What Can Possibly Go Wrong? Identifying Potential Adverse Impacts on People

Colin Watson and Ahmed Kharrufa
Open Lab, School of Computing, Newcastle University, United Kingdom

The design, creation and use of digital technologies has consequences, some of which may be unexpected, and some of which are undesirable. Despite widespread agreement on the importance of identifying harms, doing this in practice is very challenging and needs greater attention. Motivated by the need to enumerate impacts of technologies on marginalised individuals and their communities, we investigated how a hazard identification method might be used.

1. Revealing harms

Risk analysis techniques often focus on harms to the technology itself and other assets, in relatively closed and constrained systems, but we wanted to know more about potential harms to the people involved. Additionally, each harm (negative consequence) may be produced in more than one way, so using a top-down method analysing known hazards, did not seem to provide an adequate systematic exploration of all elements of a system.

Fig A: Technology scenario extract with example guide word - deviation pairs

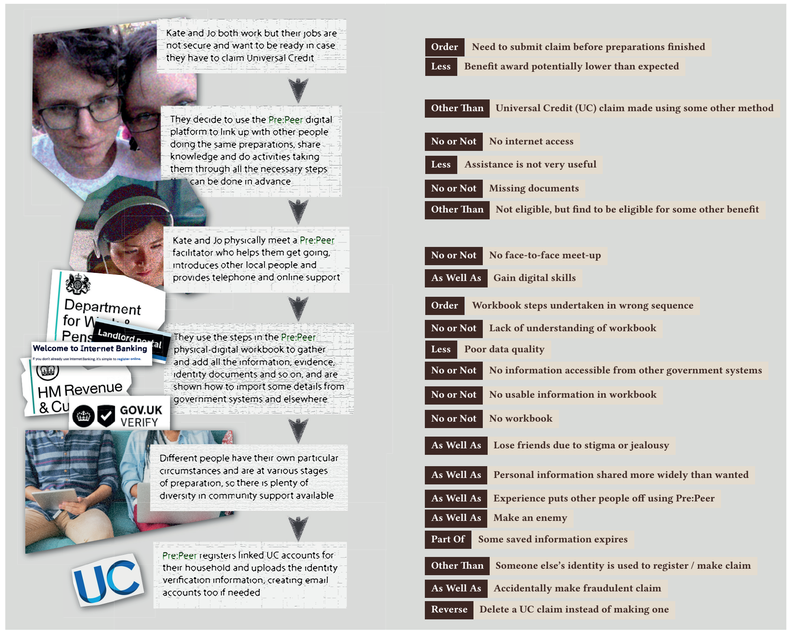
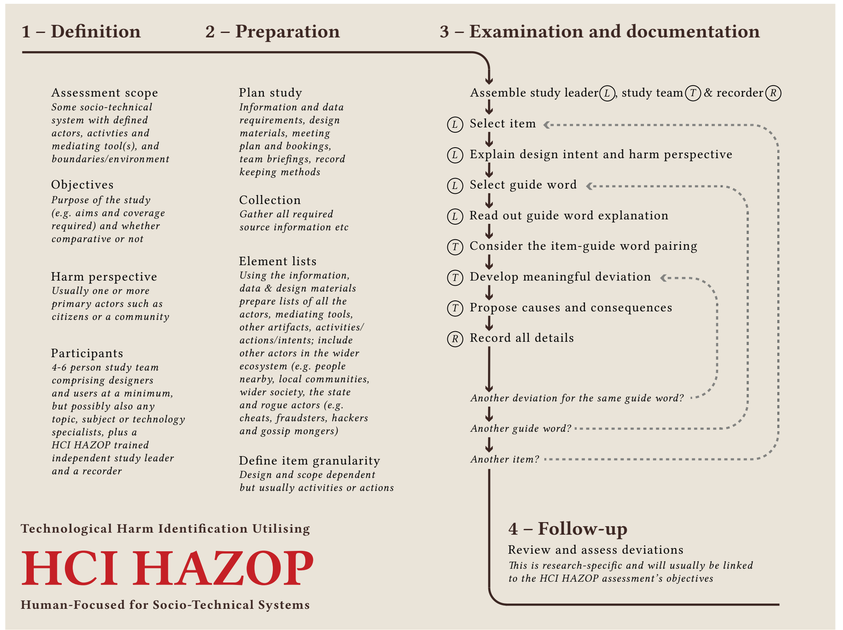


Fig B: HCI HAZOP method's four stages



2. Could HAZOP be used?

Hazard and Operability assessment (HAZOP), developed in the chemical process industries[1], is now an international standard[2]. HAZOP is an inductive, bottom-up, group activity which appeared to be a good fit for use in complex socio-technical systems, where deviations arise not only from individual and community use of digital technologies, but also from the wider ecosystem over which there can be little control. HAZOP is relatively simple and intuitive[3], but despite widespread use, especially for safety-critical systems including software engineering, its use for human-centric Human Computer Interaction (HCI) research had not been thoroughly investigated.

3. Methodology and findings

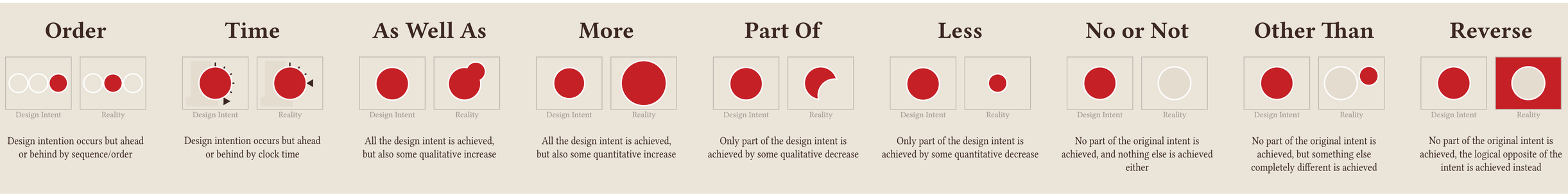
We undertook two feasibility studies to explore the viability and usefulness of HAZOP, followed by two pilot study workshops using scenarios (e.g.: Fig A) to define digital technology concept design intents. None of the participants had prior knowledge of either the scenario subject matter or HAZOP. In the first pilot, School of Computing final year undergraduate students identified 44 relevant deviations (e.g.: also Fig A) during a 90-minute workshop by considering harm impacts from the perspective of the people in the scenario. In the second pilot, experienced HCI researchers and their manager from Open Lab identified 65 deviations for a different scenario in 50 minutes.

4. Outcomes and impact

The studies progressively adapted the inductive HAZOP method for a HCI context, to foreground people as contributing actors rather than sources of system errors, and to recognise other elements in the socio-technical system (Fig B). We created HCI-specific guide word descriptions, novel diagrammatic representations (Fig C) and guidance materials for this "HCI HAZOP", and published a paper:

HCI - H is also for Hazard: Using HAZOP to Identify Undesirable Consequences in Socio-Technical Systems. In ACM SIGCAS Conference on Computing and Sustainable Societies (COMPASS '21). https://doi.org/10.1145/3460112.3471959

Fig C: Diagrammatic representation of HCI HAZOP guide words and descriptions



References:
1. Trevor Kletz. 1999. Hazop and Hazan: Identifying and assessing process industry hazards. IChemE.
2. IEC. 2016. IEC 61882:2016 Hazard and operability studies (HAZOP studies) - Application guide.
3. J Gould, M Glossop, and A Ioannides. 2000. HSL/2005/58 Review of Hazard Identification Techniques. HM Gov.

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Other credits:
We would like to thank the workshop participants for their time taking part in the study, and the proof readers and reviewers for providing feedback on our paper. Images and photograpgs in Fig A are open source and public domain. HCI HAZOP was adapted from standard HAZOP[1,2].
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