Empathy-led Digital Adoption towards Happy and Sustainable Workforce

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Abstract. This paper addresses why empathy, as a transdisciplinary engineering methodology, is key to understanding people's readiness to adopt a new technology. The paper highlights the pilot study, which applied the transdisciplinary methodology to implement Building Information Modelling in Architecture and Construction firms. The paper highlights the usefulness, applicability, and impact of the empathy-led methodology in identifying individual psychological, emotional, and intrinsic variables that are usually difficult to capture through methods common in engineering and science. The paper concludes with the key emotional variables identified by this methodology paving the way towards a people-led approach to understanding digital adoption for organisations to create a 'happy and sustainable workforce'. Funded by InterAct, the project comprises the disciplines of Design, Computer Science, and Mechanical Engineering.

Keywords. Transdisciplinary engineering, design thinking, empathy, people-led

Introduction

This paper questions why empathy is key to understanding people's perception of technology use and its usefulness in pre-adoption. The paper proposes that by acknowledging individuals' emotional concerns, organisations can foster a supportive environment that empowers individuals to embrace and harness the potential of advanced technologies effectively whilst ensuring that the workforce remains happy. A combination of the Perception-Action Model, empathy mapping and empathy modelling is applied at all stages of this research to understand what people think, feel, and do and the reasons behind their feelings, thoughts, and actions towards digital technologies even before the technology was introduced. In the case of this project, the disciplines represented are design, computer science, and mechanical engineering.

The paper focuses on a pilot study which offers valuable insights into the emotional landscape surrounding technology adoption even before technology is introduced. However, central to this investigation is the challenge of extracting tacit variables from individuals who may vary in their preparedness to embrace these technologies in their daily work routine. This presented three unique requirements for the team in developing the methodology. By applying the transdisciplinary principles stated in [1], the team resolved the ways of working at each stage of the research in the following ways:

1. Unity of Knowledge and Integration: The challenge is to create a common conceptual framework, tools, and methodologies to develop new knowledge [2]. To do this, we began the project by conducting a systematic review,

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bringing together literature from different disciplines, including design management, human psychology, engineering design, business studies, and technology management.

2. Participatory: The challenge was to collect data for pre-adoption readiness emotions. This meant that the methodology must enable the participants to consider adopting digital technology, which has yet to be introduced. Therefore, using empathy as centrism, we embedded a participatory approach to include end users, managers, and educators' voices.
3. Problem-solving capability: The challenge was to ensure that the shared framework solved a common unstructured research problem. For this project, the problem was to focus on understanding the variables that must be considered to create a happy and resilient workforce within digital adoption strategies. We applied this methodology to implementing building information modelling (BIM) in architecture and construction firms.

1. Readiness Emotions & Empathy

Parasuraman [3] defines technological readiness as an individual's willingness to embrace new technology and a complex interplay of psychological factors influencing their adoption potential. This concept provides valuable insights into why individuals engage with or resist technological advancements. It encapsulates an individual's readiness and capacity to embrace novel technological innovations, shaping their interactions with the digital realm. However, beneath the surface of readiness lies a complex interplay of emotions, where an empathy approach could be taken to understand and, where possible, i.e. support the adoption and utilisation of technology.

The Technology Readiness Index (TRI), developed by Parasuraman, is a prominent tool for quantifying an individual's technology readiness. Since then, it has undergone significant revisions to reflect the evolving technological landscape and user needs. Parasuraman and Colby [4] introduced a concise and contemporary version of the TRI, addressing limitations identified in the original model. This comprehensive metric still comprises optimism, innovativeness, insecurity, and discomfort. Optimism signifies an individual's optimistic perspective towards technology, emphasising its potential benefits and positive outcomes. Innovativeness denotes a person's willingness to embrace novel technologies, explore their capabilities and seek opportunities for advancement. Insecurity evaluates the apprehensions individuals may harbour regarding the risks inherent in technology adoption, encompassing concerns about security or privacy breaches or the fear of failure. Lastly, discomfort gauges an individual's unease or frustration when engaging with intricate or unfamiliar technologies, reflecting the challenges posed by complexity or lack of familiarity. These dimensions comprehensively understand an individual's readiness to adopt and utilise technology effectively.

Researchers have employed the concept of technology readiness to investigate its impact in various contexts. In organisational settings, Walczuch et al. [5] delved into the influence of service employees' technology readiness on technology acceptance within TAV Airports Holding. Their findings suggest that employees with higher technology readiness levels are more likely to adopt and effectively utilise new technologies. This underscores the importance of individual readiness in driving organisational, technological advancement and innovation. Additionally, Mohd Faizal et al. [6]

investigated the willingness and readiness of accounting professionals to adopt digital technologies. The study combined the unified theory of acceptance with the technology readiness framework to discover that performance expectancy, social influence, and optimism all greatly influence digital technology willingness and readiness.

Longitudinal studies offer valuable perspectives on the dynamics of technology readiness over time. Grindle [7] researched the factors influencing technology readiness across individuals and communities. He identified factors such as group interactions, access to facilitators, and training opportunities as crucial for fostering and sustaining technology readiness. This study investigated the impact of cohort-style learning, electronic information delivery, and informal training on individual technology readiness (TR). While two TR dimensions (optimism and insecurity) remained stable, innovativeness and discomfort changed significantly throughout the study. Interestingly, innovativeness and optimism also predicted an individual's willingness to use their iPad, suggesting a positive link between these TR dimensions and technology adoption. Emotions play a crucial role in shaping the perceived usefulness of technology [8]. Whether positive or negative, users' emotional reactions significantly influence their acceptance of technology. Perceived usefulness has been identified as a decisive factor in creating user experiences that generate emotions such as enjoyment, playfulness, and satisfaction [9]. Moreover, the technology acceptance model has been extended with the self-determination theory and a framework of emotions, including enjoyment, playfulness, anxiety, and frustration, highlighting the motivational role of psychological needs and emotions in technology adoption [10]. Furthermore, the influence of emotions on technology acceptance extends to consumer behaviour, where negative emotions can hinder the intention to adopt emerging technological products or services [10].

The burgeoning integration of technology across various domains necessitates a deeper understanding of factors influencing user adoption. Recent research highlights the crucial role of emotions in shaping technology readiness, presenting a compelling narrative that complements traditional technology acceptance models [11] [12] [13] [14]. Researchers have explored how emotions mediate the relationship between technology adoption and user behaviour across diverse contexts [11] [7] [15] [13] [14] [16] [17],

On the flip side, Agogo and Hess [18] identify that data security or privacy concerns can create a significant barrier to adoption. They showcased technophobia, the fear of technology, as a potential deterrent to technology acceptance. Students harbouring technophobic anxieties might be so intimidated by a new learning platform that they avoid engaging with it altogether.

Various classification methods have been employed to explore emotions' impact on technology use. For instance, Perlusz [19] utilises theoretical dimensions to construct a technology affect scale. The technology affects scale was crafted from the positive and negative affect aspects showcased by Watson et al. [20] and was used to provide insights into the nuanced relationship between emotions and technology acceptance. The findings indicate that affect is diminished when individuals experience negative emotions, suggesting a potential barrier to technological acceptance under such circumstances. However, Perlusz's [19] research reveals a contrasting pattern when individuals experience positive emotions. Both negative and positive affect emerge as significant predictors of acceptance, underscoring the complex interplay between emotional states and technology adoption. Whilst Perlusz [19] delineates two distinct emotional states, human experience transcends such binary classifications. We frequently grapple with the intricacies of mixed emotions and emotional conflicts. Berrios et al. [21] elucidates the crucial distinctions between the two in exploring goal conflict as a source of mixed emotions. As Larsen et al. [22] found, mixed emotions represent the concurrent experience of both positive and negative emotions. Consider the poignant joy of a new position interwoven with the melancholy of departing cherished colleagues. Emotional conflict, however, presents a more vehement internal struggle. It embodies the experience of being pulled in opposing directions by powerful emotions, engendering significant inner turmoil.

Beaudry and Pinsonneault [11] examination of the direct and indirect impacts of emotions on technology utilisation presents an alternative method of categorising emotions. This approach entails the creation of a comprehensive framework that delineates emotions into four specific categories: challenge, achievement, loss, and deterrence. Within this framework, each type of emotion significantly shapes individuals' readiness and behaviours towards technology adoption. Challenge emotions encompass positive consequences, wherein individuals perceive themselves as having some degree of control over their actions when interacting with technology. These emotions drive individuals to embrace technological innovations with enthusiasm and optimism, viewing them as opportunities for growth and advancement. Achievement emotions, similarly, result fully from events that generate positive reactions. They serve as catalysts for technology adoption, motivating individuals to engage with new technologies in pursuit of success and accomplishment.

In contrast, loss of emotions reflects the perception of a lack of control over the consequences of technology use. Individuals experiencing loss emotions may feel apprehensive or uncertain about the potential outcomes of adopting new technologies, leading to hesitation or resistance towards technological change. Deterrence emotions emerge when individuals believe they have some control over the consequences of an event caused by the new technology. These emotions may arise from a sense of caution or self-preservation, prompting individuals to consider the risks and benefits of technology adoption before fully committing to it.

The categories of emotions highlighted by various scholars showcase the diversity and scope through which emotions can be studied [21] [7] [15] [23] [14]. However, this study adopted the approach from [24] to classify emotions. Emotions were classified as contentment, connection, amusement, and frustration. During pre-adoption, users form initial impressions and build anticipation. They are likely to experience emotions about how technology might connect them to others, frustrate them with learning curves, bring contentment through perceived benefits, or amuse them with novelty. Gkinko and Elbanna's [24] framework addresses users' initial impressions and feelings before fully engaging with the technology. Their categories, like "connection emotions" and "contentment emotions", capture the user's anticipation of how the technology might improve their social interactions or overall workflow. Similarly, "frustration emotions" and "amusement emotions" gauge the user's potential anxieties about learning curves and the novelty factor associated with the new technology. The emotional spectrum, as shown in Table 1, underscores the importance of empathy in technology design and implementation.

Table 1. Data on Positive and Negative Emotional Stimuli.

Positive emotional attitudes		Negative emotional attitudes	
Curious	Hopeful	Angry	Doubtful
Confident	Surprised	Helpless	Frustrated
Satisfied	Relaxed	Overwhelmed	Irritated
Calm	Challenged	Anxious	Impatient
Motivated	Excited	Bored	Disappointed

2. Empathy-led Transdisciplinary Methodology: Embedding Empathy in the Research Design

Empathy is commonly used as a design tool to explore end users' feelings and perspectives. To understand users' emotional dimension in pre-adoption of digital adoption, three empathy-centric methodologies were considered for the transdisciplinary methodology: the Perception-Action Model (PAM), empathy mapping, and empathy-based stories. These were deemed most appropriate due to their ability to integrate knowledge, ideas and perspectives and adapt to a participatory delivery, which enhanced the transdisciplinary principles the project emulated.

1.1. Perception-Action Model (PAM)

The perception-action model of empathy helped provide a structured definition of empathy itself: according to the PAM theory, empathy is achieved when individuals combine certain behavioural and attitudinal actions. One key aspect of this definition of empathy is its reliance on self-other overlap. This sentiment occurs when the observer uses personal representations of experience to understand the target [25], resulting in the cognitive inclusion of the other in the self [26].

PAM states that individuals who perceive an action or emotion in another person will generate that behaviour within themselves [25]. The stimuli for this interaction can be a person, entity, or inanimate object [25], and it draws on the principles of motor-behaviour theory, where person, task and environment influence behaviour and learning [27]. In terms of methodology, self-other overlap can be achieved through perspective-taking means - to achieve an empathy-led methodology, both researcher and participant must engage in activities that facilitate observation and reflection through the lens of a scenario or prompt to set the perspective. There is evidence that this perspective-taking approach can lead to changes in the behaviour of the perspective-taker towards those of the target [28].

In summary, PAM played a key role in shaping our empathy methodology, providing the baseline argument that a non-readiness situation within one individual could be improved or overcome through observation/self-identification of a technology-ready individual or situation.

1.2. Empathy mapping – Foundation for identifying key variables

Another method that underpinned our methodology was empathy mapping (EM). This approach is traditionally used within consumer or user-facing research, allowing for structured investigation of the behaviours (Says and Does) and attitudes (Thinks and Feels) of individuals in response to a specific issue [28]. This approach lends itself well when considering technology adoption processes. It highlights that strong emotions experienced during a technology adoption process can affect behaviour, suggesting that the two elements should be examined together.

Empathy mapping provided a foundation for implementing the findings from our systematic review. Through empathy mapping, participants' behavioural and attitudinal experiences were analysed.

1.3. Empathy-based stories – Key tool for examining perceptions.

Empathy-based stories (EBS), in combination with empathy mapping, are confirmed to be well-suited for examining the perceptions, expectations and values a participant attaches to a given scenario [29] [30] [31]. EBS requires participants first imagine themselves within the desired situation before answering any questions. Using prompts, and adapting them to investigate changes or factors within the examined scenario [32] – for studies such as this, which investigate the adoption process, EBS provide a flexible methodology that can be altered depending on the needs or focus of each data collection activity.

3. Implementation of Empathy-based Transdisciplinary Methodology

The empathy-led methodology was applied to the interactive workshop BIM, a series of conferences, as part of our initial data collection. This workshop brought together professionals from architectural and construction backgrounds as well as students and educators in the field. The workshop had 36 attendees, 23 of whom consented to participate. The sample consisted of industry professionals (n=11) from architecture and construction firms, higher education academics (n=2), and undergraduate and postgraduate students (n=11) in architecture, digital construction, and building information modelling courses. There were four parts to the workshop:

First, participants were introduced to the workshop's methodology, showing how an empathy mapping approach was combined with the theory of perceived usefulness and emotional attitudes. A small amount of contextual data was gathered – what the participant's job role was, what level of technology they engaged with as part of their employment (basic, medium, advanced), and how confident they felt employing these different levels of technology (Likert scale ranging from 1 to 9, from 1 being not at all confident, to 9 being like second nature).

Second, the first case study was presented to participants, and it started with a short video that showcased examples of advanced technology in the context of the architecture and construction sectors. Alongside watching the video, participants listened to a short narrative scenario reading that introduced the idea of advanced technologies, such as AI, AR and VR, being implemented into this industry. Participants were then asked to reflect on their emotions immediately after being exposed to both the video and the narrative prompt (Figure 1). This activity helped investigate the emotional attitudes of participants in a hypothetical technology adoption scenario.

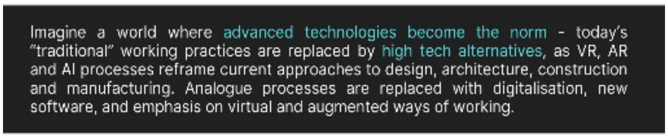

Figure 1. Scenario 1 video screenshot and narrative prompt.

Third, the workshop followed a similar framework with a different scenario and prompt. Participants were shown a short video showcasing some different examples of advanced technologies at work within the design and construction. They also listened to another short narrative scenario, which introduced the idea that advanced technologies would become the normal form of working in the industry's future (Figure 2). Participants were then asked to imagine how they would feel if they were required to use such technologies in their everyday jobs. Responses were again recorded on an identical blank table of emotional keywords, with space for qualitative reflection and justification. This part of the workshop aimed to gather data on the perceived usefulness of advanced technologies in various job roles.

Figure 2. Scenario 2 video screen shot and narrative prompt.

Fourth, participants were invited to engage with a written qualitative question on the imagined benefits and drawbacks of implementing advanced technology in the architecture and construction sector. All three activities were supported by verbal discussion and feedback led by participants to round off the session. This content was recorded and supported the qualitative responses from the scenario-based activities.

4. Findings

The mixed method approach to the workshop meant that participants recorded written narratives within the data collection. This was analysed through an inductive, data-driven thematic approach [32] [33]. The key findings from this pilot study are,

1. Across all participant groups, confidence in using advanced technologies like AI, VR, and AR had the lowest average level. Most participants self-reported high confidence levels for common and mid-level digital technologies. The contextual data also confirms that most participants were either new to advanced digital technologies or were aware that their jobs would have to be adopted in the future. Despite the similar confidence levels across all participant groups, only industry professionals had this lack of confidence carry over to their responses on specific emotional attitudes.
2. With regard to the first scenario prompt, individuals had mainly positive responses or reactions to the idea of advanced technologies, but doubt and worry are still present. The breakdown of emotions per participant group can be seen in (Figure 3) industry professionals and students and graduates (Figure 4).

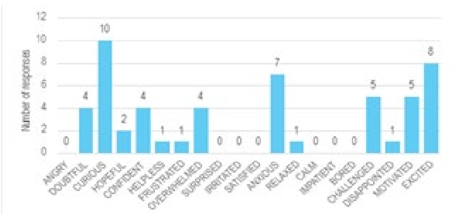

Figure 3. The number of times industry professionals (n=11) highlighted certain emotional attitudes as part of their response to the first scenario prompt. This group felt Curious (n=10), Excited (n=8) and Anxious (n=7).

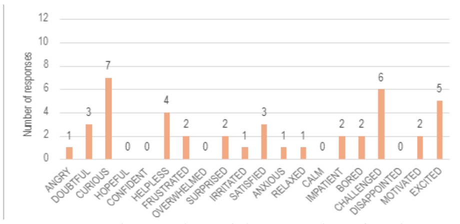

Figure 4. The number of times students/graduates (n=11) highlighted certain emotional attitudes as part of their response to the first scenario prompt. This group felt Curious (n=7), Challenged (n=6) and Excited (n=5).

3. In the second scenario, participants felt more strongly about their attitude towards technology when discussing their jobs and their direct engagement with such technologies. Overall, participants felt excited (n=17), curious (n=12), hopeful, challenged, and motivated (all n=10) when asked to consider their emotional attitudes towards using this technology in their jobs (Figure 5 and 6). Feeling anxious (n=7) was the negative emotion with the highest response rate.

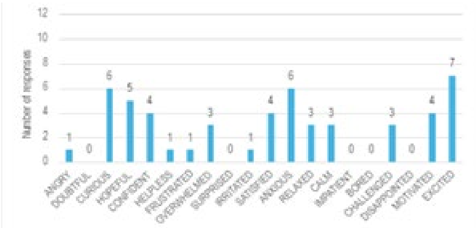

Figure 5. The number of times industry professionals (n=11) highlighted certain emotional attitudes as part of their response to the second scenario prompt. This group felt Excited (n=7), Curious (n=6), Anxious (n=6) and Hopeful (n=5).

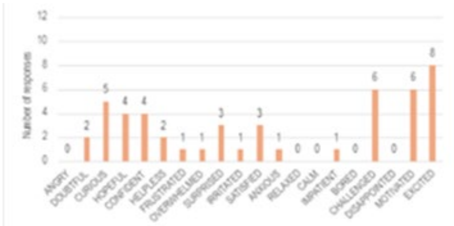

Figure 6. The number of times students/graduates (n=11) highlighted certain emotional attitudes as part of their response to the second scenario prompt. This group felt Excited (n=8), Motivated (n=6), Challenged (n=6) and Curious (n=5).

4. Overall, the pilot study identifies 6 key emotions towards technology's perceived use and usefulness in the pre-adoption stages. These emotions were both positive and negative. However, the negative emotions were associated with industry professions instead of students and academics. The negative emotions of being overwhelmed and challenged were also demonstrated. These were not only associated with the perception of technology's use or usefulness. Participants associated these emotions with the possibility of career progression, learning new skills, a manager's role, or being seen as a team expert instead of using technology itself.

5. Empathy as a Transdisciplinary Methodology

In conclusion, this paper illuminates the critical role of empathy as a transdisciplinary engineering methodology in understanding individuals' readiness to adopt new technology, particularly in the pre-adoption stage. By integrating the Perception-Action Model, empathy mapping, and empathy modelling, this research delves deep into individuals' thoughts, feelings, and actions toward digital technologies before their introduction.

The study unveils nuanced insights into individuals' perceptions and emotions surrounding technology integration in the workplace. It analyses emotional attitudes towards technology adoption, revealing a spectrum of responses ranging from excitement and curiosity to anxiety and doubt. This finding highlights the need for tailored interventions and support mechanisms to address professionals' concerns and facilitate smoother technology transitions in the workplace. Furthermore, the study identifies key positive and negative emotions that accentuate the complexity of navigating technological change and its implications for individuals' roles and career trajectories. Importantly, the paper emphasises that negative emotions are not solely tied to the technology itself but also associated with broader professional concerns such as career progression and skill development. This nuanced understanding underscores the importance of holistic approaches to addressing emotional barriers and promoting a positive organisational culture conducive to technological innovation.

This pilot study offers valuable insights into technology adoption's emotional landscape, highlighting the need for empathetic and contextually sensitive approaches to facilitate successful integration. Success is more likely if the organisation can understand and empathise with the people affected by introducing new technologies. By acknowledging and addressing individuals' emotional concerns, organisations can foster a supportive environment that empowers individuals to embrace and harness the potential of advanced technologies, effectively improving resilience to change.

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