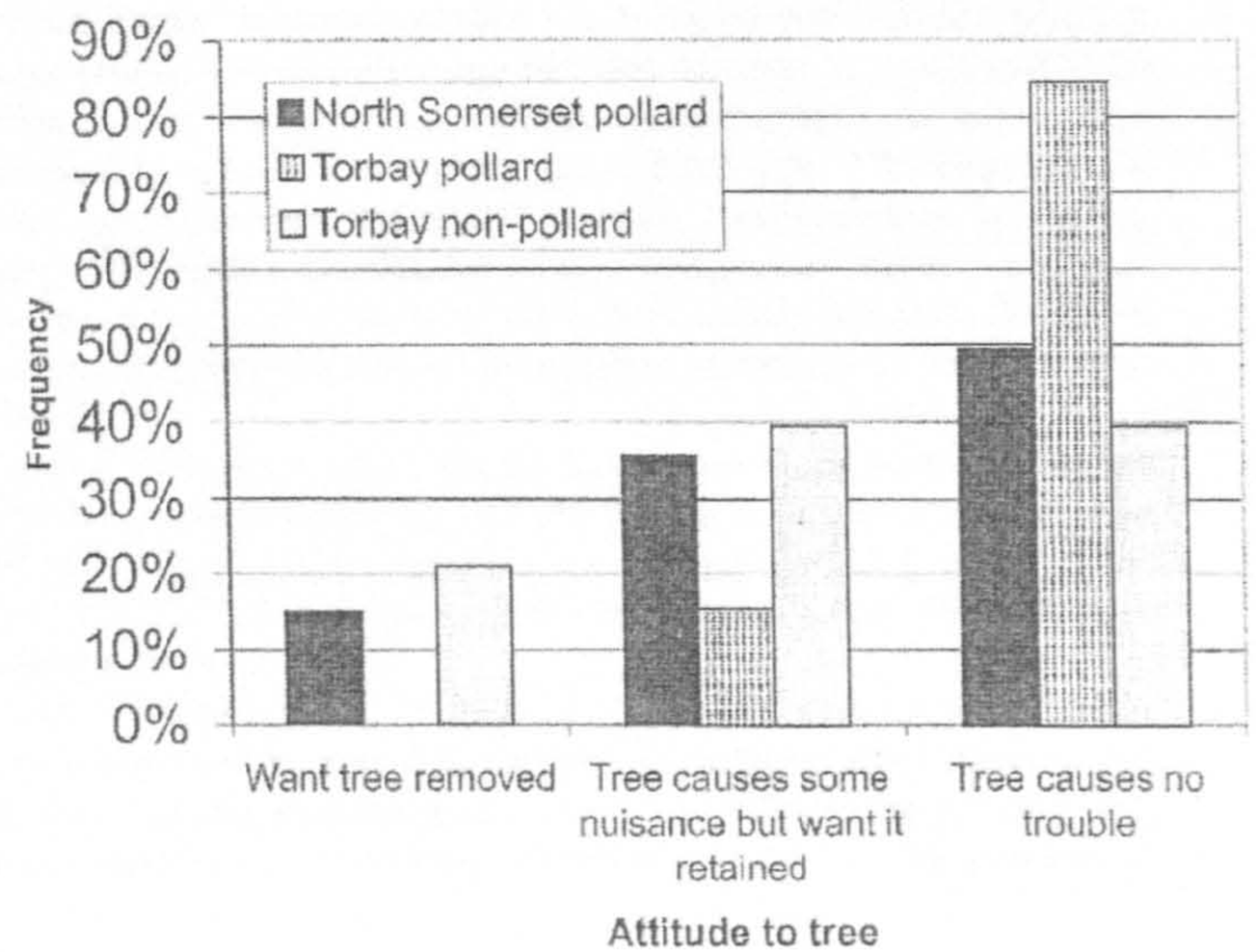

FIGURE 3. Frequency distribution of overall attitudes to trees of residents from North Somerset and Torbay with either a pollarded or non-pollarded tree outside their property (n = 73 North Somerset, n =13 Torbay pollard, n = 38 Torbay non-pollard).

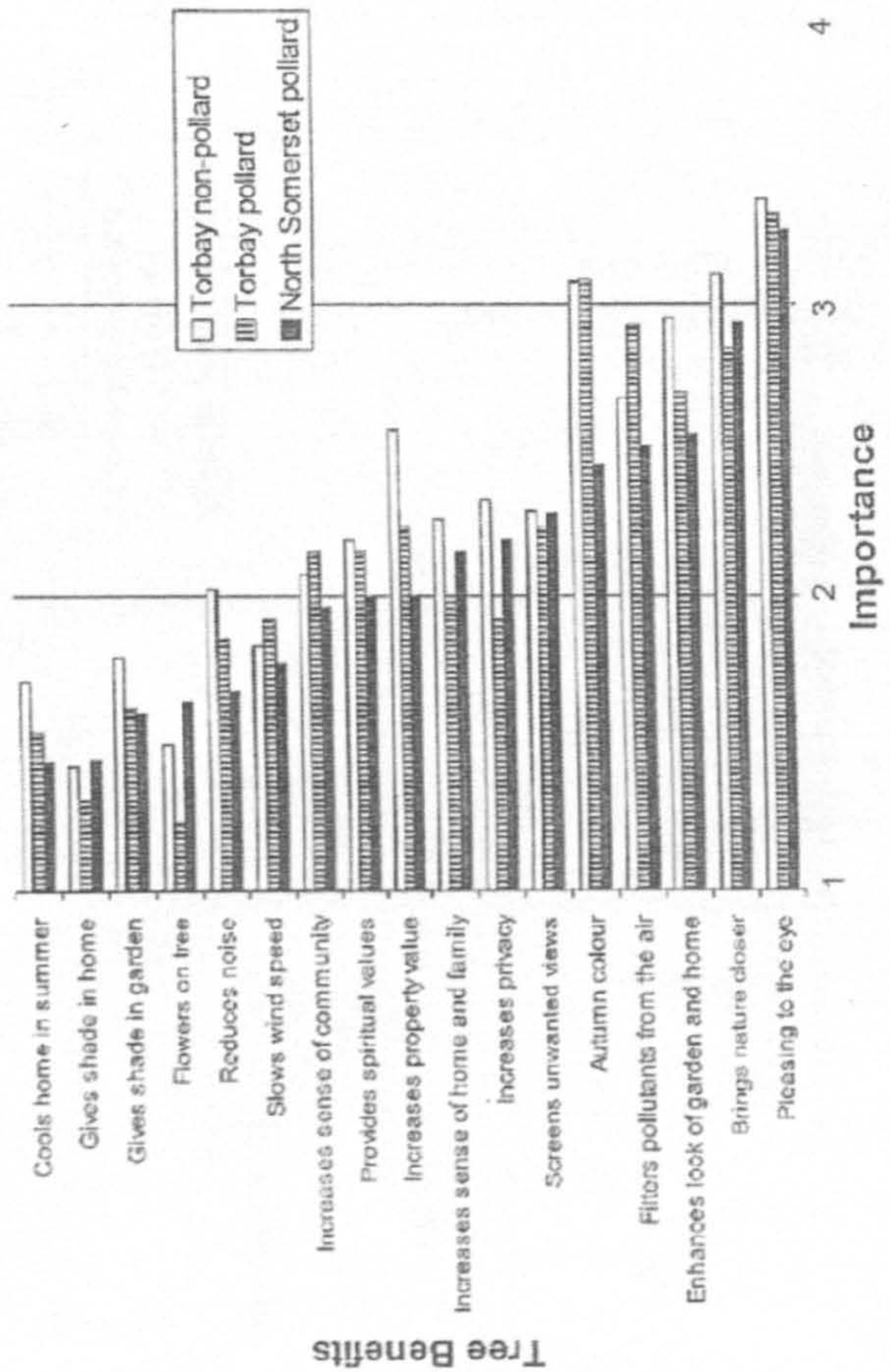

FIGURE 4. Evaluation of level of importance (1 = None/Does not apply, 2 = Minor, 3 = Moderate, 4 = Major) of 17 benefits of trees as expressed by residents from North Somerset and Torbay with either a pollarded or non-pollarded tree outside their property (values are means; n = 75 North Somerset, n = 13 Torbay pollard, n = 42 Torbay non-pollard).

also highly rated. 'Brings nature closer' was afforded importance as was 'filters pollutants from the air'. 'Autumn colour' was considered a greater benefit in Torbay than North Somerset. Intangible benefits such as 'increases sense of family and home' and 'provides spiritual values' were considered more beneficial than the tangible benefits of 'slows wind speed', shading and reducing noise, which were all rated as having a mean benefit of minor or less.

No statistically significant differences in ratings of tree benefits were found between residents with pollarded trees in North Somerset and Torbay.

Annoyances

Participants from all three areas were also asked to rate the annoying features of trees near their home using the same scale as that used with benefits (Figure 5).

'Fallen leaves in autumn' was the most highly rated annoyance in all three areas. 'General debris' was also highly rated. Torbay residents with pollarded trees were most worried about the tree falling over in storms. Root annoyances were specifically included to consider whether subsidence had a significant impact on people outside the Arboricultural industry, where it has a high profile. The response suggests that the issue is considered to be a minor annoyance similar in magnitude to 'general debris' and might relate to lower incidents of root damage due to local soil type. 'Blocking sun into the garden' was considered, marginally, a greater annoyance than 'blocks sun into home'. The larger non-pollarded trees in Torbay rated higher annoyances for blocking sunlight and obscuring views than the smaller, pollarded trees. Overhanging branches is perceived as a greater annoyance in Torbay than in North Somerset.

Significant differences exist between Torbay and North Somerset pollards with respect to 'general debris' ($p = 0.048$), 'falling limbs' ($p = 0.006$), 'blocks sun into garden' ($p = 0.021$), 'branches overhanging garden' ($p = 0.013$) and 'fearful tree might fall over' ($p = 0.009$). In all cases Torbay residents rated these annoyances more highly.

As with previous research (SOMMER *et al.*, 1990; SCHROEDER and RUFFOLO, 1996) it is important to note that annoyances received lower mean ratings overall than benefits suggesting that whilst annoyances might exist they are, to the majority of respondents, subordinate to the benefits provided by trees.

Shape, size and growth rate

Residents were also asked to rate their satisfaction about the nearby tree's shape, size and growth rate (Table 2).

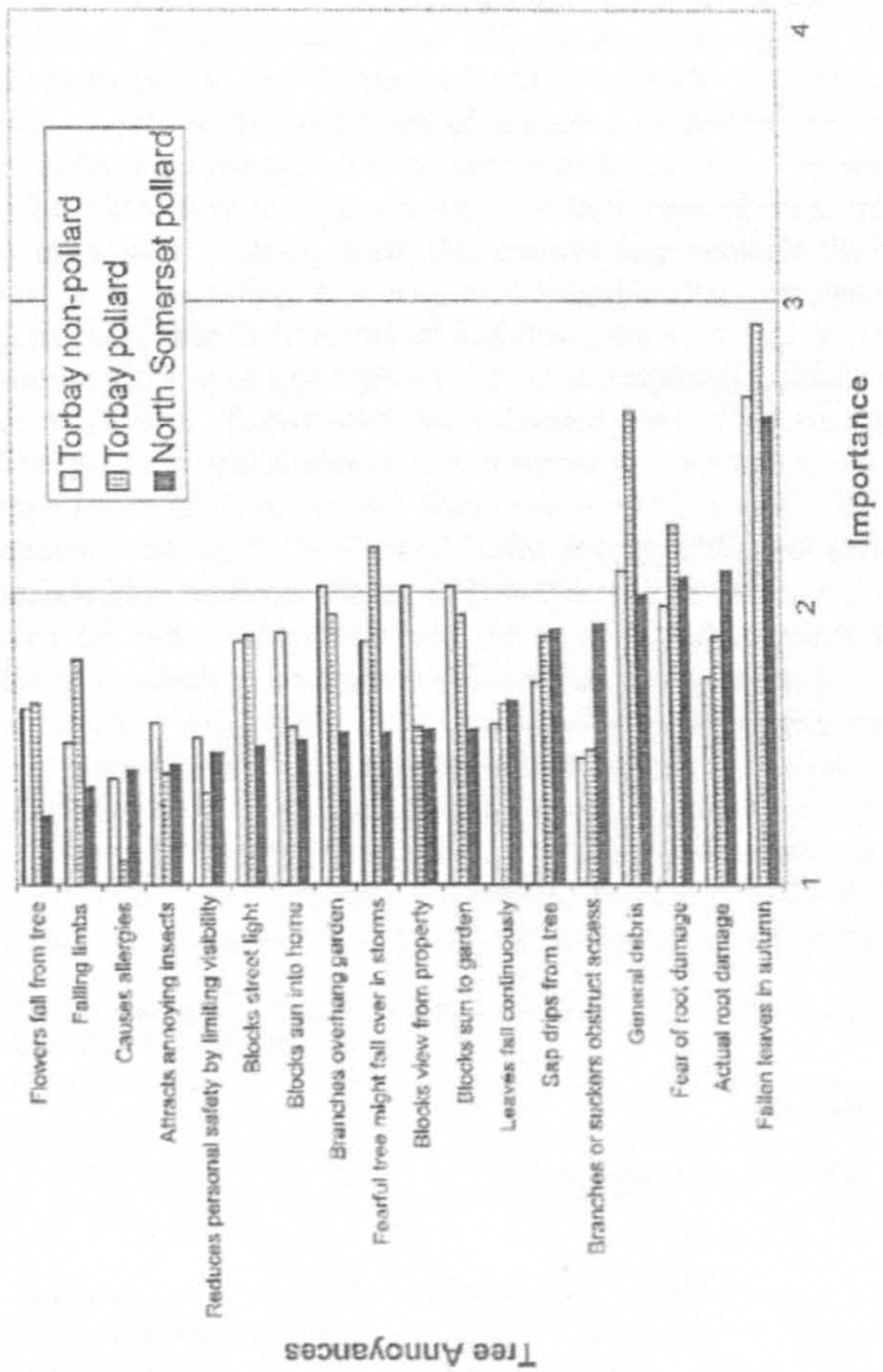

FIGURE 5. Evaluation of level of importance (1 = None/Does not apply, 2 = Minor, 3 = Moderate, 4 = Major) of 18 annoyances of trees as expressed by residents from North Somerset and Torbay with either a pollarded or non-pollarded tree outside their property (values are means; n = 75 North Somerset, n = 13 Torbay pollard, n = 42 Torbay non-pollard).

TABLE 2. The level of satisfaction with visual attributes of a nearby tree from residents of North Somerset and Torbay with either a pollarded or non-pollarded tree outside their property.

		Case study					
		North Somerset pollard[a]		Torbay pollard[b]		Torbay non-pollard[c]	
		Count	%	Count	%	Count	%
Growth rate	Good rate	41	75.9	10	90.9	23	63.9
	Too fast	13	24.1	1	9.1	13	36.1
Total		**54**	**100.0**	**11**	**100.0**	**36**	**100.0**
Shape of tree	Very unattractive	4	6.0	0	0	0	0
	Somewhat unattractive	7	10.4	1	7.7	6	15.8
	Somewhat attractive	40	59.7	6	46.2	15	39.5
	Very attractive	16	23.9	6	46.2	17	44.7
Total		**67**	**100.0**	**13**	**100.0**	**38**	**100.0**
Size of tree	Just right	46	66.7	12	92.3	18	42.9
	Too large	23	33.3	1	7.7	24	57.1
Total		**69**	**100.0**	**13**	**100.0**	**42**	**100.0**

[a]N = 75
[b]N = 13
[c]N = 42

Overall, residents had a high satisfaction with the shape of the tree outside their home. No residents in Torbay rated their tree as 'very unattractive' although 6% did in North Somerset. Overall, almost 84% of residents in North Somerset and Torbay non-pollards along with 93% in Torbay with pollards rated their tree as at least 'somewhat attractive'. Within this just under a quarter of North Somerset participants found their tree to be 'very attractive' compared to closer to half in both Torbay populations. This high opinion of tree shape is perhaps not unsurprising bearing in mind that the highest rated benefit in all three areas was 'pleasing to the eye'.

No resident considered that their tree size was 'too small'. Residents in Torbay with pollarded trees outside their home were most satisfied with their tree size. Just under one third of North Somerset residents thought their tree was 'too large' whilst those with larger, non-pollarded trees were more likely to think the tree outside their home was too big.

The majority of all residents were satisfied that their tree grew at a 'good rate' and no residents thought their tree grew 'too slowly'. Residents in Torbay with pollarded trees were least likely to think the tree grew 'too fast'. However, over one third of Torbay residents with non-pollarded trees considered their tree to grow 'too fast' as did one quarter in North Somerset.

Tree maintenance and attitude to tree pruning

Residents were asked to give their opinion about the local authority's management of the tree outside their home (Table 3).

Residents appear to be most pleased about the Council's management in North Somerset with over 76% rating it as 'good' or higher. This drops to 66.7% with Torbay pollards and 46.4% for Torbay non-pollards. It is surprising that one third of residents in Torbay with pollarded trees consider the Council's tree maintenance to be 'poor' or worse bearing in mind the high overall opinion that residents have of these trees. After all it is the Council's management that ensures they maintain the size and shape that is so appealing. However, it is possible that participants might have considered that the removal of leaf litter, the most highly rated annoyance, was an element of tree maintenance. Less surprising perhaps is the response of residents in Torbay with non-pollarded trees. These streets were chosen because the Local Authority tree manager wanted to test whether perceived high levels of dissatisfaction with trees actually existed. The supplementary question asking if the Council could supply additional services offers an insight into residents' feelings. Two thirds of residents with non-pollarded trees thought more services could be supplied, citing mainly the requirement for more pruning. Improved municipal leaf sweeping in the autumn was also requested. The following quote from one resident is fairly typical,

"More regular leaf collection during autumn and more regular pruning. Trees need to be lowered a little bit."

Pruning is an integral element of pollarded street trees and a potentially contentious issue with non-pollarded trees. Almost 80% of North Somerset residents appreciated the regular pollarding compared to 15.6% that would have preferred less frequent pruning. The remainder claimed not to notice the pruning regime. This is in contrast to Torbay where 63.6% of resident would have preferred less frequent pruning and 27.3% were satisfied with the pollarding programme. 9% claimed not to notice any pruning programme.

In keeping with their dissatisfaction with the Council's maintenance three quarters of Torbay residents with non-pollarded trees wanted more regular pruning. All the remainder were happy that regular pruning did not take place.

TABLE 3. Frequency of distribution of the opinion of residents of the Council's tree maintenance operations from all participants.

		Case study		
		North Somerset pollard[a]	Torbay pollard[b]	Torbay non-pollard[c]
		%		
Opinion of Council's tree maintenance	Very poor	12.7	25.0	31.7
	Poor	11.3	8.3	22.0
	Good	35.2	16.7	22.0
	Very good	26.8	41.7	12.2
	Excellent	14.1	8.3	12.2
Total		100.0	100.0	100.0

[a]N = 75
[b]N = 13
[c]N = 42

Tree species

Due to the variety of trees (Table 4) an effective comparison of characteristics has not been possible for all species. Pollarding is also a management technique that tends to remove species characteristics further making comparisons difficult.

Two species (Table 4) with the highest frequency were selected from each population to consider if they were a source of variation in opinion in each case study area. No significant differences were found with overall opinion or benefits between *Platanus x hispanica* Muenchh. and *Tilia x europaea* L. in North Somerset. Honeydew, however, was found to be a significantly higher annoyance with *T. x europaea* L. ($p = 0.002$). Honeydew is frequently cited as a tree related annoyance (CLOUSTON *et al.*, 1981; GILBERT, 1996) and it is not surprising that *T. x europaea* L., which is a common host of aphids (order *Homoptera*), affected residents more significantly than residents adjacent to the London plane tree. Notwithstanding, honeydew was still rated as a minor inconvenience overall.

No significant differences were found with overall opinion or benefits or annoyances for pollarded ash and common lime in Torbay.

TABLE 4. The species distribution of pollarded and non-pollarded trees found outside residences in North Somerset and Torbay.

	Case study		
Tree species	North Somerset pollard	Torbay pollard	Torbay non-pollard
Acer platanoides 'Crimson King'	3	–	16
Acer platanoides L.	–	–	9
Acer pseudoplatanus L.	6	–	3
Aesculus hippocastanum L.	4	–	–
Fraxinus excelsior L.	–	6	–
Platanus x hispanica Muenchh.	22	–	–
Sorbus aria Crantz	4	–	–
Tilia x europaea L.	36	7	14

Significant differences were found between common lime (*T.* x *europaea* L.) and copper Norway maple (*Acer platanoides* 'Crimson King') in the Torbay non-pollarded areas with the benefits 'increase property value' ($p = 0.034$) and 'brings nature closer' ($p = 0.043$) and the annoyance 'fallen leaves in autumn' ($p = 0.01$). Residents living adjacent to the *A. platanoides* 'Crimson King' rated these benefits significantly higher and the annoyance significantly lower.

Respondents were also asked if they would have preferred a different species planted outside their home. Half of all respondents wanted to retain the existing tree, 5% were undecided and 45% would have preferred a different species. The average overall opinion of those that would have preferred a different tree to be planted originally is shown in Table 5.

An open-ended answer was linked to this to find out what they would have preferred. The respondents fell into 3 broad camps:

- Those that would prefer no tree at all,
- Those that would prefer a smaller tree,
- Those that would have preferred a different tree for a specific reason such as attractive flowers, being unaffected by honeydew or a native species for wildlife.

Discussion

These results largely reflect those from similar investigations from other parts of the world. The mean overall opinion of trees outside respondents' homes is above 'good', even from the Torbay streets where perceived negativity existed. Annoyances are described but are rated less highly than benefits. The visual attractiveness of the trees was the highest rated benefit

TABLE 5. Mean overall opinions of residents from North Somerset and Torbay, with either pollarded or non-pollarded tree outside their property, who expressed a preference for a different tree or were happy with their existing tree.

Case study	Overall opinion of those that wanted A different tree*	Overall opinion of those happy with existing tree*	Overall opinion of all respondents
North Somerset pollard	2.64	4.07	3.39
Torbay pollard	3.50	4.33	4.15
Torbay non-pollard	3.11	4.56	3.78

*Respondents who were 'Undecided' have been excluded
Overall opinion rated on a scale of 1 = 'Very poor', 2 = 'Poor', 3 = 'Good', 4 = 'Very good', 5 = 'Excellent'

and raking leaves the highest annoyance. Demographic factors did not appear to significantly influence opinions; response rates were high.

One significant area of difference with North American surveys (SOMMER *et al.*, 1989; SCHROEDER and RUFFOLO, 1996), but in line with results from Melbourne, Australia (WILLIAMS, 2002), was that residents did not prefer larger trees. Not one single respondent in the UK considered that the tree outside their home was 'too small'.

Evidence is emerging that certain specific tree attributes will return unique responses according to the area under review. For example, in this study residents in the UK clearly prefer smaller trees than their North American counterparts. It does appear, however, that the high opinion of street trees is one that is shared across cultures and neighbourhoods (SCHROEDER and FLANNIGAN, 2005). Caution ought therefore be applied to drawing general conclusions from the specific issues found in these surveys but not perhaps the overall positive perspective that residents have towards street trees.

The positive attitude to nearby street trees covers a range of street tree species and management techniques providing evidence that current visual amenity measurement tools (e.g. HELLIWELL, 2004) are too narrow or too professionally defined in their outlook because they fail to recognise characteristics of trees that are appreciated by the public. Such measurement tools do not, for example, identify the diverse range of benefits of street trees as described earlier in Table 4. Moreover, evidence is emerging that suggests there is a universal appreciation of the visual appearance of trees irrespective of their species, how they are managed or where they are located (SCHROEDER and FLANNIGAN, 2005). Such a consistent high appreciation of the visual attractiveness of both pollarded and non-pollarded trees also indicates that the various physical attributes of trees measured by Arboriculturists for 'visual amenity' have little relevance to non-professionals. Further research would be required to consider people's attitudes to trees in private ownership, where Tree Preservation Orders predominate and the measurement of amenity is most frequently made, before detailed conclusions could be drawn on this matter.

Such positive reaction expressed by the majority of residents to their nearby street tree, as found in these case studies in south west England, contradicts the conclusions of the wider UK literature (HITCHMOUGH and BONUGLI, 1997; GILBERT, 1996) that suggested residents tended to have an aversion to nearby trees. Future strategic planning, particularly at a local level during the creation of Local Authority tree strategies, for example, would be improved by considering the views of residents before drawing conclusions about their attitudes to street trees. The minority that openly dislike trees near their property should not necessarily be the focus of tree management decisions by politicians or tree managers. The phrase "I love trees but..."

clearly reflected the views of some residents (Figure 3) but should no longer be the axiom used to describe a more general attitude to trees. The results indicate both positive and negative attitudes to street trees but, overall, positives outweigh the negatives in all three case studies.

Conclusions

The negative response to trees that has been so prominently reported in the UK literature does need some explanation. The positive overall opinion to street trees reported in this paper is broadly equivalent, but opposite, to that portrayed by the negative response of Ayr residents to the prospect of tree planting near their homes (HITCHMOUGH and BONUGLI, 1997). Residents, it could be argued, are more likely to choose an environment to live in that satisfies their basic needs. Street trees might figure highly in the decision to live in or avoid a particular area, hence these responses. Those that complain about trees may well be those that did not consider the annoying attributes of trees prior to moving in or have lived there for so long that age related issues occur. The effect of age on tree appreciation is clearly one factor that requires further investigation.

Gaining knowledge about specific attitudes to street trees was successfully achieved using this methodology, which was a key purpose of this study. Further work is needed to consider issues relating to species characteristics and to extend the survey to other areas of the UK. Individual responses suggest complex motivations driving perceptions of street trees particularly as demographic factors appear to have little relevance in influencing attitudes to trees. HITCHMOUGH and BONUGLI (1997) appeared to have recognised this by extending their research to consider factors relating to "complexity of planting structures and degree of maintenance care of respondents' front gardens". Such evidence was collected to discern "...any obvious trends between the aesthetic and functional preferences evident in householder gardens and attitudes towards planting in their street." Despite the common sense notion that such factors might impact on attitudes to street trees no such relationship was found to exist.

Specific investigations of the perceived negative effects of age and ill health on attitudes to street trees were subsequently undertaken in order to look beyond straightforward demographic factors. Results indicate that ill health has no significant impact on overall opinion to street trees although age is a factor. Tree managers could reduce the burden on elderly residents, particularly over the issue of tree debris, by diverting some of their budget to leaf removal from affected properties. This would be in addition to any normal street cleansing operations and is a more sustainable tree management option than pruning or tree removal and is more responsive to residents' needs. Many communities have programs that provide services for senior citizens, and gardening assistance could be coordinated through such programs. There is scope for volunteer groups who are interested in protecting and improving the local environment to help as an extra way to win public support for trees in the community.

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Appendix A

The following questions were added to the survey provided by SCHROEDER and RUFFOLO (1996) to address specific issues relevant to the case study areas.

2a. Please select the statement below which most represents your feelings about the tree outside your house.

- I like trees close to my home and this one does not cause me <u>any</u> trouble ☐
- The tree causes me <u>some</u> nuisance but I like having it there ☐
- The tree causes me <u>a lot</u> of nuisance and I would like to see it removed ☐
- I do not notice this tree near my home ☐

Attitudes to pruning were sought through the following questions. (i) was put to those residents living adjacent to pollarded trees whilst (ii) was put to those living adjacent to non-pollarded trees.

(i) 2b.
- I like the fact that these trees are pruned regularly ☐
- I would prefer these trees not to be pruned so regularly ☐
- I do not notice if these trees are pruned or not pruned ☐

(ii) 2b.
- I like the fact that these trees are not pruned regularly ☐
- I would prefer these trees to be pruned more regularly ☐
- I do not notice if these trees are pruned or not pruned ☐

Table A1 lists the descriptions of benefits and annoyances used in this survey that are in addition, or are semantically different, to those posed by SCHROEDER and RUFFOLO (1996), which are also listed for comparison.

This survey	Schroeder & Ruffolo (1996)
Benefit	
Gives shade in garden	Gives shade
Gives shade in home	
Annoyance	
Actual root damage to property, pavement, drive, wall, drains etc	Roots too close to surface
Fear of root damage to property, pavement, drive, wall, drains etc	Sidewalk damaged by tree roots
	Roots clog sewers
Blocks street light	Makes street or yard dark
Blocks view from property	Blocks view
Blocks sun to garden	Blocks sun so lawn won't grow
Blocks sun into home	
Branches overhang garden	
Fearful tree might fall over in storms	

The questions investigating the physical ability of respondents based on their age and their health.

14b. Does your age limit you in vigorous activities such as running, lifting heavy objects or participating in strenuous sports?

☐ Yes, limited a lot ☐ Yes, limited a little
☐ No, not limited at all ☐ Prefer not to answer

14c. Does your age limit you in moderate activities such as moving a table, pushing a vacuum cleaner, bowling or gardening?

☐ Yes, limited a lot ☐ Yes, limited a little
☐ No, not limited at all ☐ Prefer not to answer

15a. In general, would you say your health is

☐ Excellent ☐ Very Good ☐ Good ☐ Fair ☐ Poor

15b. Does your health limit you in vigorous activities such as running, lifting heavy objects, participating in strenuous sports?

☐ Yes, limited a lot ☐ Yes, limited a little
☐ No, not limited at all ☐ Prefer not to answer

15c. Does your health limit you in moderate activities such as moving a table, pushing a vacuum cleaner, bowling, playing golf or gardening?

☐ Yes, limited a lot ☐ Yes, limited a little
☐ No, not limited at all ☐ Prefer not to answer

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Residents' Attitudes Toward Street Trees in the UK and U.S. Communities

Herbert Schroeder, John Flannigan, and Richard Coles

Abstract. Research on residents' attitudes has shown that street trees are highly valued elements of the urban environment and that their benefits far outweigh their annoyances. Much of this research was done in communities in the United States, and it is uncertain whether the findings can be generalized to other communities or countries. We compared residents' opinions of street trees, perceptions of the benefits and annoyances trees provide, and preferences for tree size, shape, and growth rate between three communities in the United States and the United Kingdom. Overall, opinions of nearby street trees were positive and did not differ between the two UK communities and the U.S. community. Respondents in the UK communities rated annoyances as more serious, shade as less of a benefit, and physical benefits as more significant than did the residents of the U.S. community. Respondents in the two UK communities also preferred smaller trees with slower growth rates. Although these comparisons cannot be used to make inferences about differences between the entire United Kingdom and United States, they do suggest some specific ways in which community characteristics such as climate and proximity of trees to houses may contribute to variation in attitudes toward trees.

Key Words. Attitudes; benefits; residents; street trees; United Kingdom; United States.

The perceptions and attitudes of urban residents regarding street trees and vegetation in their communities have been well researched using visual simulation methods (Kalmbach and Kielbaso 1979; Schroeder and Cannon 1983; Sheets and Manzer 1991; Sommer et al. 1993b) and questionnaires asking residents about street trees in front of their homes (Sommer et al. 1989, 1990, 1993a; Schroeder and Ruffolo 1996). These studies have consistently shown that urban residents have a very positive view of trees, and that the annoyances of trees are outweighed by the benefits they provide. Most of these studies, however, have focused on specific cities or towns in North America, and researchers have cautioned against assuming that results from one study will generalize to other communities, cultures, and climatic zones.

In this article, we present an initial attempt to compare attitudes toward street trees between residents of selected communities in the United Kingdom and the United States. We combined data from a new survey of two communities in southwest England (Flannigan 2005) with data from an earlier study in a midwestern U.S. community (Schroeder and Ruffolo 1996) to explore how opinions of street trees and perceptions of the benefits and annoyances of trees vary across residents from communities located in different countries.

Concerns over the generalizability of research on attitudes toward street trees seem well founded in light of the few studies that have examined tree preferences outside the United States. For example, Williams (2002) discovered a greater appreciation for medium-sized trees in Australia as compared with the larger street trees preferred in the United States (Kalmbach and Kielbaso 1979; Schroeder and Cannon 1983). Fraser and Kenney (2000) found that Canadian residents with cultural backgrounds from different parts of the world had dramatically different preferences for the presence, size, and kinds of trees near their homes. In Scotland, Hitchmough and Bonugli (1997) found little support for street tree planting among residents of treeless streets, suggesting that the shade-casting role played by trees is appreciated more in sunnier locations such as the midwestern United States than in cooler, less sunny locations like the northern United Kingdom.

General arboricultural texts in the United Kingdom tend to echo Hitchmough and Bonugli's (1997) negative findings. Eminent UK arborists have described the "I love trees but . . ." phenomenon. Giles Biddle (quoted in Clouston and Stansfield 1981, p. 17), for example, has stated that, "Perhaps one of the most commonly heard cries is 'I like trees, but not in front of my house.'" Peter Annett (quoted in Baker 1984, p. 46) adds, "How often have we heard 'I do not like trees because . . . ,'" whereas Derek Patch (quoted in *Horticulture Week* 1994, p. 11) has described how "Street trees are often unloved by the public . . . ." Dobson and Patch (1997, p. 1)

developed this theme further, characterizing the public's attitude as "I love trees, but . . . *not-in-my-back-yard.*"

Solihull Metropolitan Borough Council's Tree Strategy expresses the equally negative view that "Those very same trees that make Solihull a pleasant town to live and work are, for many residents, a source of frustration" (Anon 2003, p. 7). As another example, after someone had secretly planted trees in residents' front gardens, a local authority tree officer was quoted in a national newspaper as saying, "It's refreshing to see someone planting trees rather than what we all too often see, which is people wanting to take them out" (*Daily Mirror* 2004). Such views appear to have been long held by professionals in the United Kingdom. An article from over 35 years ago states, "Let it be recognised that many urban trees are too large for their positions . . . many often cause inconvenience to those against whose property they are situated" (Riseley 1969, p. 195).

Do residents indeed have a lower opinion of street trees in the United Kingdom than in the United States? Despite the negative reports from arborists, research (e.g., Kaplan and Kaplan 1989) suggests that people's positive responses to vegetation are the result of underlying perceptual and cognitive factors that apply to human beings in general. Several researchers (e.g., Heerwagen and Orians 1993) have hypothesized that evolutionary factors common to all humans create an inborn affinity for nature, particularly for the kind of environments in which humans evolved. Supporting this view, Sommer and Summit (1995, 1996), Sommer (1997), and Summit and Sommer (1999), found similar preferences across diverse international communities for tree shapes resembling those in the African savanna.

Moreover, the existence of strong legal tree protection measures (Anon 1990) and the annual planting of one million trees during National Tree Week suggest that trees are in fact valued in the United Kingdom. O'Brien and Claridge (2002) and Coles and Caserio (2004) describe strong support for urban and rural woodlands and trees in the United Kingdom. One study about the public's attitude to the environment and quality of life in the United Kingdom found that the loss of trees and hedgerows was becoming a growing cause for concern, rising from 17% of respondents in 1986 to 46% in 2001 (DEFRA 2002). Finally, the experience of one author of this article, while working as a local authority tree manager in the United Kingdom, strongly suggests that public support for trees exists.

The emphasis on negative public response to trees described in the UK professional literature might indicate that people who genuinely dislike living near trees are more likely to volunteer their opinions in the form of complaints to the local authority, whereas residents who hold less negative views may remain silent unless their opinions are actively sought out. It may also reflect an asymmetry in the impacts of benefits and annoyances on community residents. That is, the aesthetic and other benefits of a tree in front of a person's home accrue not only to that person, but also to their neighbors. The annoyances of the tree (fallen leaves, shaded garden, and damaged pavement) on the other hand are more likely to impact the property owner exclusively. Thus, a person might want to be rid of the annoyances from the particular tree in front of their own home while still appreciating the benefits of trees in the neighborhood at large. This would be consistent with the sentiment of "I like trees, but not in front of my house" reported previously. In any case, it is clear that more in-depth investigations of UK residents' attitudes toward street trees are needed to understand the actual impacts of the urban forest—both positive and negative—on residents. Such knowledge could be considered crucial if the resource is to be managed optimally.

As a first step toward obtaining this knowledge, Flannigan (2005) surveyed two communities in southwest England using the methodology of Sommer et al. (1989). This survey methodology was first developed in California cities and was later applied to a Chicago suburb by Schroeder and Ruffolo (1996). It provides a detailed assessment of residents' opinions and perceptions of both positive and negative features of the street trees immediately outside their homes. Flannigan's study established that, with suitable modifications, Sommer's survey method could be adapted to work with residents of the United Kingdom. In this article, we use the data from Flannigan's surveys along with that from Schroeder and Ruffolo's earlier study to take a first look at similarities and differences in attitudes toward street trees between residents of communities in the United Kingdom and the United States.

SURVEY METHOD

Flannigan (2005) surveyed the communities of North Somerset and Torbay in southwest England in 2003 using a modified version of the questionnaire that Schroeder and Ruffolo (1996) had used in the Chicago suburb of Downers Grove in 1988 and 1990. In all three communities, respondents were asked to rate their overall satisfaction with a specific street tree directly in front of their home, the significance of various benefits and annoyances associated with that tree, and their satisfaction with the size, shape, and growth rate of the tree. Survey forms were distributed by mail along with a cover letter explaining the purpose of the survey and a prepaid envelope for returning the survey.

The Downers Grove questionnaire was modified for use in Flannigan's study. A few questions that were not relevant to North Somerset and Torbay were removed, for example, questions about birds, squirrels, and bees being attracted to the tree (a common occurrence in Downers Grove but not in North Somerset and Torbay). Some more specific questions were added regarding problems that were of particular concern to the UK communities, for example, root damage (a significant liability issue in the United Kingdom) and shade-

related annoyances (as a result of the United Kingdom's cloudier climate). The precise wording and spelling of some items were also changed to accord with British use. For example, where Schroeder and Ruffolo's survey referred to "yards," the North Somerset/Torbay survey said "gardens."

In both the original Downers Grove survey and the more recent survey of North Somerset and Torbay, the households to be surveyed were selected in consultation with the local tree management authority to address their information needs. In Downers Grove, the survey was mailed to 662 households selected by the village forester to represent eight species of street trees that he wanted to evaluate. In North Somerset, where almost all streets are characterized by pollarded trees, a random sample of 20% of streets was selected. The survey was mailed to all 119 residents on those 16 streets with a pollarded tree outside their home. In Torbay, two distinct groups of residents were surveyed. The survey was posted to all 22 properties in the district adjacent to regularly pollarded street trees to allow a comparison with attitudes toward the pollarded trees in North Somerset. Attitudes toward pollarded trees were of particular interest because of the prevalence of this management technique in the United Kingdom and the dramatic effect it has on the appearance of a tree. In addition, the Torbay survey was sent to all 71 residents of two streets which, according to the Torbay Arboricultural Manager, were characterized by residents' unhappiness with their nonpollarded, larger street trees. Thus, the individual surveys are not statistically random samples of their respective communities, but represent groups of residents who were of particular interest for management and research.

The evaluated trees in Downers Grove were typically located between the paved sidewalk and the street with an open lawn separating the tree from the house (Figure 1). The homes surveyed in North Somerset and Torbay, by contrast, mostly had enclosed front gardens. These were generally smaller than the front lawns in Downers Grove so that the evaluated trees were situated closer to people's houses (Figure 2).

Despite the modifications to the survey questionnaire, most of the questions on Flannigan's survey were substantially the same as on Schroeder and Ruffolo's. We combined the corresponding survey responses from the three communities to create a single data set, which we used to compare responses from North Somerset and Torbay with those from Downers Grove. (For survey items on which the wordings varied between the surveys, the British wordings are used in the presentation of results subsequently.) It should be noted that because the respondents of these surveys were not randomly sampled from their respective nations, the results of these comparisons do not necessarily correspond to general differences between the populations of the United Kingdom and the United States.

Figure 1. Street trees in Downers Grove, Illinois, U.S.

RESULTS

Response Rates

The overall response rate for the North Somerset/Torbay survey was 61%, resulting in 130 usable surveys. The response rate for the earlier Downers Grove survey was 46% with 307 usable surveys. These response rates are reasonably high given that no follow-up mailings or reminder cards were sent.

Demographic Information

Both the Downers Grove and the North Somerset/Torbay survey respondents were almost equally divided between men and women. Slightly more of the respondents were female in the North Somerset/Torbay survey (55%) than in the Downers Grove survey (50%), but this difference was not statistically significant. The respondents in the North Somerset/Torbay survey were significantly older than their American counterparts. In the Downers Grove survey, 47% of participants were under 40 and 37% were over 50 as compared with 14% under 40 and 64% over 50 in the North Somerset/Torbay survey. A large majority of respondents owned their own homes in both North Somerset/Torbay (94%) and Downers Grove (97%).

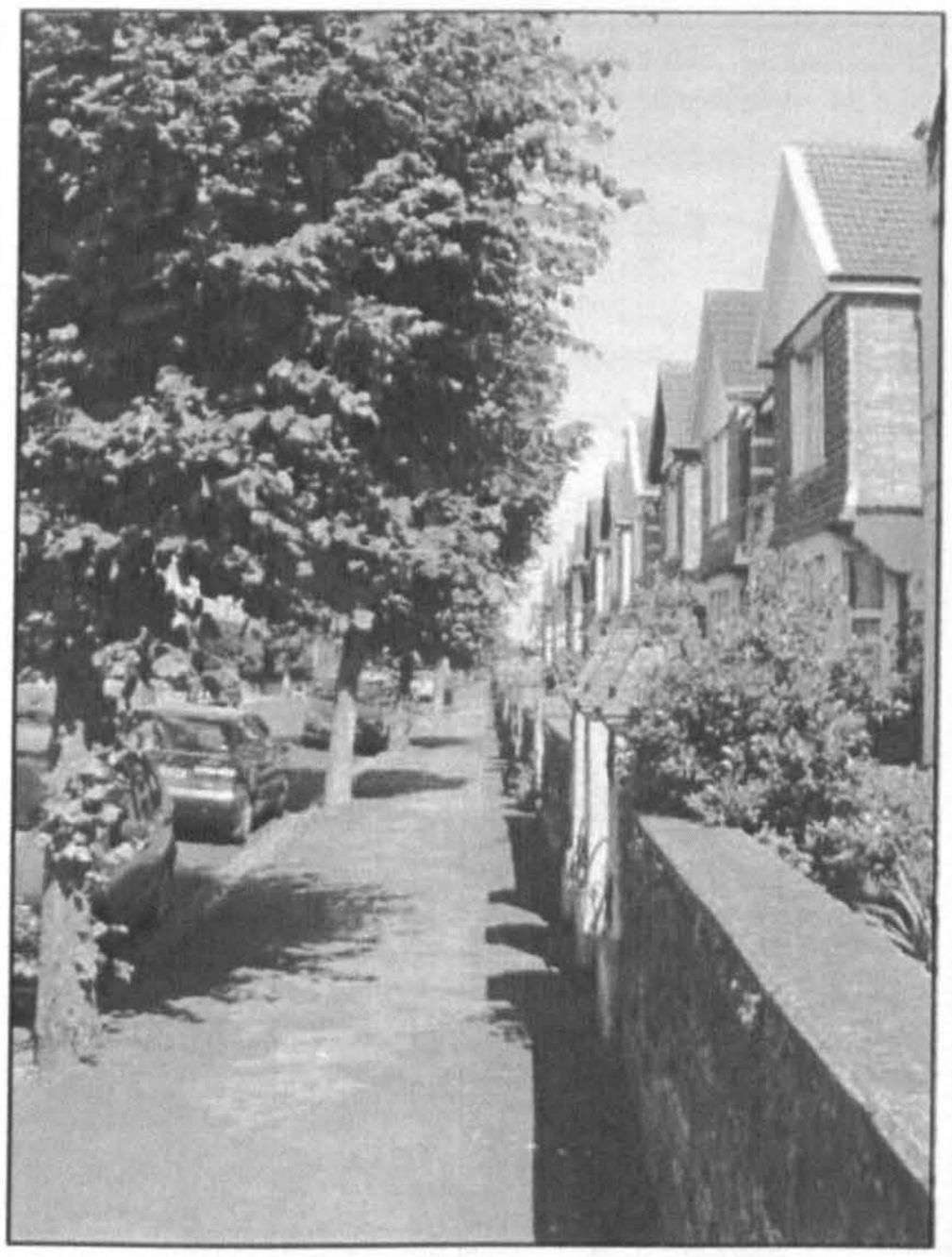

Figure 2. Pollarded street trees in North Somerset, UK.

Although differences between the educational systems in the United States and Britain make a precise comparison difficult, the educational levels of the two groups did appear to be roughly comparable. A high school diploma in the United States, usually obtained at age 17 or 18, corresponds approximately to the GCSE, CSE, and O levels in England, which are attained at age 16. In the Downers Grove survey, 84% of respondents had completed this level and gone on to at least some additional education in college or technical school compared with 70% in the North Somerset/Torbay survey. Graduate school in the United States is equivalent to postgraduate education in the United Kingdom. In the Downers Grove survey, 30% had at least some education at this higher level compared with 26% in the North Somerset/Torbay survey.

Income levels are also difficult to compare between the Downers Grove and the North Somerset/Torbay surveys as a result of inflation and the fluctuating exchange rate between the two countries during the interval of years between the Downers Grove and the North Somerset/Torbay surveys. In addition, there was a high proportion of nonresponses to the income question in both surveys (40% in the Downers Grove survey and 70% in the North Somerset/Torbay survey). Given these factors, a meaningful comparison of annual income between the Downers Grove and North Somerset/Torbay respondents did not appear possible. All of the areas that were surveyed, however, could generally be characterized as middle-income neighborhoods.

Although we did not ask respondents to indicate their race, census data for the three communities in 2000 show that 90% of the population in Downers Grove and 99% in both North Somerset and Torbay were white, making it likely that most of the respondents in both surveys were white.

Respondents' Evaluations of Street Trees

A comparison of responses at the level of individual tree species between the North Somerset/Torbay and the Downers Grove surveys did not seem feasible because there were not enough tree species in common between the two surveys and because differences in visual form between species in the North Somerset/Torbay survey were obscured by the pollarding of trees. (None of the trees in the Downers Grove survey were pollarded.) The analysis therefore focused on differences in responses to corresponding questions between the Downers Grove and the North Somerset/Torbay surveys averaged over all tree species.

Overall Opinion

Respondents in both surveys had a high overall opinion of the tree outside their home (Table 1). A large majority of respondents rated their tree as "good," "very good," or "excellent." A Mann-Whitney U-test (Hays 1973) revealed no significant difference in overall opinion between the Downers Grove and North Somerset/Torbay surveys ($P = 0.770$).

Benefits and Annoyances

Residents were asked to rate the degree to which they received various benefits and annoyances from the tree outside their home using a four-point scale from "none" to "major." Figure 3 compares the mean ratings of tree benefits in the North Somerset/Torbay and the Downers Grove surveys. Respondents in both surveys gave high ratings to "pleasing to the eye," "enhances look of garden and home," and "brings nature closer." Two of the lowest rated benefits were "cools home in summer" and "flowers on tree."

Table 1. Respondent's overall opinion of the tree in front of their home.

	North Somerset/Torbay		Downers Grove	
Opinion	N	%	N	%
Very poor	9	7	11	4
Poor	6	5	24	8
Good	38	30	102	35
Very good	45	36	89	30
Excellent	27	22	67	23

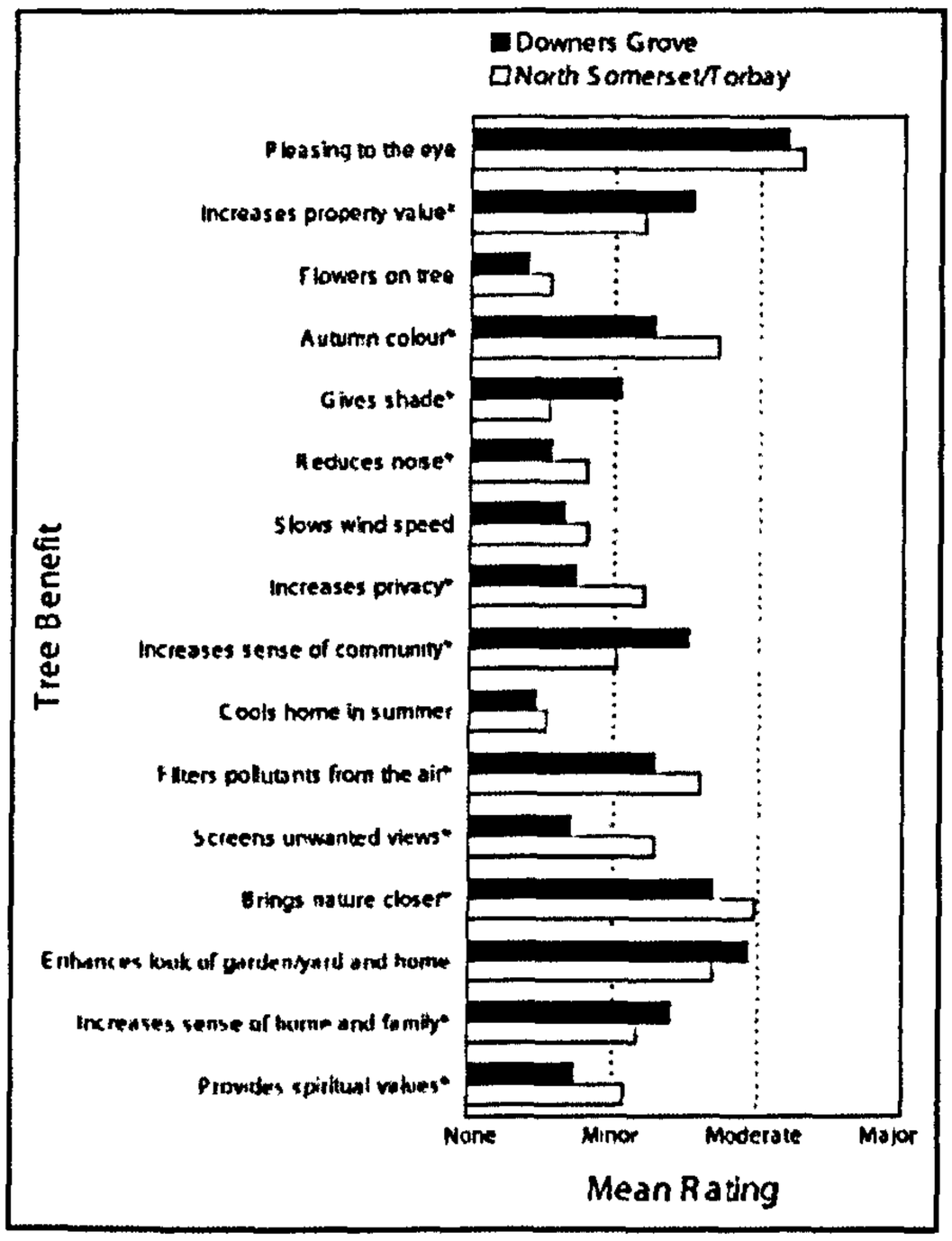

Figure 3. Mean rating of street tree benefits. (An asterisk following a benefit indicates that the Kruskal-Wallis test for the difference between Downers Grove and North Somerset/Torbay is significant at $P < 0.05$.)

Respondents in the North Somerset/Torbay survey rated autumn color, noise reduction, increased privacy, filtering air pollutants, screening unwanted views, bringing nature closer, and spiritual values significantly higher as benefits than respondents in the Downers Grove survey. Increased property value, shade, sense of community, and sense of home and family were given significantly higher ratings in the Downers Grove survey.

Figure 4 compares the mean ratings for tree annoyances for the North Somerset/Torbay and Downers Grove surveys. The annoyances received from trees were, in general, rated as less prominent than the benefits in both surveys. Fallen leaves in autumn and general debris were rated as two of the worst annoyances in both surveys. All of the annoyances were rated as significantly more important in the North Somerset/Torbay survey than in the Downers Grove survey.

To further identify the pattern of differences between the North Somerset/Torbay and the Downers Grove surveys, we performed a principal components analysis of benefit and annoyance ratings on the combined set of surveys from both countries. Principal components analysis is a statistical technique for describing the pattern of variation in a large set of variables in terms of a smaller set of categories or factors based on the observed intercorrelations between the variables (Jackson 1991). Our analysis parallels Sommer and Sommer's (1989) principal components analysis of street tree annoyances and benefits in California.

We included six factors in our final analysis. Five of these factors had eigen values greater than 1, which is the customary criterion for inclusion of a factor in the solution (Kaiser 1960). The sixth factor had an eigen value slightly less than 1, but we chose to retain it in the solution because it improved the interpretability of the factor structure. To aid in interpreting the factors, the six-factor solution was subjected to a varimax rotation. The rotated factor matrix is shown in Table 2.

Three of the six factors (2, 3, and 6) define groupings of related benefits, two factors (1 and 4) define groupings of annoyances, and one factor (5) includes both a benefit and an annoyance. The headings at the tops of the columns in Table 2 represent our attempt to characterize the benefits and/or annoyances that load on the factor in that column.

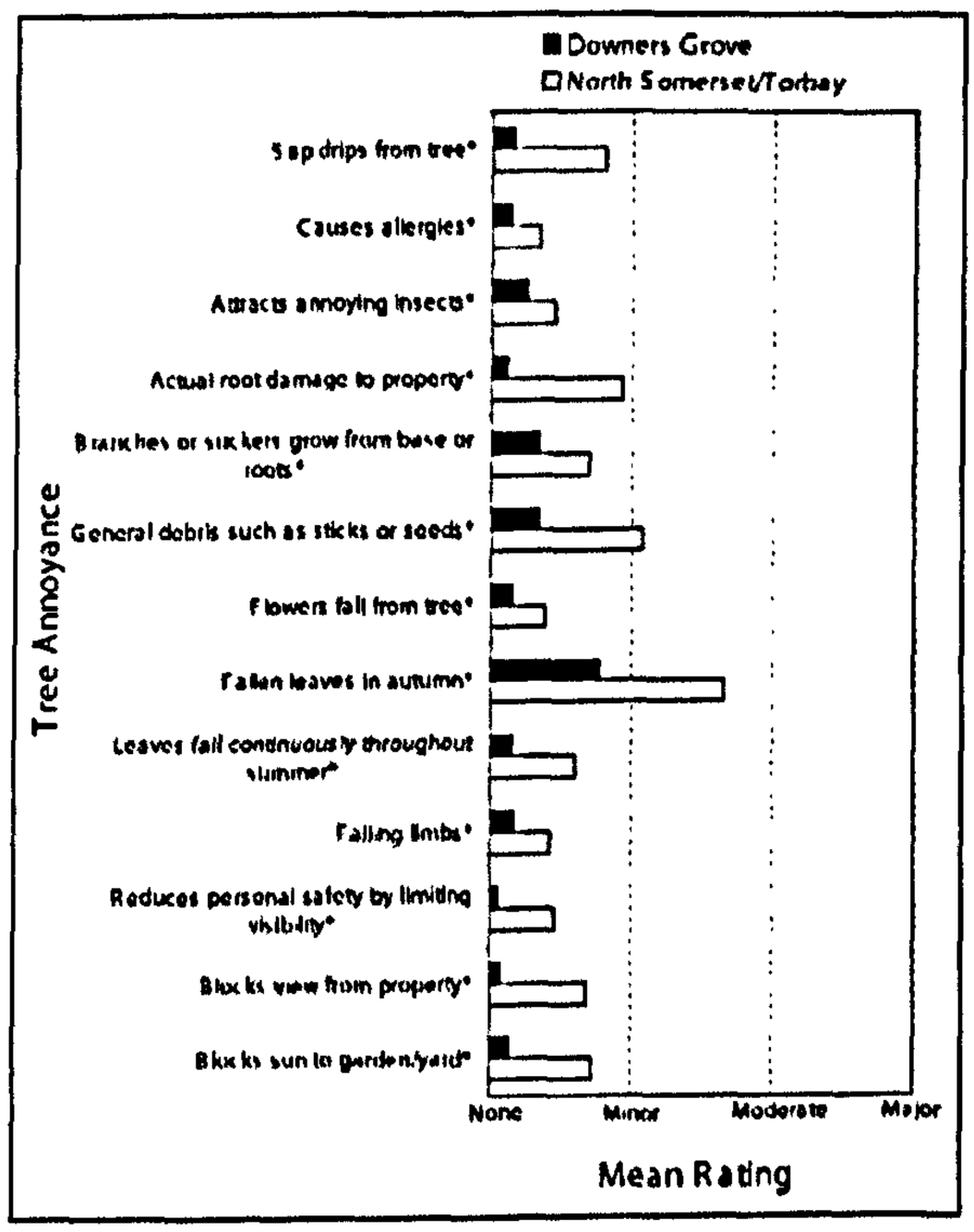

Figure 4. Mean rating of street tree annoyances. (An asterisk following an annoyance indicates that the Kruskal-Wallis test for the difference between Downers Grove and North Somerset/Torbay is significant at $P < 0.05$.)

Table 2. Varimax rotated factor loadings of street tree benefits and annoyances.*

	Factors					
	1. General annoyances	2. Intangible benefits	3. Physical benefits	4. Insects and exudation	5. Seasonal aesthetics	6. Shade
Benefits						
Enhances look of garden and home	—	0.832	—	—	—	—
Increases sense of home and family	—	0.804	—	—	—	—
Brings nature closer	—	0.795	—	—	—	—
Increases property value	—	0.768	—	—	—	—
Pleasing to the eye	—	0.719	—	—	—	—
Increases sense of community	—	0.712	—	—	—	—
Provides spiritual values	—	0.629	—	—	—	—
Filters pollutants from the air	—	0.515	(0.493)	—	—	—
Autumn color	—	0.511	—	—	(0.416)	—
Increases privacy	—	—	0.820	—	—	—
Reduces noise	—	—	0.791	—	—	—
Slows wind speed	—	—	0.779	—	—	—
Screens unwanted views	—	—	0.735	—	—	—
Cools home in summer	—	—	0.615	—	—	(0.495)
Flowers on tree	—	—	—	—	0.780	—
Gives shade	—	—	—	—	—	0.676
Annoyances						
Actual root damage to property	0.753	—	—	—	—	—
Leaves fall continuously throughout summer	0.736	—	—	—	—	—
Falling limbs	0.735	—	—	—	—	—
General debris such as sticks or seeds	0.731	—	—	—	—	—
Fallen leaves in autumn	0.723	—	—	—	—	—
Reduces personal safety by limiting visibility	0.682	—	—	—	—	—
Blocks sun to garden	0.680	—	—	—	—	—
Blocks view from property	0.677	—	—	—	—	—
Flowers fall from tree	0.572	—	—	—	(0.515)	—
Branches or suckers grow from base or roots	0.513	—	—	—	—	—
Sap drips from tree	(0.434)	—	—	0.588	—	—
Causes allergies	—	—	—	0.783	—	—
Attracts annoying insects	—	—	—	0.748	—	—

*Only factor loadings greater than 0.40 are shown. When an item loads on more than one factor, the smaller of the loadings is shown in parentheses.

The first factor (general annoyances) accounts for 18.0% of the variance in benefit and annoyance ratings and encompasses most of the annoyance items on the survey. This factor includes physical damage from roots, falling debris of all kinds, branches or suckers, and obstructed views and sunlight. Dripping sap is also weakly associated with this factor.

The second factor (intangible benefits) accounts for 17.6% of the variance. The items that load on this factor include a variety of subjective and aesthetic benefits plus the economic benefit of increased property value. The fact that property value is associated with this factor suggests that the respondents may see housing prices as significantly related to intangible and aesthetic values. The environmental benefit of filtering air pollutants is also somewhat associated with this factor. This may be because air quality is less immediately perceptible than other physical benefits such as reduced noise and wind speed. People may also associate clean air with general ideas of positive environmental and natural quality, which might tend to tie it in with the more subjective benefits.

The third factor (physical benefits) accounts for 12.8% of the variance in responses and includes the more tangible, physical benefits of cooling the home in summer, reducing noise, and slowing wind speed along with the visual benefit of screening unwanted views. Screening may be associated with physical benefits because it is based on the tree's ability to block the view physically. Increased privacy, which clearly is related to screening, also falls into this group. Filtering air pollutants is also weakly associated with this factor.

The fourth factor (insects and exudation), which accounts for 7.2% of the variance in responses, includes three items relating to insects and to substances exuded or emitted by trees. It includes allergies, which are commonly attributed to pollen or other substances given off by trees. A possible explanation for the co-occurrence of allergies and insects on

Table 3. Comparison of mean factor scores between Downers Grove and North Somerset/Torbay surveys.

	Factors					
Survey	1.* General annoyances	2. Intangible benefits	3.* Physical benefits	4. Insects and exudation	5. Seasonal aesthetics	6.* Shade
North Somerset/Torbay	0.625	0.033	0.363	0.098	0.096	–0.598
Downers Grove	–0.393	–0.021	–0.228	–0.062	–0.061	–0.375

*t-test for difference between North Somerset/Torbay and Downers Grove significant, $P < 0.0001$.

this factor might be that some people blame tree flowers both for attracting insects and for causing pollen-related allergies. Insects and sap may be associated because sap attracts certain kinds of insects or perhaps because some people identify honeydew produced by insects as a type of sap.

The fifth factor (seasonal aesthetics) accounts for 4.8% of the variance and consists of the benefit of flowers on the tree together with the annoyance of flowers falling from the tree. It also includes a weaker association with autumn color. Both flowers and autumn color are seasonal effects related to visual aesthetics.

The sixth factor (shade) includes the benefit of shade plus a weaker association with cooling the home in summer, accounting for 4.6% of the variance.

Effect of Benefits and Annoyances on Overall Opinion

To see how the different groups of benefits and annoyances identified in the principal components analysis are related to residents' overall satisfaction with their street tree, we correlated factor scores from each of the six factors with respondents' ratings of overall opinion. Three factors have significant positive correlations with overall satisfaction. Factor 2 (intangible benefits) has by far the strongest correlation with overall opinion of any of the factors ($r = 0.495$, $P < 0.0001$). Factor 5 (seasonal aesthetics) has a somewhat smaller correlation ($r = 0.217$, $P < 0.0001$), whereas factor 3 (physical benefits) has a weak but significant positive influence on overall opinion ($r = 0.132$, $P < 0.017$). Factor 1 (general annoyances) is the only factor to have a significant negative correlation with overall opinion ($r = -0.119$, $P < 0.032$). The small size of this correlation suggests that, overall, the perceived annoyances of street trees do not have as great an influence on people's satisfaction with the tree as do the perceived benefits.

Comparison of Factor Scores Between Downers Grove and North Somerset/Torbay

Table 3 shows a comparison between factor scores from the Downers Grove and North Somerset/Torbay surveys. The respondents in the two surveys differ significantly on three of the six factors. In the North Somerset/Torbay survey, respondents rated the items associated with factor one (general annoyances) as substantially and significantly more annoying than did respondents in the Downers Grove survey. The respondents in the North Somerset/Torbay survey also rated the benefits associated with factor three (physical benefits) significantly higher than did those in the Downers Grove survey. On the other hand, factor six (shade) was rated substantially and significantly lower in the North Somerset/Torbay survey than in the Downers Grove survey.

Shape, Size, and Growth Rate

There was no significant difference between the North Somerset/Torbay and Downers Grove surveys in respondents' ratings of the attractiveness of their tree's shape. Almost 85% of respondents in both surveys found the shape of the tree outside their home to be at least "somewhat attractive" and over one-third found it to be "very attractive." There was, however, a decided difference between the Downers Grove and North Somerset/Torbay surveys in respondents' evaluations of the size and growth rate of the tree outside their home (Table 4). No respondents in the North Somerset/Torbay survey thought their tree was too small compared with 53% in the Downers Grove survey. Thirty-nine percent of respondents in the North Somerset/Torbay survey thought their tree was too large in contrast with less than 1% in the Downers Grove survey. A similar difference appeared when respondents stated their satisfaction with their tree's growth rate. No respondents in the North Somerset/Torbay survey thought the tree outside their home grew too slowly compared with approximately one-third in the Downers Grove survey. No respondents in the Downers Grove survey considered that the

Table 4. Respondent opinion of tree size and growth rate.

	North Somerset/Torbay		Downers Grove	
	N	%	N	%
Size of tree*				
Too small	0	0	143	53
Just right	76	61	125	46
Too large	48	39	2	1
Growth rate*				
Too slow	0	0	92	33
Good rate	74	73	184	67
Too fast	27	27	0	0

*Mann-Whitney U-test for difference between North Somerset/Torbay and Downers Grove significant, $P < 0.0001$.

tree outside their home grew too fast compared with 21% in the North Somerset/Torbay survey.

No measurements of actual tree size were recorded in the Downers Grove survey. Thus, it is not possible to directly compare the physical sizes of the trees being rated in the Downers Grove and the North Somerset/Torbay surveys. The Village Forester of Downers Grove at the time of the survey, however, noted that some of the trees that were included in the survey had been planted relatively recently and were not yet full grown. This raises the possibility that part of the difference between the Downers Grove and North Somerset/Torbay surveys in evaluations of tree size and growth rate could simply be the result of differences in the ages of the trees respondents were evaluating and not to differences in their preferences for tree size and growth rate.

A comparison with ratings of tree size from a neighborhood tree survey reported by Schroeder and Ruffolo (1996), however, suggests that this is not the case. In that survey, which was done at the same time as the individual tree survey reported here, residents of selected neighborhoods in Downers Grove evaluated street trees in their whole neighborhood, not just the one in front of their house. One of these neighborhoods had a single-species, even-aged population of mature silver maples (*Acer saccharinum*) that formed an arching canopy over the street. On a scale of 1 (too small) to 3 (too large), this neighborhood had an average tree size rating of 2.00, indicating that the residents thought these large, mature trees were "just right" in size. The average tree size rating of 2.39 from the North Somerset/Torbay survey was significantly higher ($F[2,603] = 141.05$, $P < 0.0001$), indicating that, on average, the respondents thought their trees were somewhat too large, although most of their trees were probably physically smaller than the mature silver maples in Downers Grove. Thus, it appears likely that there is a real difference in preferences for tree size with the respondents in the North Somerset/Torbay survey preferring their trees to be smaller than did the respondents in the Downers Grove survey.

DISCUSSION

The findings show that residents in all the communities surveyed held similarly high levels of overall satisfaction with the trees outside their homes. Benefits generally outweighed the annoyances caused by street trees, and overall satisfaction was more strongly related to the intangible benefits of trees than to their physical benefits or annoyances.

A number of significant differences were found between the respondents in the Downers Grove and North Somerset/Torbay surveys. Residents of North Somerset/Torbay evaluated all annoyances as more serious than did the Downers Grove respondents. North Somerset/Torbay respondents rated most physical benefits as significantly more important than the Downers Grove respondents but considered shade to be less important as a benefit of their trees. Respondents in the North Somerset/Torbay survey appeared to prefer smaller trees and trees with slower growth rates than did the residents of Downers Grove.

There are several possible explanations for the observed differences in attitudes between respondents in the Downers Grove and North Somerset/Torbay surveys. One possibility is that some differences, particularly regarding intangible benefits, may be the result of cultural differences between the communities. For example, in the North Somerset/Torbay survey, the benefits of "brings nature closer" and "provides spiritual values" were rated significantly higher than in the Downers Grove survey, whereas in the Downers Grove survey, "increases sense of community" and "increases sense of home and family" were rated significantly higher. This suggests that there may be different underlying values influencing residents' evaluations of trees. Whether this stems from cultural differences and whether such differences, if they exist, operate at the community, regional, or national level cannot be determined from our data. Nevertheless, this result suggests that further research to investigate the possible role of culture in tree attitudes might be worth pursuing.

Another explanation for differences, particularly in ratings for tree shade, has to do with the differing climates between the regions where the surveys were done. The Downers Grove survey was done in a midwestern U.S. community, where summers can be very hot and shade is greatly appreciated for shelter from the midday sun. The mean daily maximum temperature in Chicago, the nearest large city to Downers Grove, is 28.7°C (83.7°F) compared with 22.3°C (72.1°F) in London (World Meteorological Organization 2006). The United Kingdom, on the other hand, experiences lower levels of solar radiation combined with high levels of rainfall, leading residents to value direct sunshine quite highly. London experiences an average of 145 days of precipitation per year compared with 94 for Chicago (World Meteorological Organization 2006). In such a cool, cloudy climate, trees that cause shade may be considered an annoyance rather than a benefit.

Differences in the spatial layout of residential properties may also be a factor contributing to differences in evaluations of certain benefits and annoyances of street trees. Less physical space relative to population means that properties and the associated infrastructure in UK communities tend to be arranged closer together. In the United States, which is generally less densely populated than the United Kingdom, suburbs are more spread out with larger lots, resulting in street trees growing further away from the home.

Figures 1 and 2 illustrate the differences in street layout between the communities in these surveys. Trees on the North Somerset/Torbay properties generally grow closer to property boundaries and to the actual building itself. Such close proximity between tree and building is likely to increase the impact on residents of annoying tree attributes such as

falling debris and root damage while simultaneously increasing advantages gained from physical benefits such as slowing wind speed. The relative proximity of trees to North Somerset/Torbay residences also would result in more shade cast over the home compared with Downers Grove, exacerbating the effect of climate noted here.

Proximity of trees to houses in combination with a cooler, cloudier climate could also explain the preference for smaller tree size and slower growth rates in North Somerset and Torbay. Smaller, slower growing trees are less likely to physically dominate homes and therefore keep annoyances to a minimum. Downers Grove residents by contrast would prefer larger trees that provide more shade and which, being farther away, would not tend to dominate the home so much.

Increasing age of the home owner can have a negative impact on opinions toward trees. Sommer et al. (1989) reported that opinions of trees within their study did not relate to any demographic variable except for age, in which older householders had a lower opinion of trees than younger residents. Flannigan (2005) also found a significant correlation between increasing age and negative opinions of trees. In our surveys, North Somerset and Torbay respondents tended to be older than those in Downers Grove, which could be another explanation for their higher ratings of annoyances.

Differences in species and management practices between Downers Grove and North Somerset/Torbay must also be considered as a possible source of variation in responses to benefits and annoyances. The three communities all had different combinations of tree species, and the practice of pollarding, which was commonplace in North Somerset and Torbay, did not occur at all in Downers Grove. Pollarding has a significant impact on the appearance of a tree and may tend to obscure the visual distinctions between the natural forms of species. It was not possible to compare ratings of individual species across communities in this data set, but the fact that ratings of overall satisfaction and the trees' visual appearance were very similar across communities suggests that the visual appearance of "urban nature" is a valued component of urban life irrespective of variations in size, pruning practices, and species-specific characteristics.

A final factor that might also have contributed to the differences in responses is the survey sampling procedure, which varied depending on the needs and interests of the local tree manager and researcher. In particular, one group of respondents in Torbay was specifically chosen to learn about residents who the local arborist thought disliked their trees. This sampling strategy would seem to increase the likelihood that the North Somerset/Torbay survey respondents would have more negative attitudes toward trees than their Downers Grove counterparts. In fact, however, the Torbay residents who were selected because of their supposed dislike of trees did not have significantly lower ratings of overall opinion than the other respondents, and their ratings of most annoyances were not consistently higher than in the other communities.

Finding that residents in geographically and culturally diverse communities held equally strong positive opinions about the trees outside their home is consistent with theories that appreciation of vegetation is an inherited consequence of human evolution (Heerwagen and Orians 1993). Another possible explanation, however, is that most inhabitants in these surveys actively chose to purchase a property with a street tree directly outside their home (and likely with trees in front of neighboring properties as well), and therefore both survey samples could be considered biased toward people who like street trees. Such a self-selection factor among residents could help explain the consistently high overall satisfaction with trees across such a disparate group of tree species and management regimes.

CONCLUSIONS

Our survey results do not lend support to the view that UK residents consistently have negative attitudes toward trees in front of their houses. If that were the case, then the respondents in the North Somerset/Torbay survey would be expected to give lower ratings to their trees than the Downers Grove respondents. In fact, respondents from all three communities had equally positive overall opinions of their street trees, although they did differ somewhat in their evaluations of particular benefits, annoyances, and attributes of the trees. We believe that the most prominent of these differences are related to variations in climate, the layout and size of properties, and the proximity of trees to houses. Possibly as a result of a cooler, cloudier climate and closer proximity of trees to houses and gardens, respondents in the North Somerset/Torbay survey preferred smaller trees, did not regard shade as a major benefit, and were more aware of annoyances related to the physical size and proximity of the tree. However, these annoyances did not result in lower overall satisfaction with trees in North Somerset/Torbay than in Downers Grove. Intangible and aesthetic benefits appeared to predominate in giving rise to high overall opinions of street trees, despite whatever annoyances the trees caused.

Arborists in both the United Kingdom and the United States should be aware that local conditions of climate and spatial layout of streets and homes may affect the impact that various benefits and annoyances have on home owners and should take this into account when selecting species and locations for planting trees. At the same time, they should not assume that complaints about particular problems with trees imply a generally negative attitude toward street trees among the populace. Community surveys such as the ones used in this research provide a way for arborists to obtain a more complete understanding of people's attitudes toward trees. The analyses reported in this article show that the methodol-

ogy of Sommer et al. (1990) can be adapted to study how attitudes toward trees vary across communities in different countries. In the future, more focused multinational studies, with a closer match among tree sizes, tree species, management techniques, and spatial layout of the street, could help determine how attitudes vary between cultures and climatic zones. Further comparisons between communities within a region could show how attitudes toward trees are influenced by local factors such as available building space, neighborhood age, and urban planning policies. This kind of knowledge could help urban foresters and arborists to tailor tree management to the particular needs and desires of the local community.

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Herbert Schroeder (corresponding author)
Research Social Scientist
USDA Forest Service
North Central Research Station
1033 University Place, Suite 360
Evanston, IL 60201, U.S.
hschroeder@fs.fed.us

John Flannigan
Trees Officer
Streets & Open Spaces
North Somerset Council
Weston Court, Oldmixon Crescent
Weston super Mare, BS24 9AU, UK

Richard Coles
Professor
School of Architecture
Birmingham Institute of Art & Design
University of Central England
Birmingham, B7 4DX, UK

Zusammenfassung. Die Erforschung der Anwohnergewohnheiten hat gezeigt, dass Straßenbäume als hochwertige Elemente in der urbanen Umgebung angesehen werden, und dass ihre Vorteile weit über die Nachteile überwiegen. In den amerikanischen Gemeinden wurde viel in dieser Richtung geforscht, und es bleibt unsicher, ob diese Ergebnisse generalisiert und auf andere Gemeinden oder Länder zu übertragen sind. Wir verglichen die Meinungen der Anwohner zu Straßenbäumen, Wahrnehmung der Vor- und Nachteile der Bäume und Präferenzen für Baumgröße, Form und Wachstumsrate in drei Gemeinden in den USA und Großbritannien. Die allgemeine Einstellung zu nahen Straßenbäumen war positiv und unterschied sich nicht zwischen den zwei Gemeinden in Großbritannien und der US-Gemeinde. Die Teilnehmer der englischen Gemeinde bewerteten die Nachteile stärker, Schatten eher als Nachteil und die physikalischen Vorteile deutlicher als die Amerikaner. Die Teilnehmer der zwei englischen Gemeinden bevorzugten eher kleine Bäume mit langsamen Wachstumsraten. Obwohl die Vergleiche nicht genutzt werden können, um Rückschlüsse auf die Unterschiede in ganz Großbritannien und den USA zu ziehen, so geben sie doch einige spezifische Hinweise auf welche Weise die Charakteristika der Gemeinden, so wie Klima und Nähe der Bäume zu Häusern zu Variationen bei der Einstellung gegenüber Bäumen beitragen können.

Resumen. La investigación sobre las actitudes de los residentes ha mostrado que los árboles son elementos del ambiente urbano altamente valorados y que sus beneficios pesan más que sus molestias. Mucha de esta investigación fue hecha en los Estados Unidos, y no podría ciertamente ser generalizada a otras comunidades o países. Se compararon las opiniones de los residentes de calles arboladas, las percepciones de los beneficios y molestias que dan los árboles, y las preferencias por tamaño del árbol, forma y tasa de crecimiento entre tres comunidades en los Estados Unidos y Reino Unido. En todas partes las opiniones fueron positivas y no hubo diferencias entre las comunidades de los dos países. Los encuestados en las comunidades del Reino Unido indicaron las molestias como más serios, sombra como el menor de los beneficios, y beneficios físicos como los más significativos, que los residentes de las comunidades de los Estados Unidos. Los encuestados en las dos comunidades del Reino Unido también prefirieron árboles más pequeños que árboles grandes. A pesar de que estas comparaciones no pueden ser usadas para hacer diferencias en todo Estados Unidos y Reino Unido, ellas sugieren ciertas formas específicas en las cuales las características de las comunidades, tales como el clima y la proximidad de los árboles a las casas, pueden contribuir a la variación de actitudes hacia los árboles.