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Happiness Apps: reinforcing happiness-promoting behaviour through software

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ABSTRACT

People now spend more time on mobile phones than watching television. This mode shift creates an opportunity to reach a large market on a powerful and flexible digital platform that is integrated into users' lives. The most popular mobile applications are showy, derivative experiences designed to sell in-app digital goods to teenagers. These faddish games lose their popularity after a short time, leaving users with no benefit or long-term satisfaction. Therefore there is a place in the market to enable long-term happiness using mobile applications.

This research focuses on providing long-term happiness instead of short-term thrills. The concepts developed and tested in this study aim to make experiences which are both enjoyable and satisfying for users. This research adopts Fordyce's "14 Fundamentals" techniques (Fordyce, 1977) for promoting personal happiness and Caillois' play theory categories. These theories were the basis for mobile application concepts. Eleven concepts were taken to a pre-coding stage, examined for gamification potential and processed for development. Three applications were coded and two were user-tested, with feedback and UX theory informing ongoing iterative development. Results indicated that the ideation framework was effective at identifying and populating concepts with relevant characteristics used in the development.

ATTESTATION OF AUTHORSHIP

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Signed: 

Date: 8 July 2015

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CHAPTER 1. INTRODUCTION

The new and massive increase in popularity of mobile phone platforms (CNET, 2015) presents an opportunity to reach a large market. This user base is served with games, utilities, social and communication applications, but just 6.9% of all applications are in the ‘Lifestyle’ category (“Top categories on Google Play”, 2015) which includes self-improvement.

Many of the most popular mobile applications are derivative, colourful, explosive experiences designed to sell in-app purchases (Distomo, 2013), typically little more than digital decorations for a teenage market. These faddish games lose their popularity after a few short months, with no intent to give users long-term satisfaction. The content of the applications are generally showy, insubstantial, and provide only the illusion of happiness with little of the substance.

However, there is an alternative approach to mobile application creation, which this research examines. The focus of the research is on content which provides a long-term benefit instead of a short-term thrill. The concept development process seeks to make the experience both enjoyable and satisfying regardless of the application genre. The outputs—mobile applications of different types—are then tested with users to confirm that the content is successfully communicated.

This study combines Fordyce’s 14 ‘fundamentals’ (Fordyce, 1977)—techniques promoting personal happiness—with Caillois’ play theory categories (Caillois, 1958) in a ‘forced relationship’ (Parnes & Harding, 1962) tool (see Appendix A) to create application concepts. In this way, the concepts of Fordyce are paired with gaming styles for implementation. For example, the ‘Powerful Preparation’ application concept combines Fordyce’s “stop worrying” Fundamental with Caillois’ “active mimicry” category of play in a guided movement exercise to reduce stress levels.

The two systems—Fordyce and Caillois—are paired as content and delivery. The Fordyce techniques, comprising the content, are broad and non-specific in their use. The Caillois categories, comprising the delivery structure, are descriptive and specific in their categorization. Together they can be combined to create application concepts which have both a purpose and a style for implementation. For example, "Walk To Paris" combines the technique of "Keep busy and be more active" with the play category "Active competition"; the technique is given a clear structure of manifestation by the play category, and the play category is given meaning and impetus by the technique. The technique forms the content, and the play category forms the delivery.

From the 38 concepts identified, eleven are further developed. These eleven application concepts are examined for gamification (Deterding et al., 2011) potential against a list of known methods, such as random rewarding (Mirenowicz & Schultz, 1994). The concepts are broken down for software development into key user activities. In doing so their development and testing is iterated, with user feedback informing subsequent versions.

'Long term happiness' is defined, for the purposes of this study, as an improvement in subjective well-being. This description is used by Fordyce (1977) and his techniques are applied here with the expectation that the effects of Fordyce's studies are repeatable. The term 'long term happiness' contrasts with short term thrills. If the application concepts did not include Fordyce's techniques then they would have no structure for providing long term happiness. This study does not measure the long term effects of the designed experiences on subjects, instead focusing on immediate user feedback to iteratively improve the user experience of the designed interface.

1.1 Goals and Academic Value

The goals of this study are:

- to explore the delivery of software experiences which have both positive content and an enjoyable user experience
- to create mobile applications and concepts which follow the delivery process outlined in the Methodology section

These goals delve into the main area of difference between this study and existing work: the use of established structures for content and for delivery, i.e. Fordyce and Caillois. All work in the study begins with the synthesis of these two structures. None of the application concepts posit arbitrary criteria, but rather draw from the two structures with the specific goal of creating positive content and an enjoyable user experience.

It is possible that identifying appropriate techniques and methods is key to creating the content for these experiences and maintaining the integrity of the content during development. The ideas drawn on in this research are derived from the disciplines of positive psychology (Section 2.2), gamification (Section 2.3), design, usability and agile software development (Section 2.4). The delivery process described in the Methodology section lays out specific actions and criteria examined during the creation of each application concept, and the success or failure of this process is discussed in chapter 5.

The academic value and benefits of this practice-based research include the application of theoretical principles specifically in mobile software development. The study lays out a process from ideation to conceptual development to software development to testing. The synthesis of these disparate fields is central to this research endeavour, and the tools used combine these in a process with specific inputs (positive psychology, games and play, gamification) and specific outputs (application concepts and mobile applications). Such a framework may be shown to be effective in generating concepts, identifying characteristics, and processing for development.

Studies examining user engagement in digital interfaces show that non-human interaction can be effective and efficient. Glasgow et al. (2011) tracked participants' use of a weight-

loss programme online to measure the efficacy of computer-assisted self-management with an individualized plan, specific goals, and reminders via email and phone. The study found that website-only users were as engaged as users whose website use was supplemented with human support, suggesting that the self-management techniques applied were effective in engaging users even without human intervention. Danaher & Seeley (2009) discuss online engagement in tools created for behavioural change. They point to the high trackability and recording of online behaviour as a benefit to measuring user website engagement and trends in large user groups, even when anonymous, and the advantage of a user, feeling unobserved, acting freely and engaging naturally without the pressure and expectations of clinical conditions. The use of digital interfaces can be both effective and advantageous.

The particulars of each app target specific Fordyce techniques, and seek to promote reflection around that specific technique by the user. If this is not effectively promoted by the app, it is a failure of the Fordyce technique. For example, the 'Warm Fuzzies' concept seeks to promote 'positive, optimistic thinking' through user actions dictated by game mechanics; if users are unmoved by the experience and do not reflect in an optimistic way, the Fordyce technique is not fulfilled.

It is a limitation of this study's process that happiness cannot be imbued on users automatically. This study applies Fordyce's techniques in a digital environment, with an expectation that these techniques are effective in creating happiness. The techniques are applied within the structure of Caillois' categories of play, with an expectation that these play categories will promote use. It is not claimed that any experience created is universally enjoyable to all users, or that any specific experience will trigger happiness in any one individual. The study simply applies known techniques in a digital environment.

1.2 Significance

The process in this study, including content, modification, and iterative improvement, all focus on creating positive experiences commensurate with long-term happiness, with methods and ideas suited for this purpose. Each stage of the ideation and development process seeks to add to this positive experience without compromise or distraction. While these subjects have been studied separately before, they have not been used together, thus here they are combined with a view to maximizing their effects.

Positive psychology has been applied to studies in usability in similar fields to mobile development. Lin, Gregor & Ewing (2008) measured subjects' enjoyment of website use on a scale they created using 'Dimensions of Enjoyment' comprising engagement, positive affect, and fulfillment. They compared the relative user enjoyment of two award-winning websites in these three areas on nine-point Likert scales and found statistically significant differences in user experiences. Further, specific positive outcomes have been targeted in medical interventions (Grimes et al, 2010; Franco et al, 2012) with game-based delivery on console and mobile phone platforms. These studies suggest that positive psychology has a place in digital experience design.

The content and process of this study are grounded in fields which promote happiness. Positive psychology, with its focus on wellbeing in the general population rather than on clinical illness (Compton, 2005), is compatible with the field of usability—used in later stages of the study—in that it studies positive human experience (Fordyce, 1977). It is not enough, however, to simply prescribe aspects of self-improvement; another facet of psychology can be used to make the experience enjoyable in the moment: gamification. This field examines the satisfying characteristics of engaging experiences and describes principles shared by the more immersive and alluring of these experiences.

Gamification has been applied to digital experiences designed for behavioural change in the past. The Nintendo Wii game console has been used to promote 'fun' exercise for rest home community members (Franco et al, 2012), and mobile phones have been used as platforms for quiz games encouraging healthier food choices (Grimes et al, 2010). The two studies posit their goals and the framing of their implementation rather than compare multiple approaches, and simply measure the success of their specific approach. In both studies, the immediate accessibility of digital experiences ("a pervasive platform for play") was cited as an advantage over human-based interactions, as was iterative reinforcement of the play experiences.

This study is unique in applying a structure for both the behavioural change content (happiness techniques) and the gamified delivery method (play categories) with multiple outcomes deriving from this structured approach. This differs from studies which posit a single form of content and a single form of gamified delivery (e.g. healthy eating and quiz games respectively in Grimes et al, 2010). This study makes fewer assumptions about final content delivery and creates a meta-framework for use by others in the future.

Mobile apps have the potential to serve an extremely broad market in a low-impact way that ensures that the information, tools, and experiences are always accessible, retain the power and flexibility of a software platform, and may be shared, stored, and used as digital data. The distribution and service channels already exist, are free to use, and facilitate rapid and straightforward communication between creator and user (Google Inc., 2014). People now spend more time on mobile phones than watching television (Flurry Analytics, 2014), and this mode shift creates an opportunity; a mobile phone is a now-ubiquitous and flexible tool to facilitate activities that are integrated into users' lives. It is hoped that the self-improvement tools delivered in this study in an enjoyable way through mobile applications will overcome users' resistance to the arduous and inconvenient pursuit of happiness.

CHAPTER 2. LITERATURE REVIEW AND CONCEPTUAL DEVELOPMENT

2.1 Introduction

The content and the process methods for the application concepts created in this study are drawn from three broader fields: positive psychology, games and play, and software development (Figure 1). From positive psychology, Fordyce’s “14 Fundamentals” are examined with particular focus on their testing and their context in the field. From games and play, the categorizations of Caillois and specific gamification methods are described. From software development and design, usability, user testing and agile development are examined. These areas are synthesized in the study into a linear process of conceptual development and iterative improvement (Chapter 3: Methodology and Process).

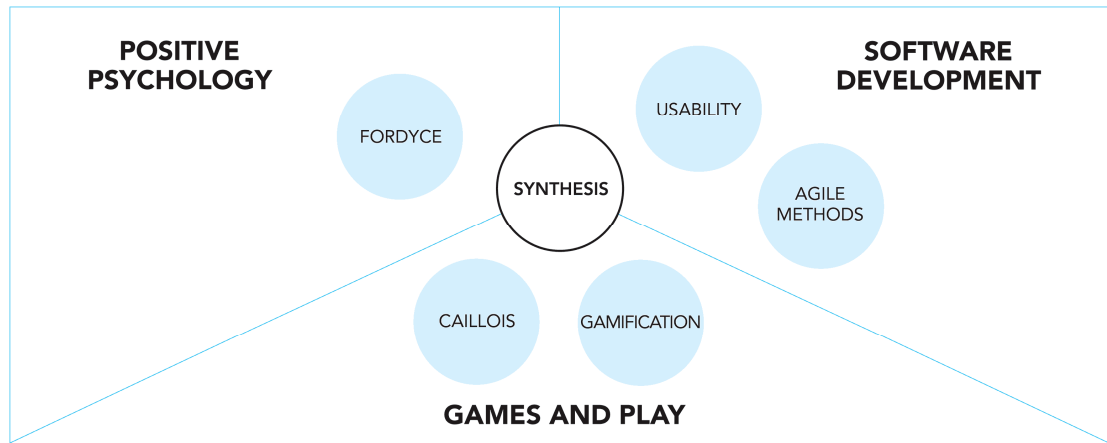


Figure 1: Broader Fields Examined and Closer areas of study

2.2 Positive Psychology

In order to generate mobile application concepts that promote long-term happiness, the genesis of these concepts naturally lie with techniques shown to achieve these effects. This section addresses positive psychology and details the success Fordyce had in synthesizing earlier work into key specific behaviours. His seven studies are described

with reference to their effects, and his 14 Fundamentals are mapped against later work by Lyubomirsky.

The field of positive psychology is relatively new, coined in 1954 by Abraham Maslow (Maslow, 1954), and focuses on practical behaviours, attitudes and exercises for the majority of the population without clinical disorders who seek self-improvement. Key thinkers in the field are Martin Seligman, who recognizes five elements of “well-being” (Seligman, 2011): positive emotion, engagement, relationships, meaning, and achievement (“PERMA”), and Mihaly Csikszentmihalyi who champions the concept of ‘flow’ (Csikszentmihalyi, 1991). The field is invested in demystifying and popularizing its work, so positive psychology principles are often laid out by academics in a way that laypeople can recognize as relevant.

A comprehensive meta-analysis of the field (Fordyce, 1974) was made by Michael Fordyce who used his findings as a basis for studies (Fordyce, 1977; Fordyce 1983) in which he applied "14 Fundamentals": techniques and attitudes that promoted happiness in his subjects. More recently, Sonja Lyubomirsky prescribed a similar set of principles (Lyubomirsky, 2008) which are mapped against Fordyce’s for this study (Figure 2, p9). Fordyce’s Fundamentals were selected for their basis in the literature and evidence in experimentation (Section: Fordyce studies 1977-1983) and are described in context of more recent work (Section: Fordyce: Lyubomirsky context).

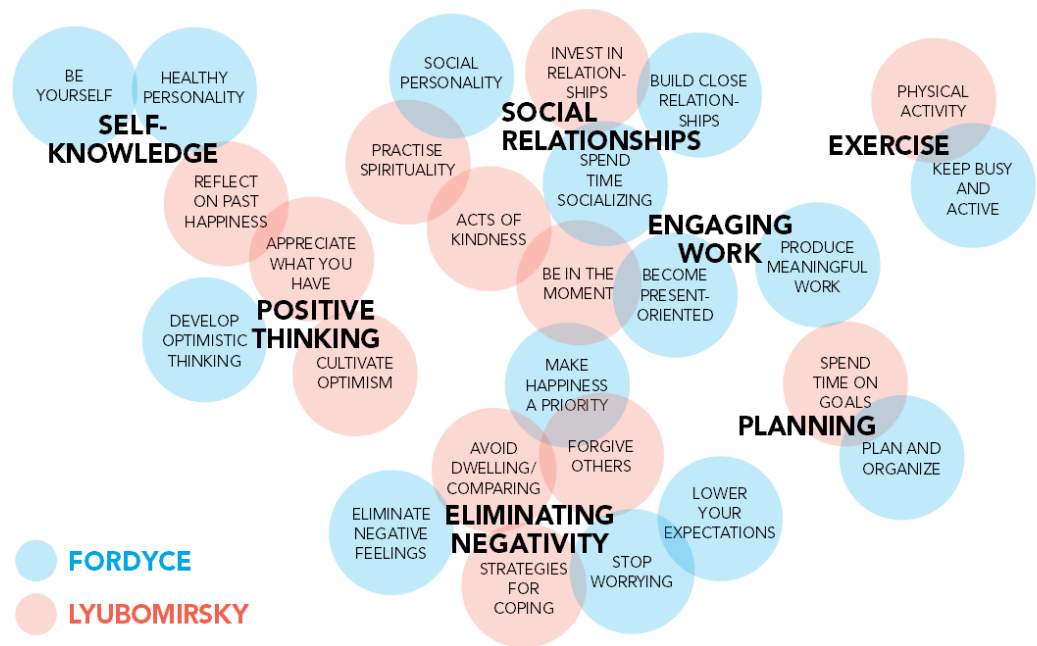


Figure 2: Fordyce's Fundamentals and Lyubomirsky's strategies mapped by theme

While Figure 2 above suggests that there is considerable overlap between schemas, the happiness techniques framework used in this study differs from Lyubomirsky (2008) or Seligman (2011) because it is both specific and wide-ranging. Fordyce's Fundamentals have greater specificity than Lyubomirsky's and address areas others do not (Section: 'Fordyce: Lyubomirsky context'). Fordyce has a broader range of techniques than Seligman. This largeness of scope and description is far more suitable for the Fordyce/Caillois tool (Appendix A) which creates a wide variety of application concepts. Applying Lyubomirsky's or Seligman's frameworks in the place of Fordyce would reduce the variety and distinctness of the tool's outputs.

Fordyce studies 1977-1983

Two Fordyce papers described a series of seven studies looking at the effectiveness of specific techniques in improving subjective well-being (Fordyce, 1977; Fordyce 1983). The studies used “14 Fundamentals”, based on a meta-analysis of 300+ happiness research studies, using psychology undergraduates as participants. The results were measured against placebo groups and control groups to confirm effects. The studies found

that the techniques resulted in higher level of reported happiness, with additional findings on which techniques were easiest for participants to apply.

Fordyce's Fundamentals comprise the following 14 techniques:

- Keep busy and be more active
- Spend more time socializing
- Be productive at meaningful work
- Get better organized and plan things out
- Stop worrying
- Lower your expectations and aspirations
- Develop positive, optimistic thinking
- Become present oriented
- Work on a healthy personality
- Develop an outgoing, social personality
- Be yourself
- Eliminate negative feelings and problems
- Close relationships are the number one source of happiness
- Put happiness as your most important priority

These 14 techniques are combined in this study with Caillois' categories of play (Appendix A) to generate application concepts.

All seven of Fordyce's studies showed higher levels of reported happiness compared to placebo groups (Table 1). The groups with higher levels were given instruction about the specific techniques. Most groups were also given practical steps to carry out the techniques, reporting higher levels of increased happiness than groups who were not supplied with either or both. The efficacy of the techniques was compounded by this guidance and clarification.

Table 1: Test Conditions and Results for Participating groups

STUDY	GROUP	N	INPUT	SPECIFIC?	PRACTICAL STEPS?	REQUIRED PRACTISE?	INCREASED HAPPINESS
First	1	26	Read 'Human Happiness'	No	No	No	55%
First	2	16	Nine techniques	Yes	Yes	No	66%
First	3	28	Self-reflection	No	No	No	67%
First	Placebo	27					53%
Second	1	39	14 techniques	Yes	Yes	Yes	69%
Second	Placebo	29					54%
Third	1	42	14 techniques	Yes	Yes	No	77%
Fourth	1	64	14 techniques	Yes	Yes	No	81%
Fourth	Control	34	14 techniques	Yes	No	No	55%
Fifth	1	50	14 techniques	Yes	Yes	No	65%
Fifth	Control	21	14 techniques	Yes	Some	No	60%
Sixth	1	14	14 techniques	Yes	Yes	No	65%
Sixth	2	8	4-5 techniques: 'personality'	Yes	Yes	No	67%
Sixth	3	10	4-5 techniques: 'attitudes and values'	Yes	Yes	No	68%
Sixth	4	12	4-5 techniques: 'lifestyle'	Yes	Yes	No	74%
Sixth	Placebo	13					37%
Seventh	1	69	Post-participation survey				72%

Simplification aided participants' application of the techniques. The sixth study shows groups with 4-5 techniques consistently reporting higher levels of increased happiness

than a group with 14 techniques, indicating that fewer techniques may have been easier to apply than all of the techniques at once. Over the study period, multiple data points show that the ‘lifestyle’ techniques (‘Keep busy and be more active’, ‘Spend more time socializing’, ‘Be productive at meaningful work’, ‘Get better organized and plan things out’, ‘Close relationships are the number one source of happiness’) were effective sooner than other groups’ techniques and “*considered, according to past feedback, the easiest to implement*” (Fordyce, 1983, p492).

The techniques had a lasting effect on participants. The seventh study measured the long-term effects of the studies via survey, with reported happiness at higher levels than any of the placebo groups, indicating that exposure to the techniques tested had influence beyond the testing period. In reporting these studies, Fordyce wrote that “*in each case, the statistical data seem to indicate that the fundamentals indeed help individuals become happier and that this increase in happiness is due largely to the information and techniques involved.... 81% of the individuals receiving the program claimed happiness gains*” and that “*there is evidence that its effectiveness may well be long-lasting*” (Fordyce, 1983).

Based on the data in these studies, Fordyce’s 14 Fundamentals provide a solid basis for creating application concepts to promote long-term happiness. The techniques tested were rendered more effective with explanation and guidance, just as the application concepts in this study are specified, described, and tested with users.

Fordyce: Lyubomirsky context

Identifying and prescribing specific sets of behaviours is not unique to Fordyce; Lyubomirsky outlines twelve “strategies” for happiness (Lyubomirsky, 2008). A number of Lyubomirsky’s strategies are very similar to Fordyce’s Fundamentals (Figure 2, page

9) but few directly duplicate one another, necessitating a mapping showing similarity by proximity.

There is evident clustering of these Fundamentals and strategies around social relationships, positive thinking, and eliminating negativity—areas covered in part by Seligman’s PERMA schema—while others are separate and discrete such as exercise and planning. Fordyce recognized clustering in his sixth study when he divided his Fundamentals between three groups, each practicing 4-5 techniques with similarities.

Some Fundamentals and strategies resist clear categorization. These are mapped in corresponding positions in Figure 2 relative to other Fundamentals and strategies; for example, ‘acts of kindness’, which is dependent on social interaction but also involves internal thoughts and attitudes, is mapped between ‘Social Relationships’ and ‘Positive Thinking’. This overlapping influence of principles suggests that a variety of thoughts and behaviours may compound, resulting in outcomes that promote happiness.

Fordyce addresses subjects others do not. The Fundamentals ‘produce meaningful work’, ‘be yourself’, and ‘lower your expectations’ have no counterpart in Lyubomirsky’s strategies. Seligman’s PERMA schema is broader and does not have the specificity of Fordyce’s techniques. This specificity makes the 14 Fundamentals more useful in this study which draws on a range of ideas to generate new concepts.

Considering Fordyce in light of Lyubomirsky’s conclusions, the 14 Fundamentals appear to remain applicable in covering a broad range of behaviours consistent with happiness. The many similarities reinforce and validate Fordyce’s findings, while the few differences provide a greater variety of areas to examine. For the purposes of this study, a variety of valid techniques is useful as an input for application concept ideation.

2.3 Games and Play

In addition to identifying techniques for promoting happiness, the delivery of these techniques requires interpretation in order to become an application concept, and developing each concept involves consideration for mobile application users: their focus, their short-term and long-term desires, and the experiences users find enjoyable. The clarification and specificity of Caillois' classification, discussed in this section, is analogous to Fordyce's work discussed above, and the two are combined into an ideation tool (Appendix A) to generate application concepts. Caillois delineates discrete categories of game types, interpreting a complex field into categories that can be used in the study. The forced relationship technique, as applied in the Fordyce/Caillois tool, is a method of synthesis for heretofore unrelated ideas. The gamification methods listed are collated from many different sources and outline a wide range of human responses to game experiences. These are used in the study to identify existing and potential enjoyable aspects of application concepts.

Caillois' classification of games

Caillois broadens the scope of traditional concepts of play and classifies these concepts into a taxonomy (Caillois, 1958). He distinguishes competitive games from games of chance, of mimicry, and of vertigo. Each of these forms can also be ludic (strategic) or active. Using this structure, chess is classified as a ludic competitive game, while dancing is a game of active vertigo. His work includes a table mapping further examples of each of these classifications (Caillois, 1958).

This taxonomy serves to classify existing games and forms of play, and can provide a framework for ideating new game experiences. The application concepts in this study are generated from a table (Appendix A) with categories defined by Caillois. The breadth of

Caillois' taxonomy spanning games and play parallels the breadth of Fordyce's Fundamentals spanning positive psychology.

Forced Relationship process

The forced relationship process (Parnes & Harding, 1962) is a creative method to combine seemingly-unrelated ideas; for example, the forced relationship between a coffeepot and a tap is a coffee urn. The process is applied in this study when combining Fordyce's Fundamentals with Caillois' categories of play (Appendix A). It is used in creative problem solving—in design, advertising, marketing, and new product development—contriving a synthesis between different sets of ideas to generate new concepts from the combination. Many new products are combinations of two earlier products (e.g. motor-bicycle, keyboard-phone, laser-turntable), demonstrating that a simple process can generate effective ideas.

Gamification methods

Gamification identifies psychologically-appealing aspects of game play and applies game-like aspects to situations which previously had none. Gamification has been linked to happiness (Hall et al, 2013) and a meta-analysis found greater engagement and enjoyment from gamification (Hamari et al, 2014). This study will include periods of development specifically to apply gamification methods to application concepts. Many kinds of gamification methods have been described in psychology and game design fields. 14 methods are shown below (Table 2) followed by brief descriptions of their origins.

Table 2: Gamification Methods

GAMIFICATION METHOD	SOURCE
Operant conditioning	Skinner
Classic conditioning	Skinner
Random rewarding	Mirenowicz & Schultz
Intrinsic rewarding	Lepper

Safety of artificial worlds	Hoffer
Completeness	Zeigarnik
Narrative/Hero's Journey	Campbell
Social comparison	Festinger
Bartle's play styles	Bartle
Cuteification	Anderson
Dominance	Russoniello
Mastery	Rigby & Ryan
Autonomy	Rigby & Ryan
Relatedness	Rigby & Ryan

- Skinner describes classic conditioning—associating a stimulus with an innate response (Skinner, 1938)—and operant conditioning, the process of reinforcing behaviours with rewarding (positive) or *de facto* rewarding by preventing aversive events (negative). Amplifying this effect in promoting repeated play is seen in slot machine gambling which uses variable interval reinforcement (Mireniewicz & Schultz, 1994) with money, and constant reinforcement with spectacle, to stimulate and overcome resistance to repeated play. This schedule of reinforcement has a strong effect on brain chemistry and reduces extinction
- Lepper et al. (Lepper, Greene, Nisbett, 1973) identifies external factors which can interfere with intrinsic enjoyment of an activity, reducing it to 'work' rather than the native pleasure of 'play'
- Hoffer addresses the difficulty of genuine change and the relative safety of play (“inconsequential”) as a refuge against consequences (Hoffer, 1963)
- Zeigarnik identifies a human drive to complete incomplete sets, achievement of which provides relief and closure in the user (Zeigarnik, 1938)

- Campbell describes the concept of "the Hero's Journey", a monomyth which draws from classical fables and has served as the archetypal basis for popular modern storytelling (Campbell, 1949)
- Festinger writes on the human drive to compare personal achievements and associated accomplishments against others (Festinger, 1954)
- Bartle recognizes different styles and motivations of play (Bartle, 1996) which often run counter to other players' goals using MMORPG as a basis, recognizing play in a highly social context that is open to subversion and reinterpretation
- Anderson examines the contrast in user engagement between a game with abstract shapes and a game with 'cuteification' applied (Anderson, 2012)
- Russoniello took brain scans while her adult subjects easily dominated computer games made for children and found mood improvements on every metric measured (Russoniello, 2009)
- Rigby & Ryan's PENS (Player Experience of Need Satisfaction) model (Rigby & Ryan, 2011) considers Mastery, Autonomy, and Relatedness in ascertaining a positive gaming experience

Gamification is a necessary step in the application concept development in this study. The underlying concepts ideated with the Fordyce/Caillois tool, while useful and functional, are not necessarily inherently enjoyable to experience, particularly if they are not cognizant as games. Examining these nascent application concepts in the light of the recognized gamification methods discussed in this section provides an opportunity to improve the user's experience and promote repeated play.

2.4 Software development

Once an application concept is generated, enjoyable aspects of the experience are identified and the application moves on to further development, it is prepared for

implementation in software. Methods for breaking applications down into modules, planning workflows, selecting high-priority modules and developing iterative releases, and testing the success of each release are outlined in this section.

Agile software development methodology

Agile is a software development methodology that allows for fast releases and iterative refinement (Pichler, 2010). This contrasts with larger, lengthier development periods used in traditional software development. Agile development aims to deliver high-priority features quickly and to solicit feedback which informs ongoing development.

Before development work begins, requirements are delivered in the form of discrete User Stories (Pichler, 2010): brief, non-technical descriptions of tasks that users carry out, written by people with domain knowledge (Cohn, 2011). Each describes an activity a user can perform when using the completed product. A well-written User Story is significant enough to matter to the user but small enough to be developed without being broken down into many subtasks. A too-large, overarching User Story is called an ‘epic’ (Pichler, 2010) and is further divided before development begins. Each story is given a time estimate for completion (relative to other stories) and a priority based on desirability to users.

Work in an Agile development environment is divided into ‘sprints’ (Ries, 2011): short periods of focused work which result in a cohesive, deliverable ‘Minimum Viable Product’ (Pichler, 2010). As Figure 3 illustrates, User Stories are placed in the Backlog section of a kanban (Polk, 2011) and the development team selects the highest-priority User Stories to develop in the first sprint. The highest-priority stories are designated for the first sprint, mid-priority stories in a second sprint, and low-priority stories in subsequent sprints.

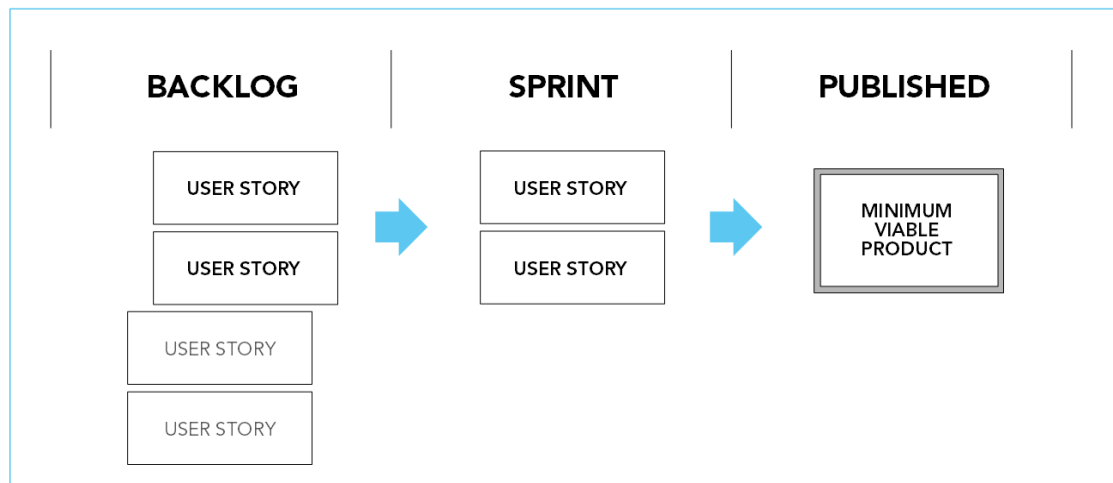


Figure 3: High-priority User Stories selected, developed, and delivered as a product

Kanban process tool

The process illustrated above (Figure 3) can be tracked by Agile development teams using a kanban: a visual process management tool which displays tasks in the context of the entire process. The kanban concept was developed at Toyota to promote transparency and improve productivity (Sugimori, Kusunoki, Cho, Uchikawa, 1977). In agile development, kanbans can display User Stories in different columns, such as ‘Development’ and ‘Done’ (Polk, 2011), showing an overview of the entire process in one place. Figure 4 below shows the web kanban tool Trello (Trello, 2011) in use for an application concept in this study.

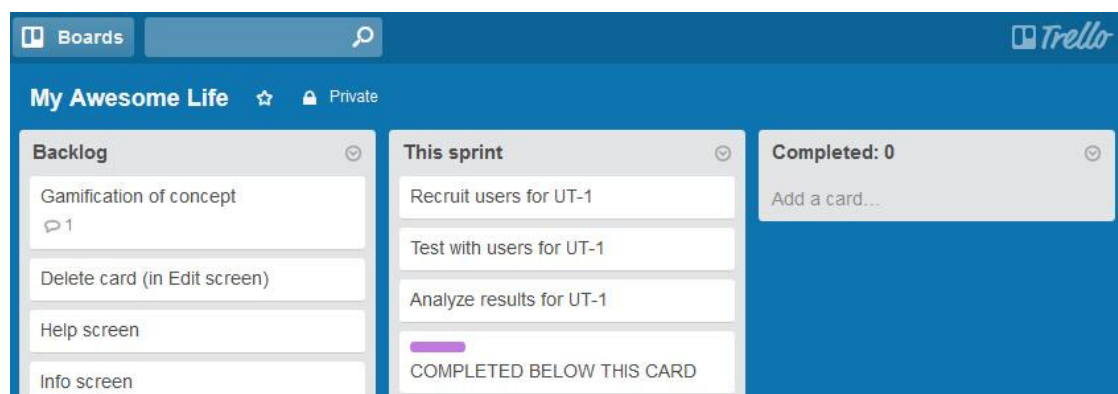


Figure 4: Trello web tool for creating and editing kanbans

Usability and user testing

Each coded application is subject to iterative user testing at different stages of development which will inform the feature set, design, and the direction of development. After each sprint is complete, the application is shown to users and their interactions are recorded. The problems users have which were not apparent in the planning and coding stages are highlighted and flagged for analysis and correction.

Significant contributions to the usability field come from Donald A. Norman, who promotes design with clearer visibility and consistency to aid comprehension and ease of use (Norman, 1999), and perceived affordance. Norman established the primary conventions of interface design before the ubiquity of graphical user interfaces—as did Kieras & Bovair's 'mental models', outlining how users navigate unfamiliar experiences (Kieras & Bovair, 1984)—and others have adopted Norman's ideas with application to modern digital experiences.

Jakob Nielsen's work concerns software interfaces. He writes about the necessity of legibility, measures the effect of distracting elements in digital interface design, identified 'F-shaped' reading patterns through eye-tracking technology, and prescribes the key elements of interface feedback online (Nielsen, 1995).

Goal-directed design (Cooper, Reimann, Cronin, 2007), a practice in which user goals are the basis for successful user interaction, dovetails with the User Story-centered Agile development methodology. The focus of goal-directed design is to “*construct products in such a way that the people who use them achieve their goals, these people will be satisfied, effective and happy*”(Cooper, Reimann, Cronin, 2007). This happiness lies in the experience and is largely concerned with removing hindrance, misinterpretation, and frustration from the interface.

Ethics

The work in this study was covered by the departmental ethics application already in force. No separate ethics application was required for the work described, as it did not operate outside the scope of the departmental ethics application.

CHAPTER 3. METHODOLOGY AND PROCESS

3.1 Introduction

The complete process undertaken in this study, as illustrated below (Figure 5) falls into two phases, the first being the concepts phase. This begins with application concepts that are synthesized, developed, and analyzed for gamification. Having identified Fordyce's Fundamentals from positive psychology and Caillois' categorizations from games and play, these are combined in a tool (Appendix A) to synthesize the two into potential application concepts. These concepts are examined against gamification methods which result in a list of 'inherent' methods (which are innate to the concept) and a list of 'contrived' methods (which may easily or naturally be applied to the concept).

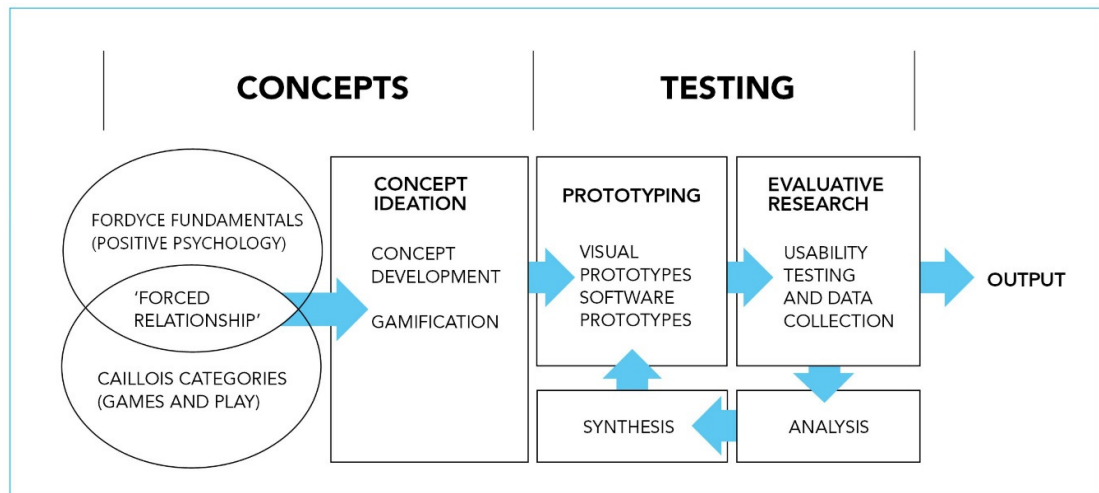


Figure 5: application ideation and development process

The second phase of the process (Figure 5) is the testing phase. Application concepts are visually prototyped and prepared for software development, then selected application concepts are encoded and iteratively tested. A visual mockup of the concept in situ is designed, a list of user stories is generated in preparation for development, and the steps for software development are entered into a kanban planning tool. Once the application

is delivered in code, it is user-tested and the data analyzed and synthesized into the following release.

Qualitative evaluation by observation is carried out following each iteration of development to identify misunderstandings or hindrances that participants experience while using the interface. Each round of testing uses 3-4 participants; Virszi (1990) notes that tests with a small number of participants reveal the majority of usability problems, and that the most serious problems are typically detected by the first few participants. User Stories are supplied to participants as goals and their activity in trying to achieve those goals is observed and recorded. Activity is evaluated to highlight misunderstandings or hindrances, itemizing specific observations in one or multiple participants. These observations are analyzed using heuristic evaluation (Nielsen, 1994) to further understand the problems encountered. Finally, specific changes for implementation in the following round of development are itemized in each synthesis section.

Participants are selected with a view to acquiring quality feedback. All participants own mobile phones and are well-acquainted with their use; are aged over 18 years old; are able to communicate ideas clearly and fluently; have played games and used utility apps on mobile; and are willing to volunteer and fully engage with the experience. The factors of familiarity and the ability to maturely express ideas are believed consistent with high-quality feedback. Two of these characteristics -- age-limiting and full engagement -- may make the sample group different from the mobile application market in general. Usability testing with children has characteristics that differ from adult testing (Markopoulos & Bekker, 2003). Full engagement is desired in order to receive greater feedback from participants. Convenience sampling (Marshall, 1996) is used in this study.

3.2 Ideation tool: Fordyce/Caillois table

A tool is created to synthesize the principles of positive psychology with those of games and play (Appendix A). The tool combines Fordyce's 14 Fundamentals with Caillois' categories of play using a forced relationship (section 2.3: Forced relationship process) to generate application concepts, for example the 'Powerful Preparation' application concept combines Fordyce's "stop worrying" Fundamental with Caillois' "active mimicry" category of play in a guided movement exercise to reduce stress levels.

The application concepts generated with this tool are examined for further development, with eleven selected. Priority is given to those concepts which present novel ideas not already existing in the mobile application marketplace, concepts which can reasonably be implemented in mobile, and concepts which are likely to engage users.

3.3 Gamification identification

After application concepts are created with the ideation tool, each concept is subject to examination against a range of gamification methods (section 2.3: Gamification Methods).

Those methods which already occur in some form are listed—with comments on the specific manifestation—under the subheading 'inherent' while those methods which may be easily or naturally applied to the application concept are listed under the subheading 'contrived'. Identifying these methods aids the ongoing development of each application by clarifying the key enjoyment aspects of the user experience.

3.4 Development

The description section for each application concept includes the following:

Table 3: Development description sections

Description
Concept background
Characteristics of the application concept
<i>Fordyce fundamental and Caillois category</i>
<i>Gamification methods</i>
<i>Inherent</i>
<i>Contrived</i>
Sprint development period (repeated as necessary)
<i>Description of sprint goals</i>
<i>Kanban tasks</i>
<i>Visual appearance of app</i>
<i>User stories</i>
<i>Evaluative research</i>
<i>Analysis</i>
<i>Synthesis</i>

The software development follows standard Agile development practice (Section 2.4: Agile software development methodology). Development periods (coding, user testing and analysis) are collated into sprints. The web tool Trello (Trello, 2011) is used as a kanban (Section 2.4: Kanban process tool) to visualize projects' tasks (Figure 4). At the beginning of each project User Stories are outlined, broken down into addressable units of work and selected for the first sprint (Figure 3, page 18), beginning with a Minimum Viable Product in the release following the first sprint.

User testing and usability analysis is carried out following the coding stage. When a functioning application is available, qualitative user tests are carried out, actively soliciting feedback while observing users with the apps and making notes, recording audio and capturing onscreen video. The results of the user testing sessions are evaluated, analyzed, and synthesized into the following sprint.

Individual users are selected for the testing sessions. There is no specific target audience for the mobile applications; the users can be male or female, and of any age 18 or over. A high level of knowledge in game experiences or mobile phone use is preferred to aid in providing quality feedback. Users will not be subject to multiple iterations of the same application, as more information is sought from fresh users. All users are volunteers and are not paid for their time. Users' time commitment is estimated to be 10-15 minutes.

Ethics

The work in this study was covered by the departmental ethics application already in force. No separate ethics application was required for the work described, as it did not operate outside the scope of the departmental ethics application.

The interactions in this study were non-invasive, non-harmful, and with prior consent from participants. The study's interactions were with adult volunteers. Activities were recorded with participants' prior verbal consent. The recorded material was spoken audio and video of onscreen activity only. Participants did not appear in the video, and were not remunerated for their participation. No information about participants was sought or used beyond that given by participants in the interactions.

CHAPTER 4. DEVELOPMENTAL DESCRIPTIONS

4.1 POWERFUL PREPARATION

Description

‘Powerful Preparation’ is a mobile application that provides information about dominant body posing (de Waal, 1998) and its benefits, shows sample poses, and allows the user to run a timer while engaging in the exercise. The poses shown are those used in an academic study measuring biochemical response to dominant body poses (Carney, 2010). The timed period is for the same length as the period in the study. The information is displayed both during the timed period and in a separate part of the application.

Concept background

The app's underlying concept is based on a Stanford University study (Carney, 2010) which measured significant increases in testosterone and decreases in cortisol levels in subjects exhibiting dominant body poses for a prescribed period of time. This physiological effect is linked to the elation following dominant social displays such as sports victories, and was shown in the study to increase confident behaviour. The poses used in the study are shown as examples in this mobile application.

The application concept combines the Fordyce Fundamental “stop worrying” with the Caillois category “active mimicry”. There is evidence that shows that meditative practice of this kind, even in short periods and limited sessions, can improve mood, reduce anxiety, and relax subjects (Lane et al., 2007) and positively affect physiological reactions (Tang et al., 2007). The user mimics the poses shown in the application during the timed period, both functions which a mobile phone has the capability to fulfill.

A mobile implementation of this exercise allows the user to practice at any time or in any location. Users may seek calm in high-stress situations such as before a presentation or

interview, or practise in an inescapably non-peaceful setting such as a bus or train. Changing location to find a private or peaceful setting amenable to focused practice is also possible with a mobile application.

Characteristics of the application concept

Table 4: characteristics of the Powerful Preparation application concept

Fordyce fundamental	Stop worrying
Caillois category	Active mimicry
INHERENT GAMIFICATION:	
Classic conditioning	Associates elevated mood with the activity
Intrinsic rewarding	User recognizes need for activity in some situations
Completeness	Trying different poses
Bartle's play styles	Explorer
Dominance	Ability to change own mood
Autonomy	Tool for personal change
CONTRIVED GAMIFICATION:	
Cuteification	Human silhouettes rather than abstract figures

First sprint

The first sprint was carried out with paper prototypes. These are sketched diagrammatical cutouts used to quickly wireframe UI concepts and allow cursory testing without formal design or software development.

Kanban tasks

1. Concept ideation: Fordyce/Caillois synthesis
2. Gamification of concept: apply gamification techniques
3. Generate screen elements: pose graphics, timer, buttons
4. Generate paper prototypes: screen sketches, animation frames
5. User testing and analysis: evaluation, synthesis

Prototype appearance

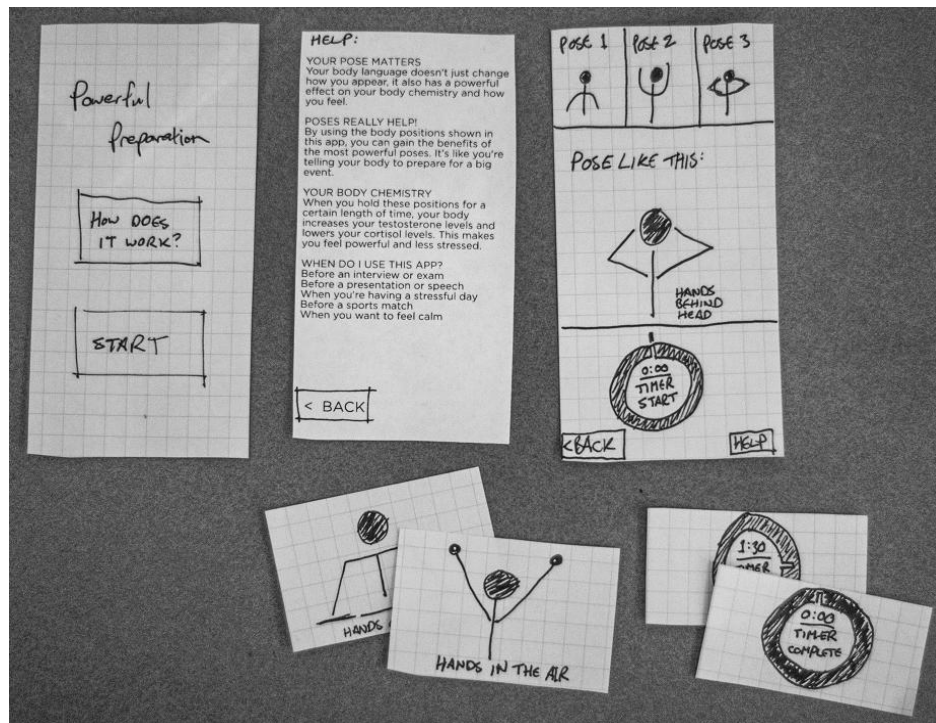


Figure 6: Powerful Preparation paper prototype for first sprint

User stories

1. Make a selection from the home screen (user comprehends purpose and meaning of button text)
2. Learn about the exercise (user navigates to help screen and comprehends text)
3. Make a pose selection from the timer screen (user comprehends pose buttons/tabs)
4. Start the timer in the timer screen (user comprehends timer interface and functionality)
5. Complete the exercise shown (user comprehends the prescribed timed process)

Evaluative research

Four users participated in this round of testing. An introduction to the underlying principles of the app's exercise was given beforehand (with similar content to the info/help page). Problems identified in the first round of testing:

- Users did not recognize the top section elements as buttons/tabs/interactive elements
- Users did not know if the middle section element was interactive, but tried to tap it
- Users did not clearly see the correlation between the top section thumbnail images and the middle section zoomed-in image

Analysis

Users did not know which elements on the timer page were interactive and which were not. The concepts of perceived affordance and physical affordance (Norman, 1999) describe how an object's appearance and form give us clues about how it can be used. Because the elements did not look like software/hardware buttons, the users did not expect that they could be interacted with like buttons. Users who are familiar with the conventions of a broader interface (i.e. mobile applications) can recognize the conventions of that interface (Norman, 1999) and likewise users familiar with a class of objects can recognize the affordances of that class in different contexts (Jones, 2003). However, these conventions and affordances must be carefully replicated by hand if they are to maintain their signalling ability to the user in a paper-prototype context. By contrast, the timer graphic had a number of characteristics which signalled its function: the shape, the skeuomorphic appearance of a kitchen timer, and the numbers in a 0:00 format which is associated with timekeeping.

Users did not clearly see the correlations between the top section thumbnail images and the middle section zoomed-in image. The visibility (Norman, 1988) of the selected state was not clear to the user. While overall the visibility of the controls was very high, with no hidden functionality, the current selection was not highlighted and so the users did not correlate the selected thumbnail in the top section with the larger image in the middle section. The feedback the user gained from pressing the buttons in the top section was clear: the zoomed-in image in the middle section changed. This confirmed to the user that

the thumbnails correlated with the zoomed-in image, but this only occurred after they had already pressed a button.

Synthesis

The following requirements were laid out for the application design based on the first round of user testing with paper prototypes:

- buttons in the top section clearly highlighted when selected
- button descriptors in the top section removed for simplicity
- 'Pose like this' descriptor in the middle section removed for simplicity
- 'Timer start' descriptor replaced with a standard PLAY symbol for simplicity
- standard PLAY symbol toggled with a standard PAUSE symbol on the timer
- timer pointer made larger for better visibility of timer progress
- 0:00 default number on the timer replaced with 2:00 to show the time period
- button graphics on home screen
- thumbnails on info/help screen

Second sprint

The design and development in this sprint derived from the user feedback and subsequent evaluation, analysis and synthesis in the first sprint. Further, the application concept was coded for mobile; all interactions in this sprint occurred on a digital screen rather than on paper. The general characteristics of the paper prototype that users comprehended were retained, and the User Goals remained the same.

Kanban tasks

1. Generate digital design elements for screen
2. Ensure buttons have clear selection highlighting
3. Remove button descriptors

4. Remove 'pose like this' text
5. Replace 'timer start' with play/pause toggle
1. Make the timer pointer larger
2. Replace 0:00 with 2:00
3. Add button graphics to homescreen
4. Add thumbnails to info/help screen
5. Coding
6. User testing and analysis

Prototype appearance

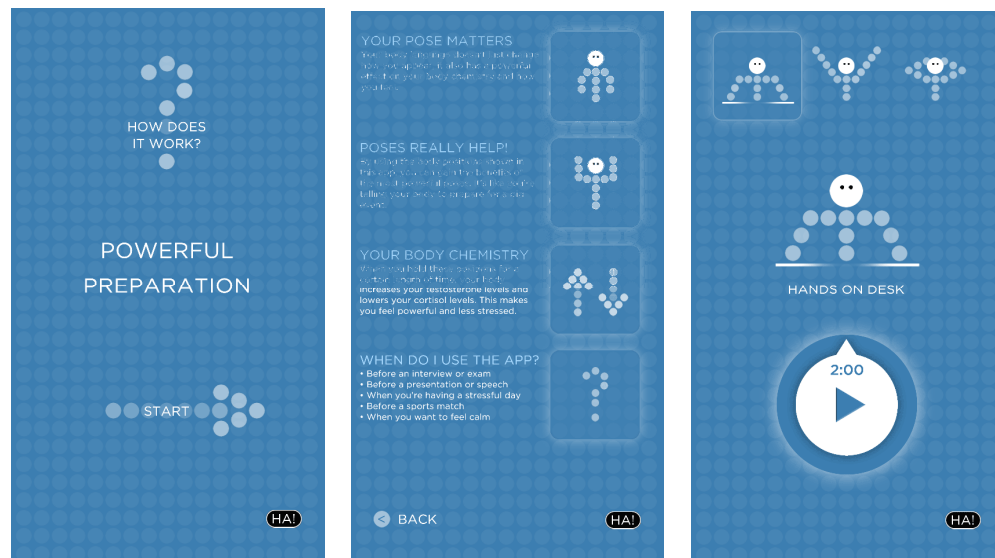


Figure 7: Powerful Preparation prototype for second sprint

User stories

1. Make a selection from the home screen
2. Learn about the exercise
3. Make a pose selection from the timer screen

4. Start the timer in the timer screen
5. Complete the exercise shown

Evaluative research

Four users participated in this round of testing. An introduction to the underlying principles of the app's exercise was given beforehand by reading users the content of the info/help screen. Their onscreen activity and the session audio was recorded as a video.

Three of the users immediately pressed the 'Start' button on the home screen, while in the first round of testing all users pressed the 'How does it work?' button first; the position and appearance of these buttons changed in the second sprint.

In the info/help screen, some users tried to press the thumbnail images. Two users wanted more text information about the ideas presented onscreen. One user thought that the thumbnail images were buttons that lead to subsections with more information; the thumbnail images looked very similar to the active buttons on the timer screen.

All users were able to complete the core activities. All users navigated between the main screen, the info/help screen, and the timer screen. Some users immediately recognized the top section elements as interactive elements. All users eventually recognized that the top section elements were correlated with the zoomed-in image in the middle section. All users were able to start the timer, pause the timer, and complete the pose exercise. All users were more engaged with the software prototype than the paper prototype: they were quicker to try pressing elements and less likely to ask for aid from the facilitator.

Problems identified in the second round of testing:

- Some users did not know if the middle section element was interactive, but tried to tap it
- Some users did not recognize the top section elements as interactive elements

- One user said that the timer countdown numbers were not large enough to see during the exercise
- Three users were unsure if the exercise time period had finished
- Two users wanted more guidance and prompting during the exercise
- Users were unsure what to do when the exercise had finished. Some went through all three poses "to see which one works best"
- Users who tried the second pose ('Hands in the air') felt self-conscious
- One user said that the 'dot guy' figures demonstrating the poses should be smiling

Analysis

The change to the home screen layout appeared to reduce the likelihood of users visiting the info/help screen. This may be a result of the visual hierarchy (Pettersson, 2010) presented by the screen layout: the title is now in the centre of the screen, with the help/info link above and the 'Start' link below. Following a visual hierarchy, the user is drawn to the large title in the centre and then reads downwards, ignoring the smaller link above. The information provided on the info/help page aids users' understanding of the application and the exercises, and bypassing it presents a significant problem.

The consistency (Nielsen, 1994) added by the use of 'dot guy' figures aided the users in recognizing the correlation between the top section thumbnails and the middle section image. There is some evidence that the 'cuteification' of an avatar or character can increase experience appeal (Anderson, 2012), as a user's desire for the 'dot guy' to smile showed.

One user described their mental model (Kieras & Bovair, 1984) of the app's exercise process was a set of gym/stretching exercises in which the user would progress in a linear way through all the prescribed movements. This idea does not conform to the study from

which the poses and timed period are drawn (Carney, 2010) but highlights the unstructured nature of the exercise in this implementation.

Users were unsure what to do when the exercise had finished. There is an opportunity to provide users with stronger feedback (Nielsen, 1995) in the form of clarity and guidance so that they are aware of the status of the exercise process and the options available to them.

Synthesis

The following requirements were laid out for the application design based on the second round of user testing:

1. home screen/landing page removed entirely
2. info/help link on home screen moved to menu on timer screen
3. additional content available in info/help screen
4. top and middle section of timer screen integrated into carousel
5. redesign of the 'dot guy' figures: more human-looking
6. redesign of timer screen to help users through a typical session
7. clearer progress indicator during the timed period

Third sprint

In this sprint the homescreen was removed, a carousel for pose selection was added, and the interface was redesigned for simpler operation. The requirements from the second sprint were implemented, and the mobile application was tested with users.

Kanban tasks

1. Remove homescreen entirely
2. Make timer page cleaner in style
3. Update timer graphic style
4. Make 'dot guy' figure a human figure

5. Replace pose selection with carousel
6. Move help/info link to timer screen via overflow menu
7. Link external content in help/info screen
8. Coding
9. User testing and analysis

Prototype appearance

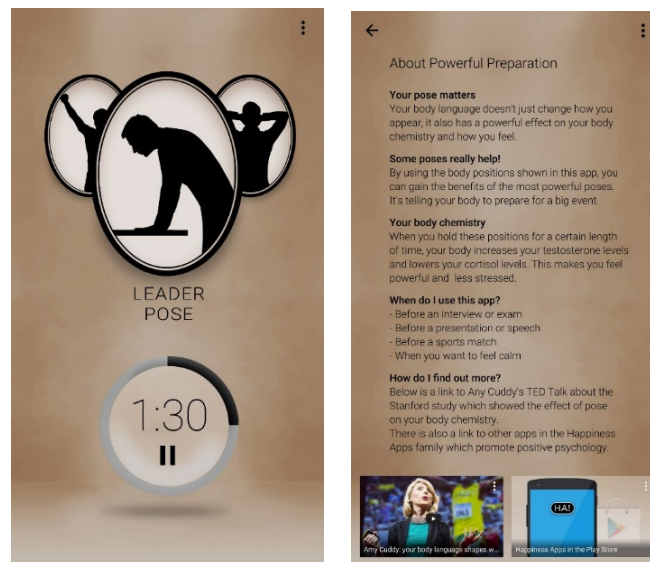


Figure 8: Powerful Preparation prototype for third sprint

User stories

1. Make a selection from the home screen
2. Learn about the exercise
3. Make a pose selection from the timer screen
4. Start the timer in the timer screen
5. Complete the exercise shown

Evaluative research

Three users participated in this round of testing. An introduction to the underlying principles of the app's exercise was given beforehand by reading users the content of the info/help screen. Their onscreen activity and the session audio was recorded as a video.

The first user was able to easily complete the selection and timing tasks. However, he was not familiar enough with the Android UI to locate the menu where the help/info screen was linked to. He grew bored during the task and suggested that affirmations or game-like power-up bars be displayed. The dimming/power-saving feature activated during the timing task; when asked, he did not consider using the app with the screen off.

The second user was able to complete the selection and timing tasks, but did not use the overflow menu. He did not have the physical range of motion to do all the available poses, so he selected the 'Leader' pose. His screen dimmed and then turned itself off during the two-minute timed period (a global setting on his phone that was not active on other phones tested).

The third user had to be coached through the selection task, completed the timing task, and did not explore the other screen elements. After the timer period ended, she began again with a different pose.

All three users recognized the poses portrayed by the graphics clearly and were familiar with the visual signifiers of the timer element.

Analysis

The changes implemented after the second round of testing were effective in aided comprehension of the timer screen interface: all users in this sprint were able to use the timer unprompted, and two of the three were able to select a pose, correctly mimic the pose, and complete the timed period unprompted. However, the use of the overflow

menu—part of Google's mobile UI recommendations (Google, 2014)—for access to the help/info screen made this function far less visible to all the users.

The dimming/power-saving feature that activated on one phone interrupted the timed activity. The user broke his pose to reactivate the screen. Mobile applications can be coded to force the screen to stay on while processes are running, a feature which can be implemented to prevent screen dimming in future releases.

As explored in the earlier analysis, users may require more visual stimulation during the timed period. Displaying content from the Help/Info page may increase the intrinsic reward (Lepper, Greene, Nisbett, 1973) and feeling of mastery and dominance (Rigby & Ryan, 2011) associated with the experience.

Currently, the app indicates the end of the timed period with a brief notification sound and by resetting the visual indicators on the timing element. Adding a congratulatory message may promote further use through operant conditioning (Skinner, 1938) in addition to helping the user understand that no further input is expected.

Synthesis

The following requirements were laid out for the application design based on the third round of user testing:

- the help/info content will be displayed, cycling text onscreen during the timed period
- a message with display at the end of the timed period with 'quit' and 'continue' buttons
- the app will force the device's screen to stay on without dimming during the timed period

Feature addition: 'Face Mode'

There is some evidence that looking at attractive people raises testosterone (Dreber et al, 2012; Ronay & von Hippel, 2010). With a view to strengthening the known effects of dominant posing already practiced with the app, an image of an attractive face will be

displayed during the timed period. This will also make the experience more visually engaging during a time when testing shows that the user can grow bored.

To apply the principle in the application, three facial images will be presented as options for the user to select: a white male, a black female, and a white female. These images are visually-averaged composites of many faces to conform with a theory that 'average' faces are generally considered more attractive (Rhodes et al, 2002). The 'Face Mode' feature will toggle off and on via a button on the menu bar, and will be switched off by default.

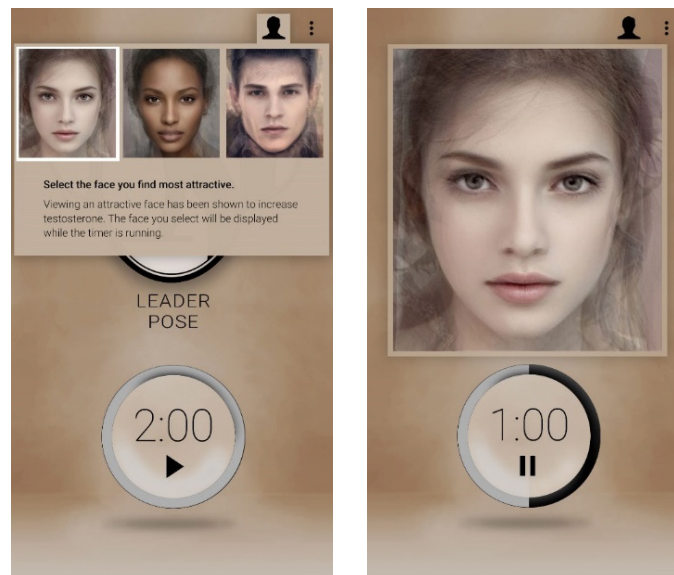


Figure 9: Powerful Preparation prototype including Face Mode (planned fourth sprint)

4.2 Buzz Back

Description

‘Buzz Back’ is a sensory game which plays a pattern of short and long vibrations. The user repeats the pattern with corresponding buttons onscreen. The sensory experience differs from most mobile games which depend on visual feedback, a dichotomy which is explored in development.

Concept background

The initial Buzz Back concept prescribes a user experience that is pared back to an absolute minimum of input to reduce stimulation rather than overwhelm the senses or take advantage of multiple aspects of user engagement. This simplicity means that repeated play may not remain compelling. Possible models for pared-back game styles are uncomplicated atmospheric games, such as Osmos, which are both immersive and calming.

The goal of Buzz Back’s haptic feedback (vibration) focus is to help the user become present-oriented. Meditative practice "activates neural structures involved in attention" (Lazar et al, 2000) and aids users seeking a positive experience. The haptic feedback focus of the game has parallels with forms of meditation which exhort the practitioner to focus on a single physical stimulus such as "mindful breathing [which] may help to reduce reactivity to repetitive thoughts" (Feldman et al, 2010). Benefits extend beyond this single form of physical focus; "Mindful low-exertion activities as well as aerobic activities enhanced mood in a single session of exercise." (Netz & Lidor, 2003). The user's focus on vibration and their physical feedback to that vibration may fall within this sphere of activity.

The contrast between haptic feedback and visual feedback is explored in development. The first sprint has minimal visual feedback, promoting a focus on haptic feedback. The

second sprint has cuteification applied, introducing strong visual elements. The contrast in experience between the two application versions is discussed.

Characteristics of the application concept

Table 5: characteristics of the Buzz Back application concept

Fordyce fundamental	Become present-oriented
Caillois category	Ludic vertigo
INHERENT GAMIFICATION:	
Operant conditioning	High scores
Classic conditioning	Stimulus/response per-tap: visual effects for taps
Random rewarding	Stage rewards
Intrinsic rewarding	Relaxing / learning / high score gaining
Safety of artificial worlds/conflicts	Game environment
Completeness	Four modes of play
Bartle's play styles	Achiever
Dominance	Relaxed Mode / Rhythm Mode
Mastery	Morse Code Mode / Action Mode
Autonomy	Four modes to choose from
CONTRIVED GAMIFICATION:	
Cuteification	Cute graphic elements

First sprint

The first sprint focused on basic functionality with little visual decoration, simply presenting a back screen with interactive buttons. A goal in this sprint was to solicit user feedback on the haptic feedback experience; by contrast, the second sprint would add strong visual elements and cuteification.

Kanban tasks

1. Concept ideation
2. Gamification of concept
3. Generate screen elements

4. Generate button animations
5. Coding
6. User testing and analysis

User stories

1. Make a selection from the home screen
2. Play the game with onscreen controls
3. Stop the game with the STOP button
4. Exit the game

Prototype appearance



Figure 10: Buzz Back prototype for first sprint

Evaluative research

Three users participated in this round of testing. An introduction to the underlying principles of the app's exercise was given beforehand with a demonstration. Users' onscreen activity and the session audio was recorded as a video. Issues identified in the first round of testing:

- While vibrations were easy for users to sense, they had trouble differentiating between the short and long vibrations

- Users stated that they did not see Buzz Back as a 'game', citing the lack of specific gamification characteristics
- Users didn't always notice the brief screen flash indicating success or failure
- Looking away from the screen or closing eyes was observed in users, indicating that haptic feedback was recognized as being more important than visual feedback
- Users imagined an overarching system in Buzz Back which did not exist (vibration patterns were in fact random), in particular the reversion to three short vibrations after a user failure

Analysis

Two users closed their eyes during the testing period, indicating that the haptic information was prioritized over the visual information. When users wanted to focus on haptic patterns, visual information was a distraction; one user said “it’s easier not looking at the screen.” The focus on a single sense experience met the initial goal of the application concept.

The haptic feedback used in the application was not well-differentiated between short and long vibrations. Vibration-perceived intensity can be altered by adjusting the vibration’s pattern with regard to the powering up periods and fade rates of the physical vibration component. A sustained low-intensity vibration is achieved by clustering short vibrations with very short intervals, creating a very different effect than a single sustained vibration. This adjusted pattern can be implemented to help users differentiate between short and long vibrations.

User input and success was not adequately recognized. Currently the user feels no haptic feedback when they tap the screen, and see just a brief flash of green (success) or red (failure) following their input pattern. Users did not consistently notice the colour of the flash or recognize its significance. Rewarding success promotes further play through

classic conditioning, and there is an opportunity to apply this principle by acknowledging user input more fully.

Adding strong visual cues, visual rewards, and visual interest would fundamentally change the nature of the user experience. Visual stimuli may compromise, overwhelm, or replace the haptic experience. By changing the appearance of the game screen, users may more readily engage with the app, categorize it into a game genre, or dismiss it as a undesirable experience. The abstract buttons and black background in this version can be significantly altered in the second version by applying cuteification and examining user responses.

Synthesis

- Changing the long and short vibrations to be significantly differentiated
- Adding haptic feedback to successful button taps (in-kind to vibration length) to reinforce success and haptic primacy
- Applying gamification methods to make an identical repeated experience more enjoyable

Second sprint

The second sprint applied significant cuteification; the abstract buttons were overlaid with images of a cat and a kitten. When the user repeated the vibration pattern correctly, the kitten moved in an animated dance. When the user repeated the vibration pattern incorrectly, the cat turned and frowned at the user. The long and short vibration pattern timings were adjusted to better differentiate vibration lengths. In this sprint, the effect of cuteification is examined.

Kanban tasks

1. Re-ideate with appropriate cuteification imagery
2. Generate screen elements

3. Generate button animations
4. Change vibration timings
5. Coding
6. User testing and analysis

Prototype appearance

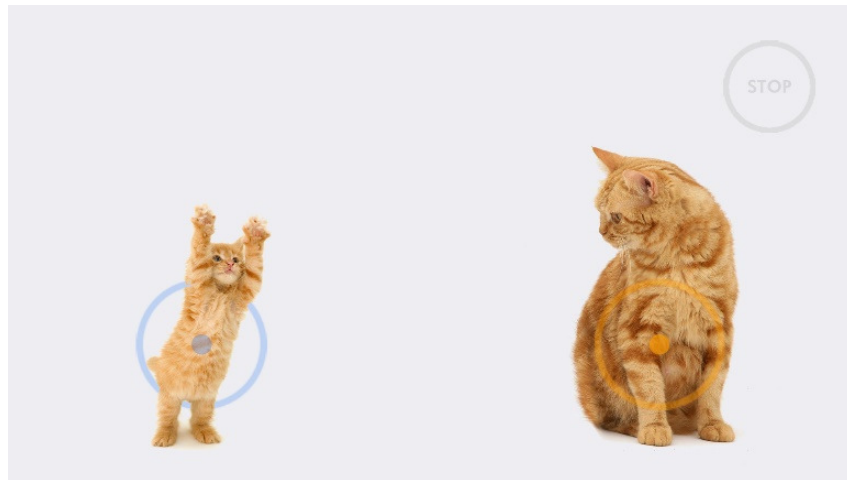


Figure 11: Buzz Back prototype for second sprint

User stories

1. Make a selection from the home screen
2. Play the game with onscreen controls
3. Stop the game with the STOP button
4. Exit the game

Evaluative research

Three users participated in this round of testing. An introduction to the underlying principles of the app's exercise was given beforehand with a demonstration. Users' onscreen activity and the session audio was recorded as a video. Issues identified in the first round of testing:

- Users liked the vibration-on-button-press response (“nice to have that feedback”) combined with the visual flash of the button circle
- Sustained play was shorter than the first version (“I think I’ve mastered it”)
- Users were focused exclusively on the screen and the animated visuals (“I was looking at it the whole time”) and valued the response (“there’d be less incentive without seeing the kittens...it’s nice to have that feedback...sort of interactive candy.”)
- The rhythm the users tapped at was at a similar rate to the vibration they felt. This differed from the first round of testing
- Users were easily able to distinguish short vibrations from long vibrations

Analysis

The altered vibration timing was very easy for users to distinguish. Users made far fewer mistakes and often scored several successes consecutively. This reduced the primary challenge of the gameplay; in the first version the experience seemed too difficult, but in this second version the experience seemed too easy. The haptic feedback the users received was too easily differentiated to be challenging.

No user closed their eyes while playing. The vibrating timing was simpler to distinguish in this version. Further, the stronger visual elements and standard pattern of interaction with a smartphone both prompted a focus on the screen. This indicates that the multiple-sensory information presented by the application distracts from a focus on the haptic information.

The primary cuteification applied—visual feedback with an animated kitten and cat—did not promote sustained play compared to the first version. Users responded positively to the appearance and the animation, but soon tired of the identical animation and it reached extinction (Mirenowicz & Schultz, 1994) as a rewarding event.

Users asked if the application was a game designed for children. There are several characteristics associating the experience with those made for children: cuteification, repetitive gameplay, animation, and a simple, easily-grasped concept. User testing with children rather than adults is required to confirm the suitability of the application for use with a specific age group.

4.3 MY AWESOME LIFE (ALPHA STAGE)

Description

‘My Awesome Life’ is a dedicated storage and display app for anticipated events, treasured memories, and inspiring plans. It serves as a central hub for positive pursuits, incidents, and occurrences, and as an overwhelming reminder of the sheer volume of these events. The user shares images, web links, or text to the app. She describes her content with a caption and places it in one of three category tabs:

- *Anticipate* – Events occurring in the near future
- *Awesome* – Past events and valued memories
- *Someday* – Distant goals or plans

Concept background

A characteristic found in happy people is to 'endow' positive past events and memories, effectively using them as a repository for positive self-reflection (Lieberman et al, 2009). This concept already exists in various forms: a hope chest, a collection of old letters, or a mantelpiece of photographs—items clustered together to engender a mood of anticipation or pleasant memories. However, while physical objects are easily gathered and displayed, digital content is often sequestered in folders and easily forgotten. This application concept provides the user with the opportunity to selectively display and reflect on digital content which best serves the desire for anticipation and for pleasant memories.

Characteristics of the application concept

Table 6: characteristics of My Awesome Life application concept

Fordyce fundamental	Close relationships are the number one source of happiness
Caillois category	Other

INHERENT GAMIFICATION:

Operant conditioning	Associates with good feelings
Intrinsic rewarding	User sees value in self-posted content
Safety of artificial worlds/conflicts	Memories of past social interaction
Completeness	Potential for many posts/memories
Bartle's play styles	Socializer
Relatedness	Connections to others demonstrated

First sprint

The first sprint designed and coded the core functionality listed in the User Stories section in preparation for release and user testing. This sprint is not yet complete.

Kanban tasks

1. Concept ideation
2. Generate screen elements
3. List user stories
4. Chalk talk with developer
5. Describe success conditions for UT-1
6. Coding
7. User testing and analysis

Prototype appearance

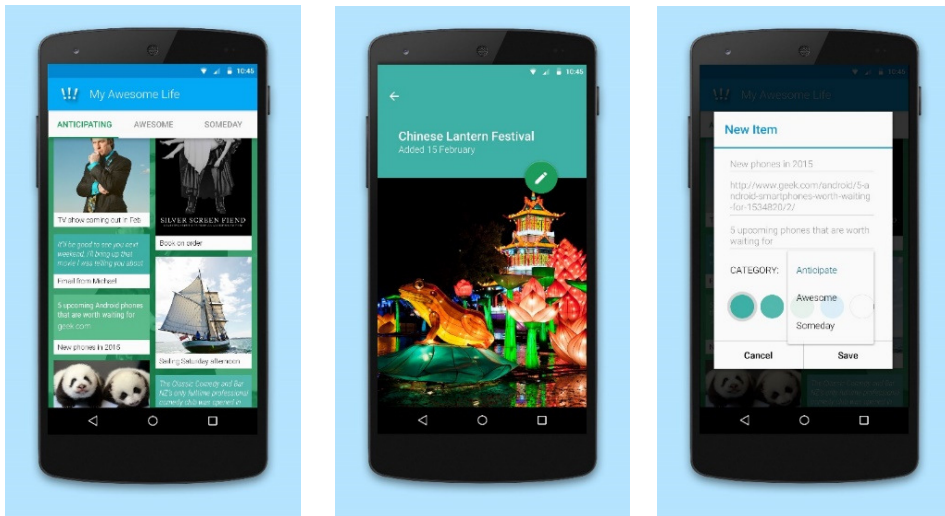


Figure 12: My Awesome Life prototype for first sprint

User stories

1. View 'Anticipating' section: Open app from homescreen/drawer, select tab
2. View 'Awesome' section: Open app from homescreen/drawer, select tab
3. View 'Someday' section: Open app from homescreen/drawer, select tab
4. View entry: Open app from homescreen/drawer, select desired tab, select entry
5. View help screen
6. View More Info screen
7. Create new entry
8. Share link as new entry. Save, return to original app
9. Share image as new entry. Save, return to original app
10. Share text as new entry. Save, return to original app
11. Edit entry

Current status

The application is currently in an alpha stage of software development. Layout is complete and functionality is being tested in code. The application is not yet ready for user testing or demonstration.

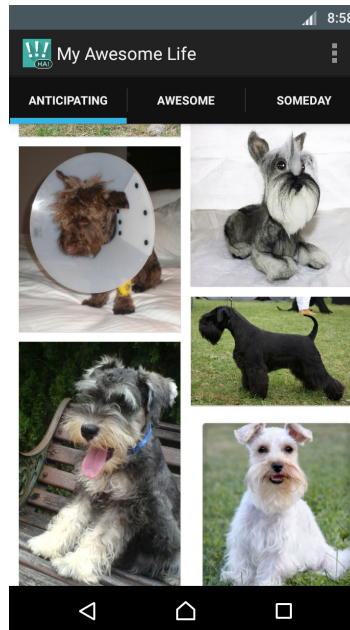


Figure 13: My Awesome Life screen (alpha stage)

4.4 SLAY THE DRAGON (CONCEPT)

Description

‘Slay The Dragon’ is a mobile app which characterizes daily to-do tasks as enemies of various difficulty. Completing these tasks rewards the user commensurately with in-game coins which can be saved or spent on user-defined rewards. Further, tasks of the highest difficulty level (‘Dragon’) are recorded in the Hall Of Fame when completed.

Concept background

The thematic tropes of roleplaying games are used in the online web tool ‘HabitRPG’ by Tyler Rennelle, who describes it as "a game for building real-life habits...in the context of a competitive and social game." (Rennelle, 2009) The dominant psychological effect in HRPg is operant conditioning (Skinner, 1938); the player is given constant positive reinforcement for completing tasks (response) in the form of in-game rewards (stimulus). There is also negative reinforcement: a player loses hit points (stimulus) if he passively allows his Daily tasks to go uncompleted, but may avoid this effect by completing them (response). Ongoing use of HRPg may incidentally induce the effects of classic conditioning as the player associates HRPg with success (Skinner, 1938), which can aid in overcoming the anxiety of change or risk.

Slay The Dragon as an application concept retains key elements of the HabitRPG tool while removing complexity. The application has a simplified interface and a single goal: to gain coins/rewards by completing tasks. This straightforward system of tasks and rewards is suited to the reduced level of engagement of a mobile interface.

Characteristics of the application concept

Table 7: characteristics of Slay The Dragon application concept

Fordyce fundamental	Get better organized and plan things out
Caillois category	Ludic competition
INHERENT GAMIFICATION:	
Operant conditioning	Rewarding per-task and per-day with token system
Classic conditioning	Rewards associated with achieving tasks
Intrinsic rewarding	Self-evident need to complete tasks during day
Narrative	Hall Of Fame for slaying Dragons
Bartle's Play Styles	Achiever + Killer
Dominance	Low-hanging fruit tasks with lower rewards
Mastery	Achievement of daily tasks
Autonomy	Self-ordained tasks, self-guided process
CONTRIVED GAMIFICATION:	
Random rewarding	Possible stochastic 'bonus' coins

Prototype appearance

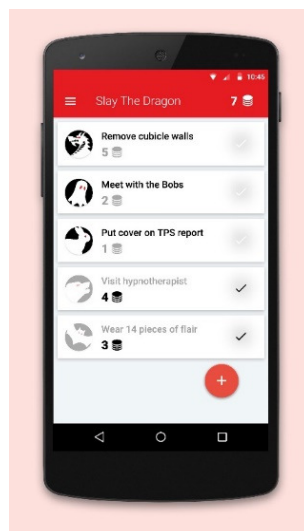


Figure 14: Slay The Dragon concept mockup

User stories

1. Add task
2. Add reward
3. Complete task
4. Claim reward
5. Navigate between screens

Reason for non-completion

While this application concept was flagged for further development, there was insufficient time for coding during the study.

4.5 WALK TO PARIS (CONCEPT)

Description

This application concept is an exercise tracker which shows how far a user has cumulatively travelled on a global map, with fine-level detail of current location and destination information. Users can form teams to achieve more ambitious trips (e.g. around the world in 80 days) and share their progress on social media.

Concept background

Exercise has an inherently meaningful long-term goal of improved health, performance and fitness, but is carried out in a series of discrete events, each of which does not necessarily have any meaning of its own. Building a mythical narrative around the activity can give it greater meaning (Sarbin, 1986), with every unit of distance being rewarded with the thrill of discovery and contributing to an overarching story with a sense of genuine significance.

Characteristics of the application concept

Table 8: characteristics of Walk To Paris application concept

Fordyce fundamental	Keep busy and be more active
Cailliois category	Active competition
INHERENT GAMIFICATION:	
Operant conditioning	Rewarding per-day, waypoints
Classic conditioning	Rewards associated with journey
Intrinsic rewarding	Curiosity
Safety of artificial worlds/conflicts	Immediacy, consistency, density
Completeness	Overarching narrative
Narrative	Overarching narrative
Social comparison	Social integration/teams
Bartle's play styles	Achiever/Explorer/Socializer
Dominance	Incremental contribution to significant goal

Mastery	Significant goal with cumulative progress
Autonomy	Opt-in contribution/progression
Relatedness	Social integration/teams
CONTRIVED GAMIFICATION:	
Cuteification	Waze-like iconography, customizable map markers, animations

Prototype appearance

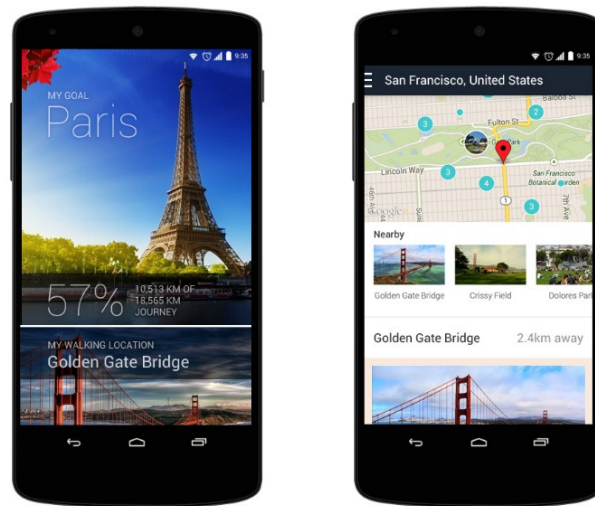


Figure 15: Walk To Paris concept mockup

User stories

1. Confirm GPS signal and current location
2. Select final destination on global map
3. Track current progress on global map
4. View proxy location on local maps
5. Track distance while exercising

Reason for non-completion

The scale of the project exceeded time available. To implement the planned features, libraries of locality information and points of interest would need to be accessed and

thoroughly tested. Hardware testing would be required in a wide range of urban and rural settings with variants of devices and components to ensure accuracy and a good user experience. In later sprints, groups of testers would be needed to resolve team data in different situations. These feature build-outs and testing scenarios could not be realistically completed within the study period.

4.6 WORK-FUN COMBO (CONCEPT)

Description

This application concept is a daily task list which alternates between ‘work’ tasks and ‘reward’ tasks. Each task period displays an onscreen timer. Each reward period begins with a dramatic visual celebratory display.

Concept background

The concept expands on existing planning tools with greater reward signalling. Time-blocking techniques such as Pomodoro (Crisillo, 2006) alternate work periods and rest periods. There is an opportunity to amplify the reward of completing a work period with a strong visual display to congratulate the user for their achievement, and provide a customizable reward period, typically a leisure activity, following the work period. The application concept is aimed at users who struggle to conform to their own schedule and are seeking a more pronounced reward signalling experience.

Characteristics of the application concept

Table 9: characteristics of Work-Fun Combo application concept

Fordyce fundamental	Be productive at meaningful work
Caillois category	Active vertigo
INHERENT GAMIFICATION:	
Operant conditioning	Rewarding per-task with desired reward activity, dramatic over-rewarding display
Intrinsic rewarding	Self-evident need to complete tasks during the day
Bartle's play styles	Achiever
CONTRIVED GAMIFICATION:	
Random rewarding	Potential for bonus time randomly added to reward activity periods

Prototype appearance

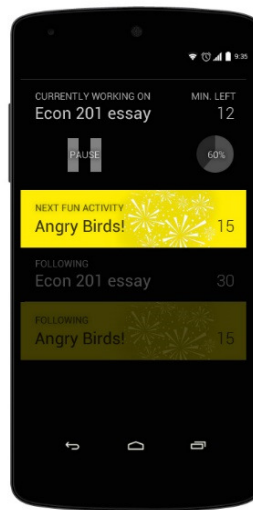


Figure 16: Work/Fun Combo concept mockup

User stories

1. User sets a work activity and time period
2. User sets a reward activity and time period
3. User completes the work activity and reward activity

Reason for non-completion

The application concept was deprioritized for software development because the functionality was very simple and has some overlaps with the more detailed 'Slay The Dragon' application concept.

4.7 BLIND MAZE (CONCEPT)

Description

This application concept facilitates the user navigating an unseen, virtual maze with his phone, which vibrates to indicate when he walks into a maze wall. Relying on haptic and audio feedback, he forms a mental map of the maze in his head and seeks to navigate to the end. He may be playing alone or racing against others in a competitive game scenario.

Concept background

The Blind Maze concept transforms a physical environment into a virtualized play space. For example, when the user walks into a virtual 'wall' to an out-of-bounds area, the phone strongly vibrates; if he continues into the area, the phone continues to vibrate for two seconds, after which it begins beeping; after four seconds, an explosion sound is played and the game ends—the player's "explosive collar" has killed him and he must begin again from the start.

This virtual environment allows games to be played in more physical ways than is usually possible in mobile gaming. Most games are visual on-screen experiences with little more physical activity required than simple tapping. The application concept expands the play space into the physical world, promoting engagement, spatial mapping, and imagination. Combined with a goal of completing the maze and a time limit, it has potential to be an exciting and kinetic experience.

Characteristics of the application concept

Table 10: characteristics of Blind Maze application concept

Fordyce fundamental	Keep busy and be more active
Caillois category	Active vertigo

INHERENT GAMIFICATION:

Operant conditioning	Physical stimulus of in-game responses
Bartle's play styles	Socializer
Dominance	Incremental contribution to significant goal
Mastery	Improvement in sensory skills over time
Relatedness	Social integration/teams
CONTRIVED GAMIFICATION:	
Random rewarding	Potential expansion of game mechanics to include power-ups and variations

Prototype appearance



Figure 17: Blind Maze concept mockup (lines indicate virtual walls)

User stories

1. Confirm GPS signal and current location
2. Confirm relative position to 'home beacon' device
3. Track relative position in maze environment
4. Respond appropriately to 'out of bounds' vibration/alert
5. Traverse full maze successfully

Reason for non-completion

Potential issues in implementation are hardware-based: the accelerometer, gyrometer, and compass units in many phones may not be accurate, fast, or consistent enough to make the game concept viable. Commercial solutions for non-GPS location (indoor positioning) rely on cell towers and known Wifi hubs to provide an accuracy level of five metres (Aomumpai et al, 2014)—far too inaccurate for the Blind Maze concept. It is possible that the use of passive RFID tags with "extensive node deployment" (Mautz, 2012) would be suitable, but this would require a level of software engineering beyond the scope of this study. The in-phone sensors like accelerometers and compasses are sufficiently accurate for only 30 seconds of movement before the data becomes unreliable ("drift") and a GPS correction is required (Mautz, 2012). These hardware-based and software-based issues could not be realistically resolved within the study period.

4.8 WORRY ABOUT THAT TODAY? (CONCEPT)

Description

This application concept allows the user to enter a number of issues she is anxious about, select one, and flip a digital ‘coin’ for each to determine if she gives herself permission to worry about the given issue.

Concept background

The application concept combines the Fordyce Fundamental “eliminate negative feelings and problems” with the Caillois category “active chance” to address the problem of worry. The solution presented is a simple mechanism to externalize the locus of control (Rotter, 1966). Typically an internal locus of control is preferred in order to increase agency, but it can be argued that worrying is a symptom of projecting one’s agency into areas where it can have no effect, creating the burden of responsibility without the relief of action. Externalizing the locus of control in this situation may help the user recalibrate her perceived limits of influence.

The application concept’s functionality is limited and simple. The user lists one or more causes of worry that she might dwell on during the day, then presses a randomizer button beside each (flipping a ‘coin’, with outcomes proportional to the number of items listed). The result—a tick or an X—indicates either that the user may worry about that subject on that day or is free to ignore it. The mechanics of the ‘coin’ flip are not 50%, but adjusted to ensure that the user is not burdened with a large number of topics to worry about.

Characteristics of the application concept

Table 11: characteristics of Worry About That Today? application concept

Fordyce fundamental	Eliminate negative feelings and problems
Caillois category	Active chance
INHERENT GAMIFICATION:	
Operant conditioning	Associates with relief
Random rewarding	Coin-flip action
Intrinsic rewarding	User seeks relief from anxiety
Safety of artificial worlds/conflicts	External locus of control
Dominance	Ability to negate worry and concern
CONTRIVED GAMIFICATION:	
Relatedness	Potential for shared goals and concerns between users

Prototype appearance

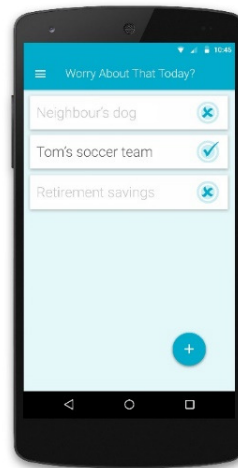


Figure 18: Worry About That Today? concept mockup

User stories

1. User creates new item
2. User activates coin-flip for an item
3. User acknowledges status of active and inactive items

Reason for non-completion

The application concept has very limited functionality compared to other concepts, and was deprioritized for development. The user interface elements were consistent with Android design guidelines which have already been thoroughly user-tested. Given the limited development time for this study, focus was placed on complicated or non-standard interfaces for user testing.

4.9 CYCLE CADENCE GAME (CONCEPT)

Description

This application concept turns a stationary exercise bicycle into a ‘smart’ bicycle with cheap components. It is a tablet game that, paired with simple hardware, controls the speed of an onscreen vehicle using the pedaling cadence rate of the user while riding an exercise bicycle.

Concept background

This concept, which promotes regular exercise through increased enjoyment, seeks to make an expensive product significantly cheaper. Some forms of exercise can be repetitive and dull, and can be made more enjoyable with gamification—in this case, a racing game controlled by pedal cadence. Exercise bicycles with integrated racing simulations already exist as commercial products, but their high price puts them out of reach of most consumers. They are self-contained products and cannot be retrofitted to existing equipment. This application concept examines the possibility of a hardware/software solution which is extremely cheap and delivers an immersive experience.

Characteristics of the application concept

Table 12: characteristics of Cycle Cadence Game application concept

Fordyce fundamental	Keep busy and be more active
Caillois category	Ludic vertigo
INHERENT GAMIFICATION:	
Operant conditioning	Enjoyment of racing game
Safety of artificial worlds/conflicts	Game environment
Bartle's play styles	Achiever
Mastery	Repetitive play

Autonomy	Work out at self-defined time
CONTRIVED GAMIFICATION:	
Social comparison	Potential sharing function to social networks, compare scores and race times

Prototype appearance

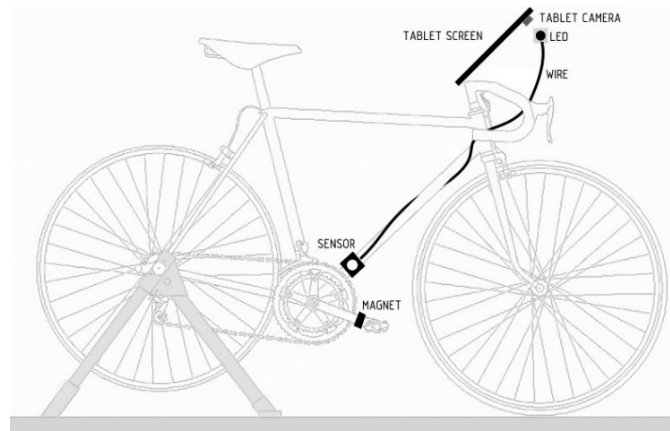


Figure 19: Cycle Cadence Game concept mockup (physical)

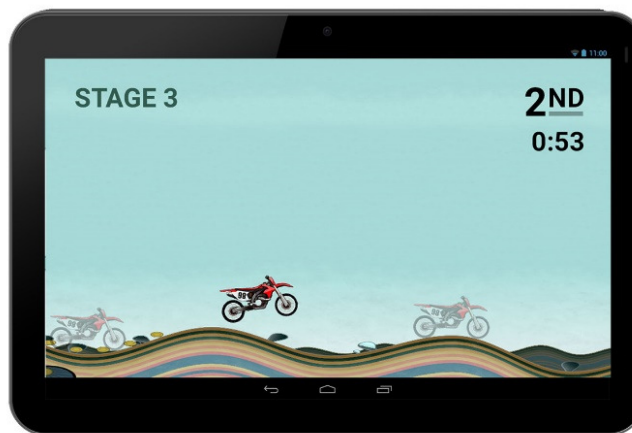


Figure 20: Cycle Cadence Game concept mockup (screen)

User stories

1. User attaches hardware to stationary exercise bicycle
2. User positions sensors to achieve successful communication
3. User begins a game

4. User varies cadence to control speed of on-screen vehicle
5. User navigates in-game screens

Reason for non-completion

The hardware implementation comprises the main portion of the early work, and no electronics expert was available to source appropriate hardware components and complete work to the required standard. Project viability was difficult to gauge without a hardware prototype, and for this reason the application concept was deprioritized for further development.

4.10 CONTACT OF THE DAY (CONCEPT)

Description

This application concept displays a randomized person from the user's contact list as a notification each day, prompting the user to maintain social connections. The contacts displayed are pre-selected by the user to filter out non-social contacts.

Concept background

The application concept combines the Fordyce Fundamental “spend more time socializing” with the Caillois category “active chance” to promote user social interaction with friends and family. Digital information is easily sequestered, hidden in lists and files instead of possessing a physical presence (i.e. information written on paper). This makes digital information easier to forget, and benefits from active delivery and curation. This application concept presents a 'nudge' periodically to prompt social interaction and maintain connections.

Characteristics of the application concept

Table 13: characteristics of Contact Of The Day application concept

Fordyce fundamental	Spend more time socializing
Caillois category	Active chance
INHERENT GAMIFICATION:	
Random rewarding	Randomized process
Intrinsic rewarding	User seeks social interaction
Safety of artificial worlds/conflicts	External locus of control
Bartle's play styles	Socializer
Relatedness	Connections to other semi-automated
CONTRIVED GAMIFICATION:	
Completism	“Don't break the chain” mechanism to promote consistent follow-through

Prototype appearance

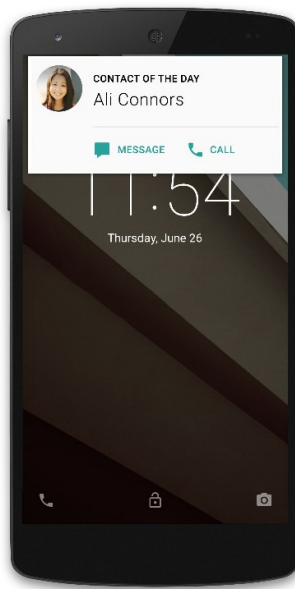


Figure 21: Contact Of The Day concept mockup

User stories

1. User selects valid contacts to include
2. User recognizes and responds to notification card

Reason for non-completion

The application concept has very limited functionality compared to other concepts, and was deprioritized for development. Further, the desired effect of the application concept takes place intermittently over a long period rather than briefly over a short period, making it difficult to test with the user-testing tools available.

4.11 WARM FUZZIES (CONCEPT)

Description

This game concept is played at a table. One member of a group tells a personal anecdote of a positive recent event (e.g. he helped someone, he was given support, a good thing occurred). The player to his left rewards him with 1-3 Warm Fuzzy playing pieces—depending on the strength of his anecdote—which he uses to build a structure of his own design.

Concept background

The term ‘warm fuzzies’ is from a children’s book by Richard Lessor (1971) created to help young children describe feelings and promote co-operative behaviour; warm fuzzies described a physical manifestation of a positive mood which could be shared via pro-social actions in a group environment.

The goal of the game concept is to promote active recognition of positive events in the players’ lives. Regularly playing the game may have a reinforcing effect, eventually creating a habit of spotting and valuing positive events as the in-game value of the players’ anecdotes transfers to recognition of value outside the game. Another aspect of Caillois’ categories is featured in the game: ‘active chance’. When a player rolls the dice, she is hoping to roll a six; when she is successful, she begins her turn primed with excitement and optimism, and this adds further emotional weight to her anecdote. The game includes a ‘prompt card’ which aids players’ memories with a number of phrases such as “I helped someone.” These gamification methods seek to promote continued play and ongoing play sessions.

Characteristics of the application concept

Table 14: characteristics of Warm Fuzzies application concept

Fordyce fundamental	Develop positive, optimistic thinking
Caillois category	Ludic competition
INHERENT GAMIFICATION:	
Operant conditioning	Rewarding per-turn
Classic conditioning	Rewards associated with anecdotes
Random rewarding	Requires the user to throw a six on the dice to begin
Intrinsic rewarding	Social validation
Completeness	Ongoing structure-building
Social comparison	Anecdotes told in social setting
Bartle's play styles	Achiever/Socializer
Cuteification	Fuzzy game pieces
Relatedness	Social/sharing

Prototype appearance

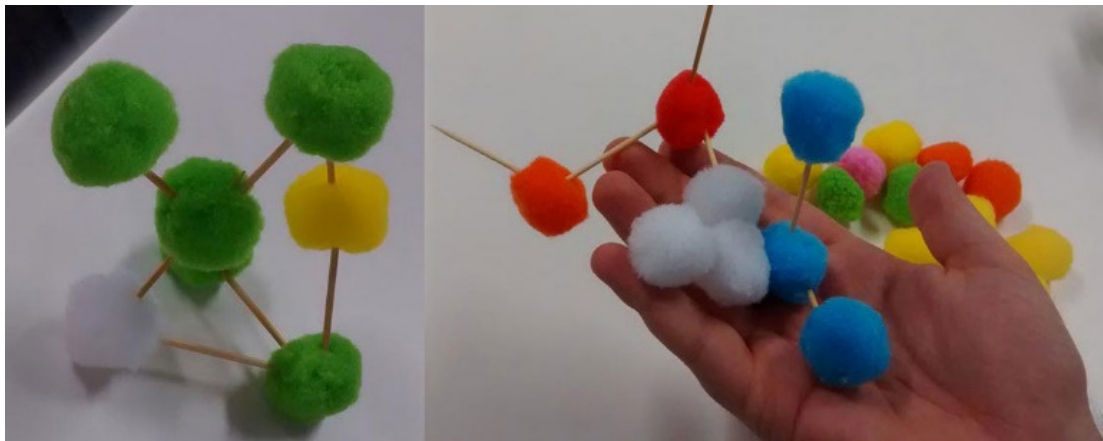


Figure 22: Warm Fuzzies structures created during playtesting

User stories

1. Comprehension of rules and clear rules-following during game
2. Sharing of a personal anecdote
3. Rewarding of another player's anecdote

4. Building a structure from game pieces
5. Spontaneous interaction during game

Analysis of playtesting sessions

Two playtesting sessions were held: the first had six players, the second five players. A moderator observed and provided guidance and clarification where necessary. No video or audio recordings were made, but notes were kept from both sessions.

Gameplay was clearly understood by the players, but early progression was slow as players had no opportunity to prepare anecdotes beforehand. The ‘gifter’ (player who rewarded the storyteller with play pieces) usually gave feedback as justification for their level of rewarding; awarding two pieces was most common, with some anecdotes earning three pieces. Players liked the tactility of the pieces and preferred grouping like colours over mixing colours.

The extremely intimate social interaction which both playtesting sessions showed was a direct result of the gaming environment: face-to-face in a group setting. It is difficult to imagine the same results in a mobile app context, an interface which allows for lower-resolution communication which takes place over a distance and can be time-shifted by any participant.

Reason for non-completion

There is no clear path to mobile implementation of the game concept. Play is carried out in a physical environment with tactile game pieces, the versatility of which would be lost in an on-screen experience. The social interaction in the game is direct and unmediated, but introducing a mobile aspect to the game would interrupt and dilute the impact of this interaction. For these reasons, mobile development of the game concept was deprioritized.

4.12 SUMMARY

Table 15: Summary of Concepts and Findings

APPLICATION CONCEPT	FORDYCE FUNDAMENTAL	CAILLOIS CATEGORY	GAMIFICATION METHODS
Powerful Preparation	Stop worrying	Active mimicry	Classic conditioning Intrinsic rewarding Completism Bartle's play styles Dominance Autonomy Cuteification
<i>Findings</i>	<i>Paper prototyping is fast but does not communicate affordances as well as digital prototyping.</i> <i>Visual hierarchy and order is important when presenting new information.</i> <i>Without clear guidance, users may engage in Completism behaviour.</i> <i>Users' mental models aid acceptable and activity.</i> <i>Cuteification through less-abstract figures aided users' comprehension.</i>		
Buzz Back	Become present-oriented	Ludic vertigo	Operant conditioning Classic conditioning Random rewarding Intrinsic rewarding Safety of artificial worlds/conflicts Completism Bartle's play styles Dominance Mastery Autonomy Cuteification
<i>Findings</i>	<i>Cuteification improves user response. However, this effect alone does not extend play periods.</i> <i>Haptic feedback must be carefully calibrated to communicate multiple states.</i> <i>Gamification methods conflicted; the efficacy of one deprioritized the primacy of another.</i> <i>Users sought patterns in gameplay.</i>		
My Awesome Life	Close relationships are the number one source of happiness	Other	Operant conditioning Intrinsic rewarding Completism Bartle's play styles Relatedness
Slay The Dragon	Get better organized and plan things out	Ludic competition	Operant conditioning Classic conditioning

			Intrinsic rewarding Bartle's Play Styles Dominance Mastery Autonomy Random rewarding
Walk To Paris	Keep busy and be more active	Active competition	Operant conditioning Classic conditioning Intrinsic rewarding Safety of artificial worlds/conflicts Completism Narrative Social comparison Bartle's play styles Dominance Mastery Autonomy Relatedness Cuteification
Work/Fun Combo	Be productive at meaningful work	Active vertigo	Operant conditioning Intrinsic rewarding Bartle's play styles Random rewarding
Blind Maze	Keep busy and be more active	Active vertigo	Operant conditioning Bartle's play styles Dominance Mastery Relatedness Random rewarding
Worry About That Today?	Eliminate negative feelings and problems	Active chance	Operant conditioning Random rewarding Intrinsic rewarding Safety of artificial worlds/conflicts Dominance Relatedness
Cycle Cadence Game	Keep busy and be more active	Ludic vertigo	Operant conditioning Safety of artificial worlds/conflicts Bartle's play styles Mastery Autonomy Social comparison
Contact Of The Day	Spend more time socializing	Active chance	Random rewarding Intrinsic rewarding

			Safety of artificial worlds/conflicts Bartle's play styles Relatedness Completism
Warm Fuzzies	Develop positive, optimistic thinking	Ludic competition	Operant conditioning Classic conditioning Random rewarding Intrinsic rewarding Completism Social comparison Bartle's play styles Cuteification Relatedness

CHAPTER 5. DISCUSSION

The goals of the study were to explore the delivery of positive and enjoyable mobile applications and concepts, and to use this delivery process to create mobile applications; this section identifies seven areas of note in the research: the effectiveness of the Fordyce/Caillois ideation tool, the systematic gamification stage, the effect of cuteification, the organic appearance of Completism, the effect of user testing, the suitability of Trello, and the compounding effect of the techniques when combined.

These areas were identified as those which might contribute to academic knowledge and provide greater understanding of the framework used in the study and how it might be applied or modified. These were areas of novelty or findings not reflected in the material in the literature review sections. The study concatenated a number of schemas, and their combination produced results through use.

Firstly, and of key interest in this study, the Fordyce/Caillois ideation tool (Appendix A) was effective in generating application concepts. 38 concepts were ideated, addressing different happiness techniques across the range of play styles outlined by Caillois. Only 10 of these concepts shared content or style with existing mobile application genres, indicating the ideation tool prompted new ideas outside common patterns of the existing marketplace. In particular, the application concepts which involved physical movement beyond the screen of a mobile phone (e.g. the Blind Maze application concept), an area not broadly addressed in the marketplace. These concepts were prompted by the generalized nature of Caillois' play categories.

Secondly, the development stage which examined application concepts for gamification methods was systematic in highlighting areas of a concept which would appeal to users. The list of methods allowed for recognition of game-based characteristics that would otherwise have gone unnoticed, and sparked discovery of potential changes or

improvements to the application concepts under development (e.g. cuteification in the Buzz Back concept). The checklist-style systematizing of this stage made recognition of gamification methods fast and thorough. Further methods could be added to this system based on project requirements.

Thirdly, the study confirmed Anderson's theories that users respond more to cute or well-defined figures than abstract figures (Anderson, 2012). Throughout Powerful Preparation testing, users were able to mimic the figures' poses displayed and gave positive feedback about the exercises. Changing from a lower-detail abstract human figure to a higher-detail silhouette figure improved comprehension. The second Buzz Back prototype had cuteified elements (dancing kitten/frowning cat animations), and the initial response from users was very positive. The cuteification did not, however, result in longer play times as users grew tired of identical success rewards; a variable schedule of reinforcement would have addressed this problem (Mirenowicz & Schultz, 1994).

Fourthly, during Powerful Preparation testing users were observed engaging in Completism (section 2.3), the drive to complete incomplete sets (Zeigarnik, 1938) by progressively selecting each pose and repeating the exercise. This was not a designated gamification method for this application concept. Users completed the timed exercise for one pose and then, bereft of guidance or prompting, selected a different pose and began again. The analysis and synthesis sections for the last sprint identified this and outlined a more guided process following the timed period of the exercise.

Fifthly, the user testing stage reinforced the importance of UX and usability principles. User feedback informed the redesign of the interface: the actions available and response from the interface elements, and the clarity of states and content for users. Tabs, menus, and other interactive elements were redesigned and adjusted in response to user feedback. The analysis of developed apps (Section 4: Powerful Preparation, Buzz Back) details correlation between user feedback and specific usability principles. Without these user

testing sessions, the quality of the applications' user experience would have been poorly defined.

Sixthly, the use of Trello as a kanban (Section 2.4: Kanban process tool) dovetailed well with the Agile software development process. User stories were itemized and details relevant to each story were annotated. Trello facilitated file sharing in a similar manner, with the ability to attach graphics and photographs to the pertinent kanban cards. The chronological order of user story implementation could be adjusted easily, and updates such as these were immediately propagated to others viewing the kanban. The centralized and all-inclusive functionality of the Trello kanban improved the process over a paper or email-based planning method.

Seventhly, each stage of ideation and development added to the goal of creating a positive experience. The Fordyce/Caillois tool was used to generate an application concept grounded in positive effect and recognized play styles. Gamification methods were identified or prompted, highlighting enjoyable aspects of the concept. Agile software development selected and coded the highest-priority user activities to deliver key experiences in early releases. User testing confirmed or recalibrated the efficacy of the mobile applications' implementation of the techniques and methods. Analysis of user feedback and redelivery improved the user experience in the mobile applications. This goal in the study was met by the processes used in concatenation.

CHAPTER 6. LIMITATIONS AND FUTURE WORK

Conclusions

The framework used to ideate and populate the underlying principles for each application concept worked well in this study, based as it was in existing frameworks for positive effect and established play categories. Identifying gamification methods was straightforward and provided further material for the development period. The concept stage of the process was effective in this study and can be applied in the future to generate new concepts for mobile applications or other gamified positive experiences.

Limitations and Academic Implications

The Fordyce/Caillois tool (Appendix A) did not promote exploration outside the prescribed categories. The tool partially addressed this limitation by including the column “Other” which gave space to non-game concepts (e.g. the application concept “My Awesome Life”) not allowed for under the Caillois categories. The tool created new concept possibilities but also limited the range of concepts to the predefined techniques and categories. Further rows and columns may be added to promote medium-specific ideas and serve as an overflow for ideas which resist categorization.

Users engaged in behaviour organically that fulfilled criteria defined by gamification methods not applied to application concepts. During Powerful Preparation testing, users performed unprompted Completism behaviour. This was identified and a plan was made to provide greater guidance at the end of the timed activity. This highlights the validity of the drive to complete incomplete sets (Zeigarnik, 1938) but also shows that untested interfaces can promote behaviour that is unplanned and out of scope for the project.

The application concepts which extended beyond the screen of a mobile device (e.g. Blind Maze) were not developed further during the study. This was due to time limitations and a lack of specialist expertise. Concepts involving electronic components—selecting,

sourcing, and integrating—and highly technical hardware-software coding were consequently deprioritized for development. These concepts had potential as saleable, marketable products, but required expertise and resources that were beyond the scope of this study.

Managerial Implications

The single-session user testing periods were unable to address potential ongoing conditioning effects (relevant to a number of gamification methods). This was a weakness of the brief user testing stage in the iterative development. The shortness of the testing stage and the variation in testing subjects was planned in order to quickly solicit user feedback to highlight problems or hurdles in the user experience. In an ongoing project with a team of developers and designers, a more robust user testing schedule would be appropriate if longitudinal data was required to measure changes over time with continued use of an application.

The cuteification method was applied in two forms: the well-defined figures in Powerful Preparation and the cat and kitten in Buzz Back. The figures compared favourably with more abstract earlier versions which were far less humanlike, with users more able to recognize and mimic the poses displayed; this form of cuteification was effective for demonstration. The cat and kitten compared favourably with more abstract earlier versions which were simply circular buttons. Users engaged with the onscreen creatures readily, but this effect was short-lived; this form of cuteification was effective for short periods of high engagement. Other forms of gamification can be applied in conjunction with cuteification.

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APPENDIX A: FORDYCE/CAILLOIS TOOL

	Active competition	Ludic competition	Active chance	Ludic chance	Active mimicry	Ludic mimicry	Active vertigo	Ludic vertigo	Other
Keep busy and be more active	Walk To Paris		Exercise Generator				Blind Maze	Cycle cadence game	
Spend more time socializing		20-Name Night	Contact Of The Day	The Activity Or The Bag	Pied Piper Of Social Activities				
Be productive at meaningful work					Hero Mode	Crazy Amazing Tuesday			
Get better organized and plan things out		Slay The Dragon		Tasks assigned by roulette wheel					Anticipated events
Stop worrying					Powerful Preparation		Big Baby Dance		
Lower your expectations and aspirations	Too Many Meetings								
Develop positive, optimistic thinking		Warm Fuzzies				Don't Smile			Journaling
Become present-oriented	Good Things scavenger hunt			Turn Out The Lights	Mediation/ mindfulness			Buzz Back	
Work on a healthy personality		Enemies Future, Powerups Past				Reframing situations			Aspiration Wall
Develop an outgoing, social personality		Recruiting games			Hero Mode				
Be yourself	Boasting contest				Role play	Re-creating successes			Moral priming
Eliminate negative feelings and problems			Worry About That Today?				Squeaky hammer		The Angry App
Close relationships are the number one source of happiness					Copy Their Day / breadcrumbs				My Awesome Life
Put happiness as your most important priority									