

Supplementary Material: Inclusive Design meets AI: a Case Study focusing on Back Health

1. Extended Discussion

An inclusive health intervention addressing back pain at work should be tailored to individual experiences and consider the various factors associated with acute back pain. This paper focuses on creating a translatable and actionable intervention, as well as identifying the qualifying factors influencing back health, particularly in the workplace context. This approach aims to enhance understanding and relevance to everyday life.

The additional features we have identified, beyond existing posture estimation methods, will provide richer insights and contribute to the personalisation of a holistic intervention. Creating a user-centric approach to understanding personal factors that impacts back pain could offer continuous mentorship to a wider range of people, helping them manage their posture effectively throughout life.

AI is effective in managing large and complex datasets, allowing us to identify patterns and connections between lifestyle choices and images that may not be immediately clear. To support this effort, we are collecting extensive data from a diverse group of users. By incorporating a variety of features, we aim to integrate AI with individual differences in the next phase of our research.

2. Images and Figures

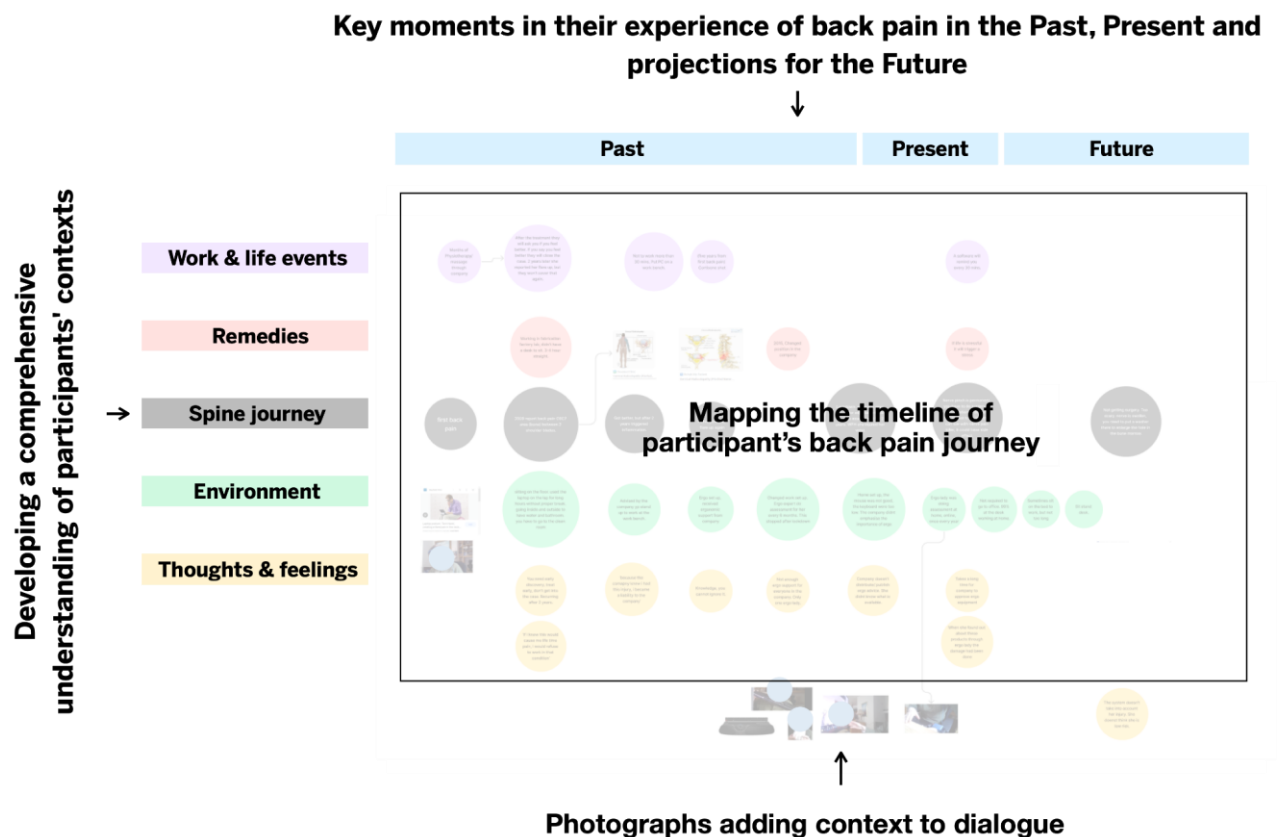


Fig. 1. Conversational tool designed for interviews. The bespoke tool builds on the existing ID methodologies of observation, interview, time mapping, design provocations and cultural probes (Gaver et al, 1999). It aimed to allow participants to be objective about their experiences and began by mapping key moments in their experience of back pain in the past, present and future. This timeline enabled visualisation of each participant's journey of back pain.

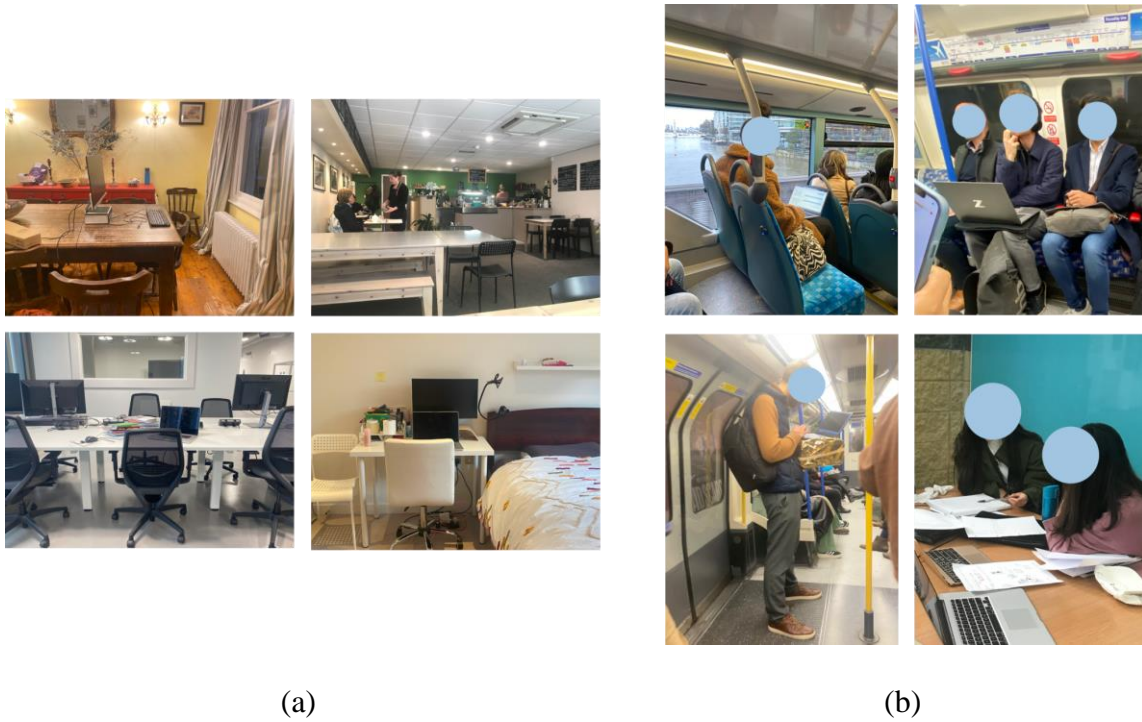


Fig. 2. (a): Collected photographs from workplace observations, (b): Collected photographs from posture observations. Observational research helped to understand issues alongside empathic connection with the participants (Gheerawo, 2018). This was conducted with people in their natural setting with minimal interference from the researcher. They were recorded as photographs to provide situational context and enable detailed visual analysis.

As shown in **Fig. 3 and 4**. Where possible, participants were asked to demonstrate their posture in various contexts, providing insight into their contextual behaviours.



Fig. 3. Participants demonstrate posture they perceive as comfortable yet 'incorrect'.



Fig. 4. Participants demonstrate posture they perceive as ‘correct’.

3. Quotes from Interviews

Quote number	Quote
Q1	<i>‘A lot of postures people believe to be bad are actually well within what we’d expect as normal posture’ - Chiropractor and injury expert</i>
Q2	<i>‘The big variable is people’s natural geometry. You don’t see any ‘normal’ backs. How many backs have I seen that are as the textbook told me? Maybe 10?’ - Back Expert</i>
Q3	<i>‘There are people with straight backs with back pain and people with hunched backs who feel perfectly fine... The natural position of one’s arm, neck, back etc. is not the direct cause of their back pain.’ - Chiropractor and pain expert</i>
Q4	<i>‘Even the ideal posture is not a panacea. Even if you adopt that posture, if you work for long periods without taking breaks, back pain will manifest... Any static or repetitive behaviour will cause injury and injury is hard to fix.’ - Workplace health and safety professional</i>
Q5	<i>‘I often tell people, you don’t need to feel guilty about slouching. It’s not inherently bad for your back. That’s just another posture that your back is perfectly capable of adopting. It doesn’t put any undue stress or force through your back to sit like that. People seem to really believe their back is inherently weak.’ - Chiropractor and pain specialist</i>
Q6	<i>‘After about 30 minutes, even with the best design chairs for people to not adopt [a certain] posture [is difficult]. Because we are designed to move, we’re not designed to sit still, so broadly what I would say is that in the set-up it’s the ability to move with ease that is advantageous.’ - Workplace health and safety expert</i>
Q7	<i>‘The key is to get people to move, try and put in strategies. Every 20 minutes you should get up. If you can’t do that it should be every 30 minutes. Take a phone call standing up, or we often tell people to drink more water because that means you’re getting up more to use the toilet.’ - Back expert</i>
Q8	<i>‘Posture is highly individual -and the best posture is as many as possible. Your best posture is your next posture.’ - Chiropractor and injury expert</i>
Q9	<i>‘You need to know what the problem is before you can solve it.’ - Under 30s participant</i>
Q10	<i>‘[Before I go to the doctor] I do not know what I should do, because I do not know what the problem is. You do not know what the purpose of doing something is until you have someone who tells you.’ - Under 30s participant</i>
Q11	<i>‘One thing furniture hasn’t done well is looking at how we maintain movement. Even chairs like the kneeling chair, one of the problems with that is the ease of getting in and out of them.’ - Workplace health and safety expert</i>
Q12	<i>‘Posture is linked to stress, also you must factor in existing ailments’ – Workplace health and safety professional</i>
Q13	<i>‘People tend to adopt a hunched posture when they are feeling low in mood. So actually, it might not be that the posture is causing the pain. It might be that the stress is exacerbating an existing complaint... In this case the pain was much more linked to their mental state than whether or not they were sitting at a desk or working from their bed.’ - Chiropractor and pain specialist</i>
Q14	<i>‘I get back pain when I am stressed. I sit at the desk with perfect posture and I get pain. I sit on the sofa watching TV with bad posture and I am fine.’ – Over 60s participant</i>

4. Alt Text for Figures

Figures number	Alt text
Fig. 1	<i>Figure 1 shows a conversational tool designed for interviews. One axis features key moments of people's experiences of back pain in the past, present, and projections for the future. On the other axis, the tool includes themes such as Work & Life events, Remedies, Spine journey, Environment, and Thoughts & Feelings, aiming to develop a comprehensive understanding of participants' contexts. This allowed the researchers to map the timeline of the participants' unique back pain journeys with descriptive texts, quotes, and photographs, adding context to the dialogue.</i>
Fig. 2	<i>Figure 2 shows four images of participants demonstrating postures they perceive as comfortable yet "incorrect." The participants showcased a variety of comfortable postures and work locations.</i>
Fig. 3	<i>Figure 3 shows two images of participants demonstrating postures they perceived as correct—both participants are shown sitting at a desk with a straight back.</i>
Fig. 4	<i>Figure 4a shows collected photographs from workplace observations, demonstrating a variety of work locations including offices, home offices, cafes, and bedrooms. Figure 4b displays collected photographs from posture observations, illustrating a variety of sitting postures in different contexts and spaces.</i>

References

1. **Gaver, B., Dunne, T., Pacenti, E.:** Design: Cultural probes. *Interactions* 6(1), 21–29 (1999).
2. **Gheerawo, R.:** Design thinking and design doing: describing a process of people-centred innovation. In: Norman, D., Verma, R. (eds.) *Security by Design: Innovative Perspectives on Complex Problems*, pp. 11–42. Publisher, City (2018).