THCI Coursework 2019

Essay 1: Improving The Efficacy Of Games for Change Using Personalization Models [2017]

Topic: Persuasive Technology - How might computer technologies be designed to encourage behavioural change for users' benefit and for the benefit of society at large? In recent years, this question has motivated a range of research under the title 'Persuasive Technology'. Especially current, in the light of government policy, is the potential for mobile and ambient technologies to 'nudge' behaviour change. In this coursework assignment you would review some of these developments, question what they have in common, and reflect on how a design science might be developed to tackle these questions. Important background is in the psychology of persuasion and influence.

Abstract: There has been a continuous increase in the design and application of computer games for purposes other than entertainment in recent years. Serious games—games that motivate behavior and retain attention in serious contexts—can change the attitudes, behaviors, and habits of players. These games for change have been shown to motivate behavior change, persuade people, and promote learning using various persuasive strategies. However, persuasive strategies that motivate one player may demotivate another. In this article, we show the importance of tailoring games for change in the context of a game designed to improve healthy eating habits. We tailored a custom-designed game by adapting only the persuasive strategies employed; the game mechanics themselves did not vary. Tailoring the game design to players' personality type improved the effectiveness of the games in promoting positive attitudes, intention to change behavior, and self-efficacy. Furthermore, we show that the benefits of tailoring the game intervention are not explained by the improved player experience, but directly by the choice of persuasive strategy employed. Designers and researchers of games for change can use our results to improve the efficacy of their game-based interventions.

Video: https://www.youtube.com/watch?v=T0nPw2WrO_Q&list=PLghXYFYmZ-VeQedZeRi7N4jrBxCycsxbR&index=7

- *One size doesn't fit all when designing games to change behaviour*
- *Does tailoring games to target the user's personality type increase their efficacy at motivating behaviour change?*
- *Are the beneficial effects of tailoring mediated by an improved play experience?*
- *99% of adolescent boys play digital games regularly. 94% of adolescent girls play digital games regularly*
    - *Seeing games developed for purposes other than entertainment at increasing pace*
- *Games for change are effective at motivating behavioural change and actions beneficial to them and their community*
    - *E.g. Health games to manage addictive diets, maintain effective exercise and activities, manage disease. Squire's Quest 2 game aimed to increase consumption of fruit, juice and vegetables to reduce diseases related to diet*

- *Main problem – adopting "one size fits all" approach does not work – this works against the performance of users of certain personality types*
    - *Using a leader board could motivate competitive players but not other personality types*
- *How to tailor for change?*
    - *Study of 1108 participants in initial work explored relationship between type of personality (Achiever, Conqueror, Daredevil, Mastermind, Seeker, Socialiser, Supervisor) and type of persuasive strategies (Competition and Comparison, Cooperation, Customisation, Personalisation, Praise, Self-Monitoring, Simulation, Reward)*
    - *Developed models to compare how different user types responded to different strategies*
        - *Numbers are the coefficient from model – if significant a number exists in the cell, higher number = higher weight*
        - *Empty cell means strategy won't motivate player of that type to change their behaviour*
        - *Negative value means demotivation*
        - *Detail (Orji 2014)*
        - *Statistically significant difference in responses to strategies for each type of player*
    - *Now question is how to employ results in games for change design?*
        - *Designed 2 model-driven games targeting achievers and conquerors*
            - *Two of the common gamer types, which show a distinct difference in response to strategies shown by Origi 2014 – interesting types to consider*
                - *Achievers = rewards, Conquerors = competition. Complementary effects on each respective gamer type.*
            - *"Junk Food Aliens" game designed – competition vs reward versions – cross-platform game based on the classical space invader game – twist in narrative.*
            - *Game panel designed to simulate conflicting impact of healthy eating and struggle people face between healthy and unhealthy foods.*
            - *Both versions: Player's avatars lose health and eventually dies when player chooses unhealthy foods*

        - *Difference = competition version has competing with other players whereas in the reward version they are rewarded on their performance.*
            - *Reward = badges based on performance*
            - *Competition = performance shown relative to other players of the game.*
- *To evaluate efficacy a large scale randomised controlled study took place with 272 game players after the game was deployed – 50% achiever, 50% conqueror.*
    - *177 / 155 F/M*
    - *Evaluated efficacy of game using pre-test and post-test – measure behaviours before and after playing*
    - *2 conditions – each gamer type split into 2 groups and randomly assigned 1 of 2 conditions –*
        - *tailored (TC) – played game with strategy they deemed persuasive (Achievers = rewards, Conquerors = competition)*
        - *contra-tailored condition CTC - played game with strategy they did not deem persuasive (Achievers = competition, Conquerors = reward)*
        - *50 / 50 not done by recruitment but by scaling down total number of players from over 800 – controlling for gender randomly*
        - *To determine player type, automated scale when players respond to questions based on their playing attitudes n first playing the game*
    - *Measure of efficacy to promote healthy eating – **attitude, self-efficacy, intention** (3 direct predictors of behaviour)*
        - *If model true, then competition should be more effective for conquerors and reward should be more effective for achievers playing game. This is the result from measuring mean attitude change before and after –*
            - *achievers playing the reward version showed heightened positive change in attitude towards healthy eating, and increased mean negative attitude after playing competition version*

        - *conquerors playing the competition version showed heightened positive change in attitude towards healthy eating, and increased mean negative attitude after playing reward version*
        - *Similar for self-efficacy and intention – tailored version more effective than contra-tailored.*
    - *CTC led to no change in self-efficacy, and negative mean change in attitude for achievers – using inappropriate persuasive technique can be detrimental to behavioural change*
- *Still unclear:*
    - *Were the tailored conditions more effective because the <u>strategies themselves were more effective</u>?*
    - *Were the tailored conditions more effective because the players had a <u>better play experience</u> of playing games using that persuasive device?*
- *To answer these questions, it was investigated whether play experience mediates the effects of tailoring games for change.*
    - *To answer, conducted parallel mediation modelling of tailoring on attitude, intention and self-efficacy change with play experience on the mediator.*
        - *Results from mediation analysis show there is a total effect of tailoring on attitude change ($\beta = .721$). Direct effect remains significant even after including play experience as a mediator in the model ($\beta = .662$).*
        - *Similar results for intention and self-efficacy change. Effects significant even after including play experience as a mediator in the model.*
- *Conclusions:*
    - *<u>There is value in tailoring games for change</u> – heightened positive changes in all measures.*
    - *<u>CTC led to no significant change</u> - tend to lead to mean negative change in attitude of achievers.*
    - *<u>Play experience doesn't mediate the effects of tailoring games for change</u>*
- *<u>Future work:</u>*

- *Self-selection of player type vs. detected – gamer chooses a strategy they think benefits them – customisation*
- *Understanding player type from their in-game activities – open to work*
- *If we have multiple strategies at a time – do the cumulative effects produce a positive or negative result?*
- *Test more combinations of strategies on gamer types.*

https://dl.acm.org/citation.cfm?doid=3149825.3119929

500 words: Summarising contribution of article – (e.g. new ideas, what do we learn?) include references to neighbouring literature.

500 words: Assess extent to which work reported justifies articles' conclusions.

500 words: Outline further work you consider might be done to build on article. Begin by future work authors outline but try to add your own suggestions.

Essay 2: Exploring Interactions with Physically Dynamic Bar Charts [2015]

Topic: Information Visualisation - How should complex data best be presented to decision makers? The field of Information Visualisation ('InfoVis') has grown rapidly in recent years as designers of interactive software have targetted this issue. There is important background research in Exploratory Statistics as well as in the Psychology of Decision Making (especially multi-dimensional decision making). Additionally, there are plenty of interesting theory-based research products - see for example the edited collection by Card, Mackinlay and Shneiderman; and more recent journal articles.

Abstract: Visualizations such as bar charts help users reason about data, but are mostly screen-based, rarely physical, and almost never physical and dynamic. This paper investigates the role of physically dynamic bar charts and evaluates new interactions for exploring and working with datasets rendered in dynamic physical form. To facilitate our exploration we constructed a 10x10 interactive bar chart and designed interactions that supported fundamental visualisation tasks, specifically; annotation, filtering, organization, and navigation. The interactions were evaluated in a user study with 17 participants. Our findings identify the preferred methods of working with the data for each task i.e. directly tapping rows to hide bars, highlight the strengths and limitations of working with physical data, and discuss the challenges of integrating the proposed interactions together into a larger data exploration system. In general, physical interactions were intuitive, informative, and enjoyable, paving the way for new explorations in physical data visualizations.

Video: https://www.youtube.com/watch?v=oMWTn_h0NqE&index=4&list=PLqhXYFYmZ-VeDVQtk8euBKlJS97KGzW9a

- **Research: How people might interact with physical representations of data such as a bar chart?**
    - Key interaction techniques and the feasibility of a physical dynamic bar chart
- Combine InfoVis with shape-changing display technology – EMERGE (10x10 physically dynamic tool)
    - Picked tasks from Heer and Shneiderman's taxonomy for visual data analysis – covers a wide range of tasks.
    - No idea how people interact with physical charts so a selection made of fundamental tasks – Filtering, Navigation, Annotation, Organisation.
- Architecture – slider panels, mechanical linkages, plastic rods, LED strips, Kinect and projector
- User study – 17 participants (6f). For each task (Filtering, Navigation, Annotation, Organisation)
    - User proposed interaction: Before showing users tool, asked how they wanted to achieve tasks
        - Asked them to complete tasks like "select the year a country had the highest electricity consumption".
    - Demonstration: Then gave demo of tool
    - Actual interaction: Tasks using EMERGE tool
    - Questionnaire: Getting feedback – rate interactions they carried out. Semi-structured discussion.
- Findings:
    - Annotation: (Selecting or marking data points) –
        - Point: Point on axes, then selects by cross-hairs the point to select to annotate.
        - Pull: Direct pull of data point bar.
        - Press: Direct press of data point bar.
        - User proposed: **Press**
        - Actual interaction: **Press**
            - Need visual feedback (selected bar stays illuminated) – pressing most natural.
    - Filtering: (Hiding data to compare values and trends) –
        - Swipe-away: Swipe on row axis to hide them.
        - Manual (full) press: Manually push down individual bars to hide them.
        - Assisted (partial) press: Manually push down individual bars part of the way to hide them.
        - Press shortcut: Manually push down individual bar at end of row to hide entire row.
        - Press to compare: Manually push down individual bar at end of 2 rows to hide all rows besides the ones selected.
        - User proposed: **Touch / gesture interaction**
        - Actual interaction: **Press shortcut and press-to-compare**
            - Combine hiding and keeping of rows – pressing almost all rows just to see one is very repetitive.
    - Organisation: (Re-arrange data by moving rows)

        - Instant drag: Drag on axis to shift row (rows swap and click into place after gesture).
        - Transition drag: Drag on axis to shift row (rows are shown to move where finger points and click into place after gesture).
        - Instant press: Press on two rows simultaneously on axis to swap them (rows swap and click into place after gesture).
        - Transition press: Press on two rows simultaneously on axis to swap them (rows are shown to move and click into place after gesture).
        - User proposed: **Drag projected label**
        - Actual interaction: **Drag projected label**
            - Transitions unnecessary
            - Mistakes embarrassing if used for presentations – wait for transition
    - Navigation: (Go through larger data sets – e.g. identifying trends over time). As it's a 10x10 interface, how does navigation work.
        - Scrolbar: Drag bar across to change (continuous or discrete) data.
        - Touch to scroll: Fine grained - Use touch buttons to change (continuous or discrete) data.
        - Press to scroll: Fine grained - touch bars to change (continuous or discrete) data by 1 row.
        - Paging: pressing on bars to move left and right (blocks of 10).
        - User proposed: **Swipe to scroll**
        - Actual interaction: **Swipe to scroll**
            - Show values whilst scrolling
- **Physical / gestural interactions have benefits / shortcomings**
    - Larger actions suited to touch-gesture interactions (e.g. organisation).
    - Smaller actions suited to physical interactions (e.g. annotation).
    - Interacting with data points feasible (not intrusive) – not perceived to interfere with data. People liked pressing bars.
        - *Physical = annotation and filtering*
        - *Gestural = organisation and navigation*
- **Combine fine-grained and coarse-grained control to minimise repetition**
    - E.g. filtering (hiding / keeping rows)
    - E.g. navigation (trends vs specific ranges)
- **Perceptions of physical bar chart**
    - Influence from touch-screen style interactions – smartphones
    - Movement / behaviour around the display – physical position / posture
    - Surprise factor from actuation speed – too fast is surprising, too slow is frustrating
- **Limitations and further work:**
    - Scoped to fundamental tasks – limited interaction techniques
    - One possible implementation for bar charts
    - Exclusion of vertical axis (z-axis) data – only X-Y-Z data considered.
    - Combining techniques – more physical exploration

https://dl.acm.org/citation.cfm?doid=2702123.2702604

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