

TravelTag: Tracking GPS and accelerometer data to facilitate an imitation of travel for those with insufficient access, through enhancing mundane exercise.

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Introduction

When a user selects a route on TravelTag, a digital keyring, the device begins using an accelerometer and GPS to track their steps and distance travelled. These are used to progress them along a virtual route that reflects real-world routes like the West-Highland Way¹, displaying images from their virtual journey throughout. This emulates the experience of travel while users engage in mundane activities like commuting. Users can also visualise their progress on a route map and view in-depth statistics, as well as revisiting past journeys, and can share their current virtual location and a message with others by connecting two devices in person.

Background

In terms of positionality, I'm a Human-Computer Interaction MSc student, which indicates a strong familiarity with technology that may reduce my ability to comprehend concerns of less digitally fluent users. Being a male may also limit my understanding of safety concerns for female-presenting users exercising outdoors, especially considering time-of-day or location. Coming from near the Lake District, I have a positive perception of nature which might not be shared by all users, for example those who must fear nature e.g. natural disasters. My working-class background, and subsequent familiarity with lack of access to travel, allows me to appreciate the appeal of *TravelTag*. Lastly, I accept my ability to partake in physical exercise is a privilege, and hope to consider users with a variety of disabilities.

Here, the outlined contemporary matters in PI and gamification shall be further elucidated, to provide sufficient background for subsequent Responsible research and innovation (RRI) discussion:

Beginning with data privacy and security, Khoo et al. (2024) point out the concerns users of mental-health applications have over control of their personal data, especially that which is identifying. This informs the need for developers to minimise data collection and implement robust security measures.

The issue of information overload is outlined by Jones and Kelly (2017), who state that good algorithmic curation of data is necessary to improve engagement, as users are often overwhelmed by PI systems presenting excessive correlatory data.

Bias in data processing is a prevalent contemporary discussion in HCI (Balayn, Lofi, and Houben, 2021), and Yfantidou et al. (2023) investigated this from a PI context, showing that representation, aggregation and learning biases in PI systems disproportionately affect certain groups, like diabetics.

Over-surveillance is another concern. Whetton (2013)'s review highlighted systems ability to overstep into social control and monitoring through personal data misuse, since stakeholders have uncritical trust in authority organisations.

Dahlstrøm (2017) investigated where gamification may be ineffective, advises against over-reliance on rewards, advocating for goals, challenges and stories to foster a sense of competence and autonomy in users. They cite (Deci et al., 1999), who state that tangible rewards can undermine intrinsic motivation.

Another issue is the counterproductive effects of harnessing user psychology. Mogavi et al. (2022) found that, in Duolingoⁱⁱ, poorly implemented gamification hindered users learning aptitude and capacity, proposing implementing optional gamification and customisation.

Adherence and engagement in health games was addressed by El-Nasr et al. (2021), since single-player games only retained 41% of players after 90 days (Farago, 2011). They found that modulating autonomy, relatedness, and integrability improve user retention.

Finally, regarding inclusivity, Klock et al. (2024) promoted gamification aligned with equality, diversity, and inclusion (EDI) principles. Namely, features such as competitive leaderboards can further exclude marginalised groups as they cannot compete wholly with limited access. They recommend focusing on collaboration, flexible participation, and equitable access to resources to alleviate this.

The above literature, amongst other considerations, helped inform anticipated risks and impacts of this project.

RRI in Action

Firstly, the intention of the project should be considered; to provide an experience of travel for those with a lack of access. When ensuring responsible design, the intention must be justifiable, which can be assessed by measuring the impact of the design. To be impactful, this design should be a competitive solution for the problem of lack of access to travel and have enough potential users to justify it's undertaking. Regarding the former, a cash bursary for travel would be an alternative solution, but this is unjustifiable due to prohibitive costs. Secondly, "We're Not All Going On A Summer Holiday..." (2024) cites 42% of the UK public being unable to afford a summer holiday, a large enough user group for this criteria. Additionally, accessible travel is a fundamental right according to "Technology is Changing the Future of Accessible Travel" (2024), providing further justification.

The sustainability of the device must also be anticipated. We were myopic regarding this initially, but the device may lack sustainability. For one, the plastic casing is non-biodegradable, and users might discard the device once bored, as noted during engagement. This risks contributing to microplastics in food, water, and marine debris. A more sustainable alternative could be consolidating the concept into a mobile app, thus providing no additional environmental impact beyond existing phone usage. That said, the choice of a separate device was prioritized to enhance data protection.

Next, we anticipated stakeholders besides the target user who may benefit or suffer from the device. For one, active individuals could enjoy gamification regardless of access to travel, whereas stalkers could misuse data to track victims. In order to empower users like the former and inhibit the latter, we included a statistics screen for active users to track their activity, while removing the device from Bluetooth and internet connection to safeguard sensitive information.

Conducting a risk assessment revealed notable challenges for developers and users alike. Firstly, acquiring route images either posed significant copyright challenges (which could lead to persecution) or required conducting photography expeditions with numerous safety concerns. So, we considered crowdsourcing images to reduce risk (longer timescale) and avoid copyright infringement, although this raises issues such as validating image suitability. A primary risk for users would be carrying a valuable device, which could increase vulnerability to mugging, damaging wellbeing. One consideration to reduce this risk was “bricking”ⁱⁱⁱ devices that were separated from the intended user to reduce black-market value.

Following anticipation, a period of reflection was necessary to address unintended consequences of assumptions and values. While there are few potential conflicts due to the innocuous nature of the device, it is possible organisations implicated in travel or tourism may see the device as reducing willingness to travel, though this is unlikely since the experience is not intended as a replacement for actual travel. Additionally, mobile phone companies might oppose its message to reduce screen usage, but as profit-driven entities, this poses no significant concern from an RRI perspective.

Regarding unintended consequences, besides malicious use, there is of course the risk identified by Mogavi *et al* (2022) wherein gamification can be counterproductive. Here, users may focus excessively on their virtual journey and not their real-world surroundings, leading to anything from a lack of mindfulness to possible accidents. To combat this, we reduced gamification elements to encourage incidental checking of the device rather than it requesting attention.

From an EDI perspective we worked within a diverse team in terms of gender, race and nationality, and incorporated inclusive practices like considering disabled individuals at each stage, rather than as an afterthought, to ensure universal design (Mitrasinovic, 2008). Furthermore, participants in our engagement activity are also diverse, reducing bias in insights gleaned. One EDI decision we made was including GPS as well as an accelerometer, so that users in a wheelchair can engage with the device without counting steps. Still, users who cannot move themselves independently at all may find the device unsuitable, so further consideration is required to include them, e.g. allowing other forms of exercise to progress the route.

Considering means of reflection, we reflected on our decisions during group meetings, using our combined knowledge of RRI. That said, our initial priority was producing a project with a deliverable we found appealing, from our ideation phase, instead of identifying a target area based on thorough user research of current problems. This means our personal biases are central to the concept altogether. Furthermore, since we continued learning about RRI throughout, it is likely we could not apply every facet at each stage, so reflection may be incomprehensive.

Another crucial process in RRI is engagement with stakeholders. This took the form of a presentation to our peers, whereafter we presented them with a task; to envision themselves as provided personas, then provide feedback on various questions. The benefit of this engagement was eliciting vast data from a more diverse group, compared to our own considerations or conducting interviews. One key finding from this activity was doubts about the device's ability to retain users once initial excitement has declined, which echoes the sentiment of El-Nasr *et al* (2021) regarding health games. We considered addressing this through further gamification but elected to maintain the simplicity of our project. Another finding was that many questioned whether affordability would be an issue, considering those with limited access to travel for financial reasons. That said, we believe the cost of a device which simply consists of a basic computer, a non-touch screen, a GPS and accelerometer should be low enough to sufficiently undercut real-world travel, and indeed competitors like Google earth VR^{iv}.

To critique our engagement, firstly instructing participants to envision themselves as persona intended to increase relevance of feedback amongst those not part of the target user group, however, it could also reduce the utility of engaging a diverse group, since feedback won't pertain to their identity. Additionally, many ignored our instructions to visualise themselves as persona and provided general feedback, reducing the differentiation between engagement and typical user research.

Next, we identified actions based on the anticipation, reflection and engagement to this point. One example is choosing to implement data minimalism (Softtek, 2021). That is, only collecting GPS and step data, where more data could allow further gamification, like connecting to an account, permitting leaderboards etc. Data minimalism was important to us in reducing potential for malicious usage, as well as aforementioned concerns about information overload, and encouraging mindful usage. Another action we took was in not providing the device with internet or Bluetooth capabilities. As mentioned earlier, this protects from malicious usage, but also means any data gathered cannot be profited on, analysed, or leaked. Altogether, the device's lack of connectivity increases users' safety, and perception of safety, encouraging wellbeing and trust towards the device. Furthermore, this removes social media capabilities, synthesising with our face-to-face sharing system to encourage real interaction over digital interaction, as shown to have many benefits. (Stieger, Lewetz, and Willinger, 2023).

Future actions we could take largely revolve around more complex considerations of the device's implications rather than its concept. For example, considering whether the device could be deployed to impoverished areas as an educational tool, or to obese areas as a persuasive health intervention. In addition, considering how it could be improved for a second iteration. For example, providing facts, sounds and rewards as well as images, as noted by the engagement.

Some limitations of this report, and our ability to incorporate RRI are as follows. For one, it is difficult to incorporate current research into gamification since most current solutions in that domain focus on games where the user's attention is actively engaged with the game, rather than being a background enhancement. This is due to our inspiration from slow technology (Hallnäs and Redström, 2001), wherein mindful interaction is encouraged, but means that

criticisms and benefits of gamification may not be relevant. For example, the concept is reliant on the users' intrinsic motivation to exercise regardless of the device, in order for the device to be enjoyable, instead of it providing powerful extrinsic motivation. Similarly, it can be difficult to draw from personal informatics research since our focus on data minimalism means that the amount of data tracked is miniscule compared to many systems. Therefore, drawing comparisons between concepts like information overload and our system may be weak. Finally, since our device is conceptual rather than a deployed product, it is simple to state the various actions we may take to improve RRI, where in reality these actions may be more complex than it is possible to anticipate without actually conducting them.

Conclusion

To conclude, the research and innovation process undertaken to create the *TravelTag* device revealed many key take-aways, as well as some limitations. In summary, in the domain of personal informatics and gamification, concepts from slow technology and data minimalism were utilised to minimise typical concerns regarding data usage and the attention economy. For example, prioritising incidental interactions rather than notification, as well as only collecting GPS and accelerometer data rather than any identifying data, and storing this exclusively on device. Furthermore, EDI was ensured from team diversity to considering minority user groups at each design decision. Having said that, the limitations of the project, as noted above, can be summarised as the concept not immersing itself in gamification or personal informatics wholly enough, limiting the usefulness of research and perhaps limiting how powerful the device could be in achieving its aims. That is, perhaps a device with more considered RRI could sacrifice elements of data minimalism for a robust social sharing functionality that increases adherence or embrace gamification to create the travel experience more thoroughly.

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ⁱ <https://www.westhighlandway.org/>

ⁱⁱ <https://www.duolingo.com/>

ⁱⁱⁱ <http://www.catb.org/jargon/html/B/brick.html>

^{iv} https://store.steampowered.com/app/348250/Google_Earth_VR/