

# STRESS THROUGH A DIGITAL USER-CENTRIC LENS

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## ABSTRACT

Digital health as an industry while exponentially growing in breadth, has not lived up to potential thus far in actually being able to produce meaningful positive health outcomes.

This research project explored the applicability of user-centered design as a methodological approach toward the decline of digital health. Stress amongst university students was the context used for the design process in order to carry the research out through a full design cycle.

The user-centric nature of the project meant the involvement of university students who were currently attending Auckland University of Technology within the design process. A set of methods and phases within the cycle were employed at the start of the research but were ultimately changed and adapted to accommodate the complexities of stress amongst university students. In particular, the psychological and non-physical nature of stress had significant limiting implications on certain user-centered methods, lowering the effectiveness of those methods. To account for these implications literature surrounding stress and stress coping were constantly referred to and used to inform methods.

As a result of the full cycle user-centered design process used within this research, a stress related digital intervention prototype was the final output. The prototype is a mobile voice user-interface that aims to provide university students an informed perspective on their stressful situation.

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## ATTESTATION OF AUTHORSHIP

I hereby declare that this submission is my own work and that, to the best of 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

A handwritten signature in black ink, appearing to be 'G. M. P.', enclosed within a large, hand-drawn oval. The signature is written in a cursive style with a horizontal line underneath.

10 / 10 / 19

## ACKNOWLEDGEMENTS

I would like to acknowledge my supervisors, Dr. Kei Hoshi and Dr. Susan Hedges and thank them for their patient guidance, strong encouragement, wise advice and constant support prior to, and throughout the entire project.

I would like to thank all those who consented to and took the time out of their day to participate within the user feedback related methods used within this research. Your participation was crucial to this project and it's success.

# **ETHICS APPROVAL**

The user-centric nature of the context and methodology employed in this research meant the direct involvement of other people as end-users was required.

Students (at the time) at the Auckland University of Technology (as the end-users in this project) were recruited to participate in two methods employed in the project. The students were interviewed and participated in usability testing of a prototype produced in this project, data gathered from these methods were analysed and used to inform the project.

As research being conducted at the Auckland University of Technology, the methods that sought to involve the students, were reviewed by the Auckland University of Technology Ethics Committee (AUTEC).

Formal ethical approval by AUTEC for the interviews was given on the 9th of March 2019 and the usability tests as an amendment to the interviews, received formal ethical approval on the 4th of September 2019. Number 19/51, see Appendix A (p. 71) for the approval documents.

01

**INTRODUCTION**

From Apple's first Macintosh in 1984 (Still & Crane, 2017, pp. 1–17), the world wide web (WWW) on personal computers in the 1990's to the emergence of the iPhone and in 2008 (Still & Crane, 2017, pp. 19–40), technology has vastly improved over the last 40 years. Digital technology is now more complex and more integrated into societal living than ever through its impact and role on most professional fields.

Healthcare as an industry has incorporated digital technology into many of its processes, leading to digital health, the intersection between the internet and healthcare (Frank, 2000). The healthcare industry absorbing digital technology has resulted in its exponential commercial growth in both users and technologies available (Rivas, 2018, p. 3), while exploring the applicability of new and emerging technology. However, the results have not been favorable for the healthcare industry. The landscape is extremely cluttered, lacking regulatory and evaluative processes while unable to most importantly, produce meaningful health outcomes (Mathews, et al., 2019, pp. 1–2). The success of digital health is crucial for the next generation as the digitally inclined inheritors of current healthcare systems (Meskó, et al., 2017, p. 6). A key assumption amongst literature suggests that the lack of involvement of end-users is the biggest reason for the inability of digital health to produce meaningful health outcomes (Meskó, et al., 2017; Mathews, et al., 2019, pp. 2–8).

A solution being explored is the use of user-centric design methodologies among healthcare and digital health contexts (Bazzano, et al., 2017), advocated for and recognized by medical professionals and designers alike (Ghazali, Ariffin, & Omar, 2014). However, the lack of documentation (Bazzano, et al., 2017, pp. 12–16) and contrasting procedures with existing healthcare processes have meant little progress (Meskó, et al., 2017, pp. 1–3; Birnbaum, et al., 2015).

This project seeks to explore the feasibility of user-centered design (UCD) as a design methodology within the context of digital health and healthcare, conducted through the research question;

*“How might an understanding of stress experienced by current Auckland University of Technology students through a user-centered design approach, be used to explore the creation of a stress relieving digital intervention?”*

Stress is the digital health context and university students are the target end-user group, acting as the contextual catalyst for exploring UCD as a methodology within a healthcare context. Specifically, this project aims to explore the practicality of UCD methods.

This report describes and discusses the project from the perspective of the UCD design process used in the project. Methodology and contextual research are outlined while the design process is documented. The feasibility of UCD within the context of stress amongst university students is then discussed.

02

**CONTEXTUAL REVIEW**

## User-Centered design

1  
Human-centred design (HCD) and Design Thinking (DT) are similar design methodologies, although uniquely varying within context of organisation and use.

UCD or User-centered Systems Design (UCSD) (Norman and Draper, 1986) can be defined as an approach to designing products that focus on understanding the needs of end-users in order to drive design process (Ritter, Baxter & Churchill, 2014). A series of methods are used to engage and involve users, involving evaluation and testing in an iterative fashion. Understanding of the product and its relation to the end-user evolves throughout the design process as more is understood about the user (Still and Crane, 2017, pp. 1–17). UCD, while more commonly used and applied to areas relative to digital technology (Bazzano, et al., 2017), is often interchangeable with other design methodologies, through similarities in practice of methods and process.<sup>1</sup>

Critical review and iteration of UCD through many overlapping events, movements and fields has resulted in what it is today. Influential movements include; the Industrial Revolution, Arts & Crafts and Bauhaus (Borteh, 2010; History.com, 2009; Clericuzio, 2017). Many events spanning back to World War II towards Apple and the first desktop computers and now the emergence of mobile smart-phones (Still & Crane, 2017, pp. 1–17; MacKenzie, 2013). This project aims to contribute to UCD in the same fashion, through the contexts of digital health and stress amongst university students.

## Digital health

2  
Seth Frank is currently the vice president of Investor and treasury relations at medical prosthetic and orthotic provider, Hangar, Inc.

3  
Enhancing a patient's ability to actively engage in healthcare provided to them (James 2013).

4  
Other low ROI reasons for digital health include; evidence of effectiveness, privacy or security problems and resistance from medical professionals (Rivas 2018).

Healthcare has had difficulty adopting digital technology due to complexity in practice and organizational standards (Mathews, et al., 2019; Meskó, et al., 2017). Although, much of the literature to the knowledge of the researcher focuses on public digital health contexts at a systematic or organizational level, this report will focus more on practical everyday contexts.

Digital Health as a term and concept was coined by Seth Frank,<sup>2</sup> which since then has expanded parallel to the advancement of technology and now includes many forms of technology such as artificial intelligence (AI), mobile health applications (mHealth) and wearable technology used in research and practice within healthcare. Patient engagement<sup>3</sup> is also increased by these digital health technologies (Birnbaum, et al., 2015).

From a commercial standpoint, the digital health industry has grown exponentially with roughly six billion dollars in funding as of 2017 with over three million mHealth applications (Mathews, et al., 2019, pp. 1–2). However, while there is breadth in digital health technology, the lack of an evaluation framework has resulted in low return of investment (ROI). Particularly, there has been a lack of produced meaningful health outcomes amongst mobile health applications (Ibid). However, movement amongst organizations like the World Health Organization (WHO) producing a digital health intervention classification document (World Health Organisation, 2018) and the United Kingdom's National Health Service (NHS) hosting a library of approved healthcare mobile applications (Mathews, et al., 2019, p. 2), show promise in digital health evaluation. While many reasons explaining low ROI have been suggested,<sup>4</sup> the predominant is involvement of end-users (or patients) during digital health development.

## Designing for digital health

5

Some notable examples are firms; IDEO, Frog and Dalberg who design within the healthcare and the wider social innovation spaces.

6

Generation Z are the generation after millennials, born between the mid 90's and early 2000's, they've grown up with technology and the internet (Seemiler and Grace, 2018, pp. 28–35).

With the lack of ROI and patient engagement amongst digital health technologies, implementation of design methodologies to develop digital health are currently being explored as a solution (Bazzano, et al., 2017). The success of UCD in other industries and contexts give reason to also apply it to digital health, recognized and suggested by medical professionals and designers alike (Ghazali, Ariffin & Omar, 2014).

However, digital health has many nuanced established details and practices that make it hard to implement design methodology (Ghazali, et al., 2014, pp.11–12). Most notably, the established standards for healthcare interventions which contrast the flexibility of design methods incorporated within UCD. Healthcare eco-systems are also often limited in terms of ability to change and innovate (Rivas, 2018). Although not the focus of this project, political and personal problems can also accompany that of practical and systemic ones (Rivas, 2018, p. 4).

While there is effort amongst public health agencies, international development agencies, hospitals or health systems to incorporate UCD with design firms,<sup>5</sup> it is difficult to assess effectiveness due to little documentation (Bazzano, et al., 2017, pp. 12–16). Formal documentation may cause increased adoption by medical professionals and healthcare bodies who may have initially dismissed the idea. Adoption and success of digital health is important for generation z<sup>6</sup> and future generations as inheritors of current digital healthcare systems and beyond (Meskó, et al., 2017; Bazzano, et al., 2017; Altman, Huang & Breland, 2018).

Conversely to UCD's involvement of users, historically, healthcare and now digital health has involved medical professionals along with current prominent theories and scientific evidence. (Meskó, et al., 2017, pp. 1–3; Birnbaum, et al., 2015; Mathews, et al., 2019; Altman, Huang & Breland, 2018). Along with the involvement of end-users or patients within healthcare, a shift in mindset and approach is needed toward collaborative, interdisciplinary and shared decision making (Meskó, et al., 2017, pp. 4–5). While the iterative nature of UCD clashes with the risk-averse approach to innovation that healthcare has (Mathews, et al., 2019), iteration may be able to address lack of evaluative standards and regulations amongst digital health interventions.

In summary, UCD as a methodological approach and design practice is based on the philosophy of designing with the involvement of end-users. Today it is often used to develop digital technology in many fields. Digital health's inability to produce meaningful health outcomes has resulted in attempts to implement UCD. However, the nuances of current digital health development make it difficult.

This project aims to explore the practical issues between design and digital health, through examining the feasibility of UCD in a digital health context. Specifically, toward developing a stress related digital intervention for university students. The next chapter will discuss the methods that were used throughout the process.

03

# RESEARCH METHODS

## User-Centered design

7  
Other stakeholders are those that are involved in the development process and what is being developed itself. For example, software developers, clients, investors, healthcare professionals, etc.

8  
The international organization for standardization (ISO) is an international, non-government group that collectively create expert reviewed standards for innovative practices. (International Organization for Standardization, n.d.).

9  
To the knowledge of the researcher, Co-design is the only distinct user-centric methodology (Steen, Manschot & De Koning, 2011).

From a methodological perspective, UCD is a design approach that aims to put the needs, wants and surrounding contexts of the end-user to inform design and development processes towards solutions or products (Ritter, Baxter & Churchill, 2014, pp. 33–53).

UCD in this project is employed to address perceived issues around digital health design processes. Specifically, issues surrounding the lack of involvement of end-users and over-reliance on existing organizational healthcare processes. As an approach often catered to digital technology, UCD is also suited to digital health (Bazzano, et al., 2017). The vulnerable nature of stress as the context of this project however, severely limits end-user involvement, this is further discussed in the following chapters.

While UCD designers seek to understand the end-user to develop a solution for their needs (Lowdermilk, 2013), in many situations, designers need to also consider and communicate with other stakeholders,<sup>7</sup> relative to the product. (Lowdermilk, 2013, pp. 31–32). This project however, will only consider end-users.

UCD is standardized under the international standard for designing human-centered interactive systems (ISO 9241-210)<sup>8</sup> (International Organization for Standardization, 2019). However, each UCD process is unique depending on methods and context of use. Each process encompasses over-arching phases with methods within them, all phases are collectively called a cycle. Iteration in UCD is common and occurs by method, phase or cycle (Usability.gov., n.d.).

Even after a design solution is created, methods can be iteratively used to improve the solution. To address the lack of documentation of full design cycles within digital health (Bazzano, et al., 2017, pp. 11–13), a full cycle is used in this project; encompassing research, analysis, synthesis and refinement phases (figure 1).

Currently, HCD, UCD, or DT are being used as general idioms<sup>9</sup> for design involving users (Cossu, 2015). Considering lack of distinction, although this project focuses on UCD, methods used are typically applicable to all three methodologies.

The phases and methods employed in this UCD design process were through discussion between the researcher and supervisors. The methods were changed and adapted throughout the design process to accompany the complexities of stress amongst university students as a context. These adaptations will be discussed in the next chapter.

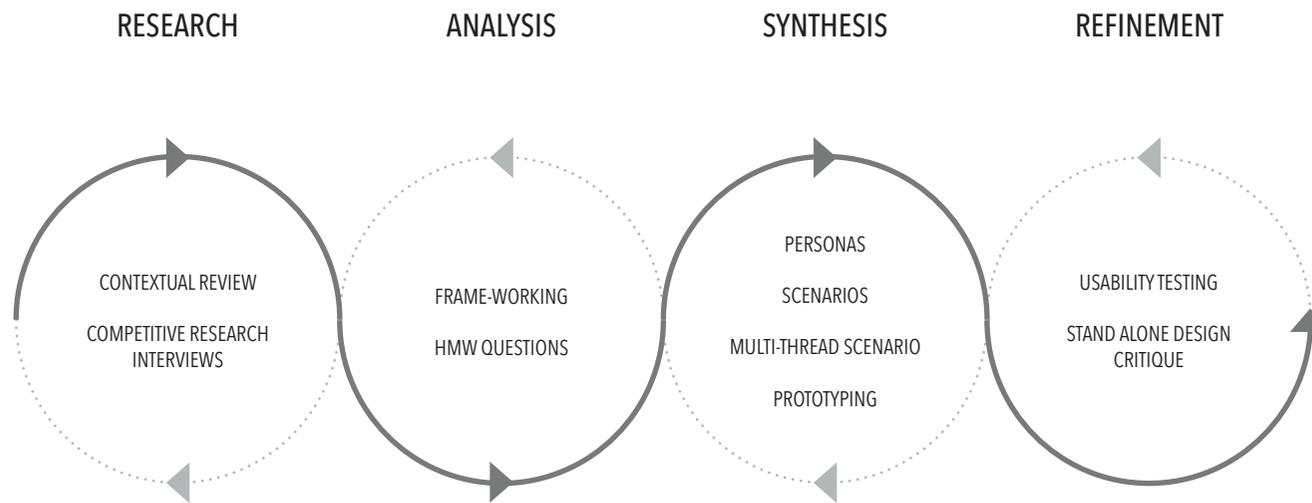


Figure 1. Phases and methods within the user-centered design process.

Ethnographic methods typically aim to understand the behaviors of people within their natural environment. (Mabson, et al. n.d., pp. 1–4)

## Design ethnography

Design ethnography commonly perceived as the adaptation of ethnographic approaches to research, amongst designers and design processes. Adaptation occurs through the use of ethnographic methods<sup>10</sup> to inform a design process (van Dijk, 201; Salvador, Bell & Anderson, 1999; Mabson, et al., n.d).

In this project, design ethnography will be an accompanying approach to UCD, applied in the planning and carrying out of methods (particularly those that involve end-users). As a result, there is much more focus on qualitative data than quantitative.

While end-user involvement is mandatory amongst UCD processes, how the user is viewed and actually involved in the process varies heavily between unique methods and approaches. There are many complexities surrounding university students and their stressful situations as a particular user within a digital health and healthcare context. Design ethnography has been employed to account for and gain a holistic understanding of these complexities, through qualitative methods.

This also addresses, the short comings of current digital health development processes in involving end-users. Particularly, understanding them outside the context of their health-related problem and the product being developed.

As digital products have become exponentially more complex (Cossu, 2015), design ethnography is suited to understanding the complexities of context of use surrounding these digital technologies. Particularly so, for digital health.

## Contextual Research

Contextual research was used within both the design process and the report overall. Within the UCD process, contextual research was used to understand existing knowledge surrounding stress amongst university students and the current prominent theories surrounding stress (IDEO.org, 2015, p. 37). Conclusions drawn from contextual research were used to inform design decisions within the analysis and synthesis phase.

## Competitive Research

Competitive Analysis within UCD is researching then comparing and contrasting existing solutions to the problem being addressed, drawing focus on weak or unexplored parts of these solutions (Kirakowski, 2011; Still and Crane, 2017, pp. 135—137). Competitive research and analysis were used to understand existing stress general and digital interventions/solutions. Research examined the interventions while analysis compared them along a set of metrics established through contextual review.

Affinity mapping involves organizing data that are similar or related, in order to find themes or patterns (Pernice, 2018).

## Interviews

Interviews are a self-reporting, one-on-one research method for gathering information on what user's feel, think and perceive about a certain context (Pernice, 2018, p. 19; IDEO.org., 2015, p. 84). Hypotheses were constructed from contextual research and competitive research were used to scope the semi-structured interviews used (Lowdermilk, 2013, pp. 83—85; Edwards and Holland 2013, pp. 2—3). Within this research, the use of interviewing as a method were limited due to ethical reasons surrounding the sensitivity of stress as a topic. These limitations will be discussed in chapter four.

## Frameworking

Frameworking are organizational or mapping methods for making sense of data or findings. A 2x2 Framework and Affinity map<sup>11</sup> frameworks were created for both the research and analysis phases of the UCD process used (IDEO.org., 2015, pp. 89—93). Conclusions drawn from the frameworks are used to inform other methods that

## Personas

A persona is a fictional personification of a group of users who have similar goals, motivations and behaviors relative to the product or solution being designed. The aim of a persona is a resource to create a mindset of empathy towards end-users for not only designers but anyone else involved in the design process (Lowdermilk, 2013, pp. 43—44; Still and Crane, 2017, pp. 101—103; Flaherty, 2018). Personas were formulated from findings within the research and analysis phase, to inform other methods, in particular, brainstorming, scenarios and multi-thread scenarios. Traditionally to add a sense of realism and increase empathy, demographic information including a realistic fictional name is emphasized (Harley, 2015), however in this report personas mentioned will be referred by a number.

## Scenarios

Scenarios are stories describing motivations, goals and tasks of a user within the context of what is being designed. Similarly, to personas, scenarios are used to draw empathy and drive design decisions (Lowdermilk, 2013, p. 45; Usability.gov., n.d.). Formulated through interview data, scenarios were used to emulate real world contexts around stress amongst university students. Scenarios informed other methods, specifically, multi-thread scenario and usability testing.

## How might we (HMW) questions

How Might We (HMW) questions are reframing of problem stories into questions and prompts that encourage unique ideas (Both, 2016, p. 33; IDEO.org., 2015, pp. 85—88). HMW statements were used to brainstorm prompts from user requirements in order to effectively generate ideas surrounding functional requirements (Still and Crane, 2017, p. 122; Lowdermilk, 2013, p. 33) that address the particular problem stories explored within the design process.

## Multi-thread Scenario

Multi-thread scenarios are a diagramming tool to explore all interactions (physical and digital interactions) between a user and a product, needed to achieve a certain goal (Lowdermilk, 2013, p. 36; Still and Crane 2017, pp. 94—95; Sato 2004). Multi-thread scenarios were used to explore functional requirements within a scenario, in an effort to come up with ideas on how they may be translated into digital wireframes.

## Prototyping

Prototyping involves testing and gathering feedback on an early version of a design, with the aim of improving it. The ideas constructed through the multi-thread scenario were further refined and were used to create medium-fidelity digital wireframes as prototypes (Bevan and Wilson, 2005; Still and Crane 2017, pp. 166—172; Lowdermilk, 2013, pp. 89—91).

## Stand-alone design critique

Stand-alone design critique within the context of UCD, are used to gather user feedback when users aren't available, through other designers or usability evaluators (Gibbons, 2016). Standalone design critiques were used to gather feedback and iterate on digital prototypes within the design process before and after feedback methods involving users.

## Usability Testing

Usability testing is a method used to gather feedback on a prototype that analyzes how well the prototype is used by its intended users within a certain context. Usability testing can be formative (qualitative feedback) or summative (quantitative feedback) depending on the situation (Still and Crane, 2017, pp. 192—194).

In the synthesis phase, formative usability testing was conducted to gather feedback on prototypes following a stand-alone design critique. The formative nature of the usability test was chosen due to the qualitative focus of the design process and methodology employed in this research.

04

## RESULTS & FINDINGS

## Competitive & contextual research

12

Parameter one; the digital intervention was commercially available as it would be accessible and examinable by the researcher first-hand, as well as increased likelihood of available existing public information.

Parameter two; the particular digital technology's main feature(s) were to alleviate stress in some way.

13

See Competitive audit document. Appendix B (pp. 89–92)

14

See Contextual research document. Appendix B (p. 93–96)

15

See Hypothesis and assumption building document. Appendix B (p. 97–99)

Parameters<sup>12</sup> were established to structure and narrow the scope of competitive research relative to stress related digital interventions. Digital technology type was used to categorize and organize findings<sup>13</sup> due to its great implication on context of use. For example, the implications of context of use between a virtual reality application and a mobile phone would vary greatly.

A trial search for competitive research was conducted on mHealth applications through the Google Play Store and Apple App Store. Based on the trial, a set of aims were formulated to narrow the scope of searches amongst all other categories. The aims constructed were based on perceived significance in comparing stress related digital health interventions. These aims include; features of the intervention, scientific credibility, how the digital technology is alleviating stress and whether this was direct or indirect.

Contextual research included published academic papers, journals and articles. Initially focusing on general stress; types of stress, stressors, physical symptoms and stress coping theory,<sup>14</sup> then towards application of those contexts to university students. Theories and data (qualitative & quantitative) inquired through contextual research act as foundational knowledge to drive decisions within the UCD process and will be mentioned as they are used.

Affinity mapping was used to make sense of the findings, of which conclusions regarding stress and stress coping amongst university students were made. Hypotheses were then formulated from the conclusions relative to their implications toward digital health interventions.<sup>15</sup>

**Research phase**

16

Psychotherapy is a form of talk therapy that focuses on the individual and his or her relationship with the psychologist as an outside perspective (The American Psychological Association, n.d.).

17

For the purpose of categorization, a personalized intervention is defined as an external activity performed to alleviate stress that is not digital or is a mix of digital and physical activities.

18

See Competitive audit document. Appendix B (p. 83–86)

19

Specifically, hypotheses that had implications toward features of interventions that were potentially effective at alleviating stress amongst university students.

Simultaneously, contextual research informed the researcher of conclusions regarding non-digital interventions amongst university students. Based on this, two new categories for competitive research were formed, stress-related psychotherapies<sup>16</sup> and personalized interventions.<sup>17</sup> Psychotherapies were drawn from literature and personalized interventions were from online internet forums from anonymous sources.<sup>18</sup> To work around anecdotal credibility of personalized interventions, several forums and posts were reviewed to create a solid consensus of personalized intervention sub-categories.

A 2x2 map was used as a framework to compare interventions, the axes parameters were based on contextual research hypotheses,<sup>19</sup> allowing comparison between interventions (i.e: figure 2). Mapping allowed for conclusions and hypotheses to be formulated regarding implications toward effectiveness toward stress alleviation amongst university students (i.e: figure 3).

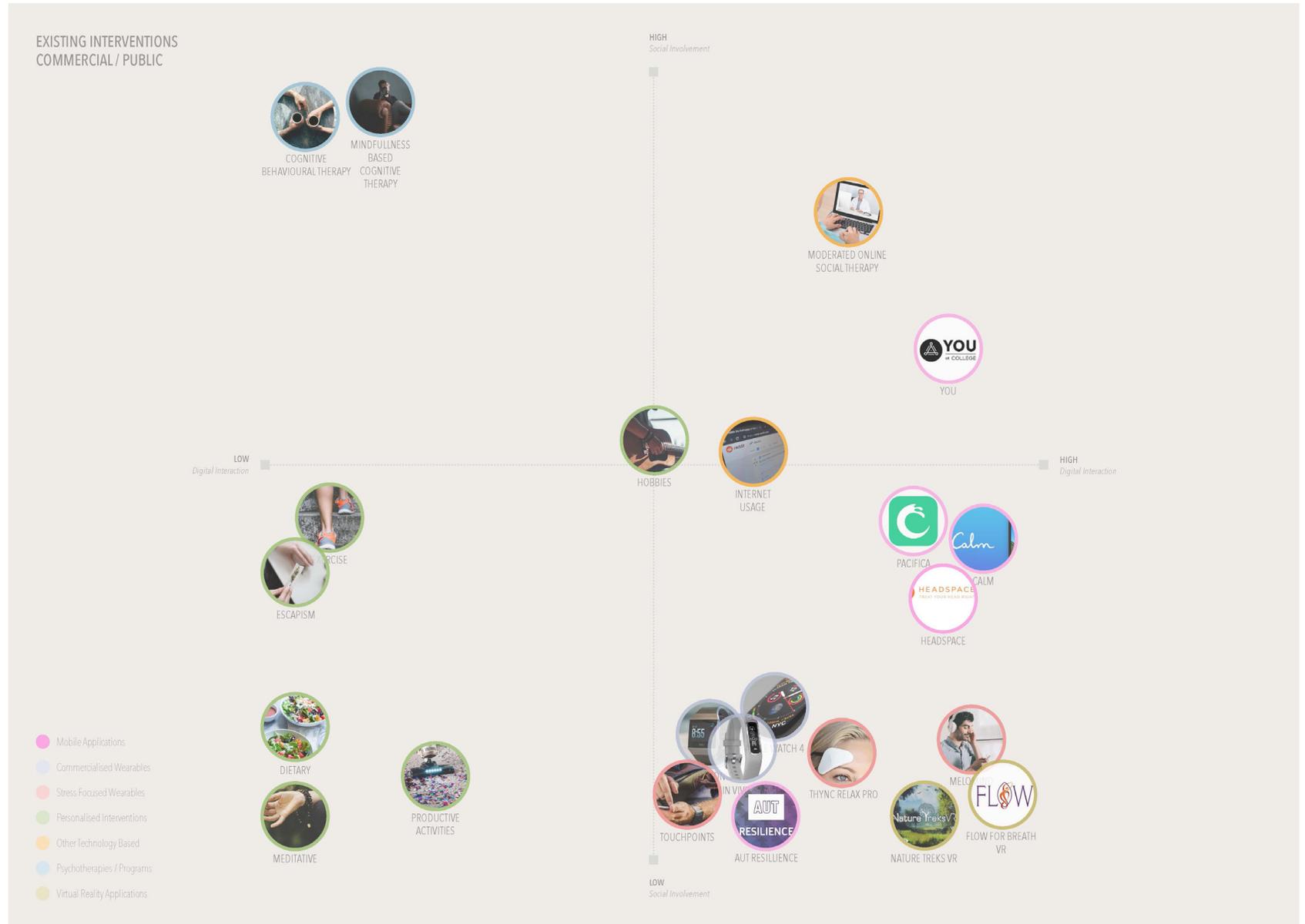


Figure 2. 2x2 intervention map, comparing interventions across social involvement and digital interaction.



## Testing assumptions through research

20

See Ethics Documents.  
Appendix A  
(p. 76)

The hypotheses formulated from competitive and contextual research were used to inform the interviews. Particularly, the scope of the interview, aims and type of questions. Interviews were semi-structurally planned to account for the complexities and arbitrary nature of stress on an individual level.

21

Auckland University of  
Technology Ethics  
Committee (AUTEC)

As a method that requires involvement with other people, the interviews needed ethics approval<sup>20</sup> from AUTEC.<sup>21</sup> As stress is a sensitive topic, the interview plan and all relative documents<sup>22</sup> were altered twice with guidance from AUTEC, this will be discussed further in the next chapter.

22

See Interview kit.  
Appendix B  
(pp. 77–82)

The final iteration aimed to understand how students have overcome stress relative to digital technology. Six students were recruited across 2nd year<sup>23</sup> to post-graduate, across a range of study areas, this meant implicative bias toward study area and year were reduced.

23

Only students who were in their second year of tertiary study were recruited based on the assumption that students below second year would not have enough experience overcoming university stress to provide insight.

## Making sense of the interviews

24  
See Ethics approval  
documents.  
Appendix A.  
(p. 76)

A distilling process (figure 4) was formulated with an aim of narrowing the scope of the design process, starting from interview data through to a tangible output toward a stress related digital intervention. Distilling occurs either through grouping common data/information within the corresponding stage or prioritization based on implications toward stress management amongst university students.<sup>24</sup> The process acts as a bridge between the analysis and synthesis phases.

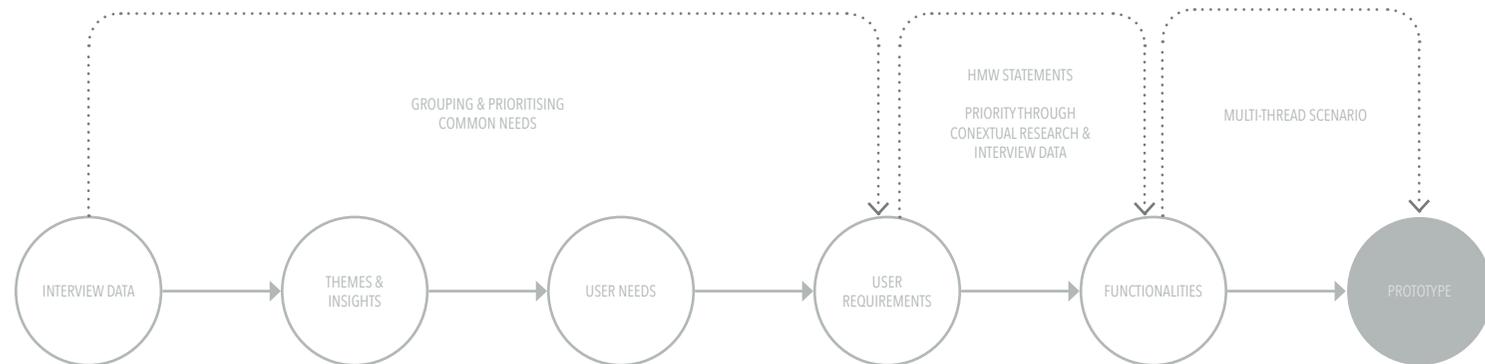


Figure 4. Distilling process for logically translating data into a prototype.

25  
Asking “Why” for each user need allowed the researcher to uncover the underlying reason for the occurrence of what the theme was about, this underlying reason would then become the next iteration of that theme.

The interviews were audio recorded, transcribed and thematically analyzed through affinity mapping. Themes were established and the strongest ideas were identified based on commonalities across the 6 participants. This was significant in creating more direction due to the many variables that can affect stress.

In an effort to further distill the themes established in the first affinity map (figure 5), similar and/or related themes were grouped, of which over-arching themes were established (figure 6). To find out the barebones form of each theme, applicants were questioned as to “why” the theme was occurring.<sup>25</sup> After three iterations the final version of the themes were translated into user needs.

Common user needs were then grouped and with each cluster forming into a user requirement. User requirements were framed into HMW statements, encouraging a different angle for thinking about the user requirement (or a specific part of the user requirement).

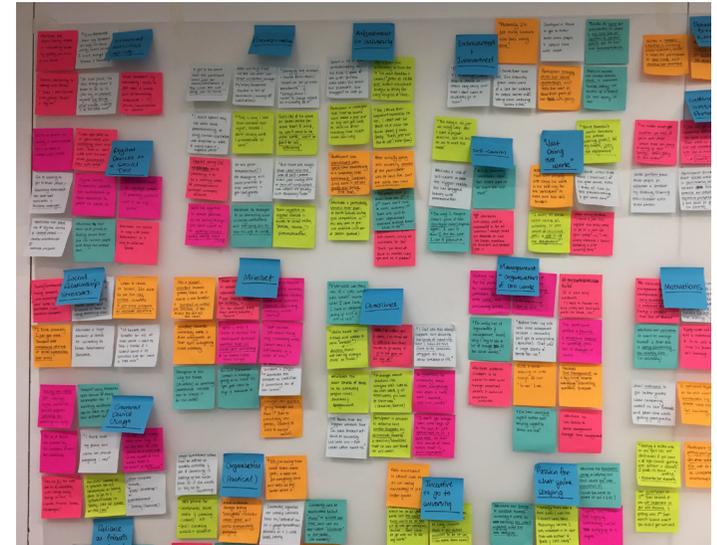


Figure 5. Affinity Map of raw interview data, with each participant represented by a colour other than dark blue (theme).

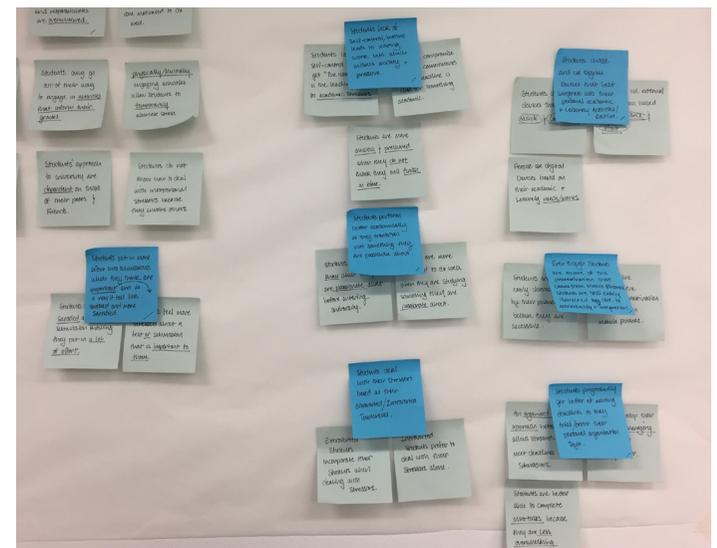


Figure 6. Affinity mapping of established themes (grey post-it notes) into over-arching themes (blue post-it notes).

## Brainstorming functionality

26

Functionality can be described as the purpose or key idea of a feature or product as it relates to what the user is able to do (Nielsen, 2012).

The HMW statements formulated from the analysis phase were used as brainstorming prompts reflecting the user requirements. Each idea was extrapolated, of which each fundamental feature of that idea that directly addressed the corresponding user requirement was highlighted (figure 7). Highlighted features were grouped and would become functionalities (figures 8 and 9).<sup>26</sup>



Figure 7. Brainstorm mapping that explore and map each idea (outlined in red) to a corresponding HMW statement (grey post-it notes).

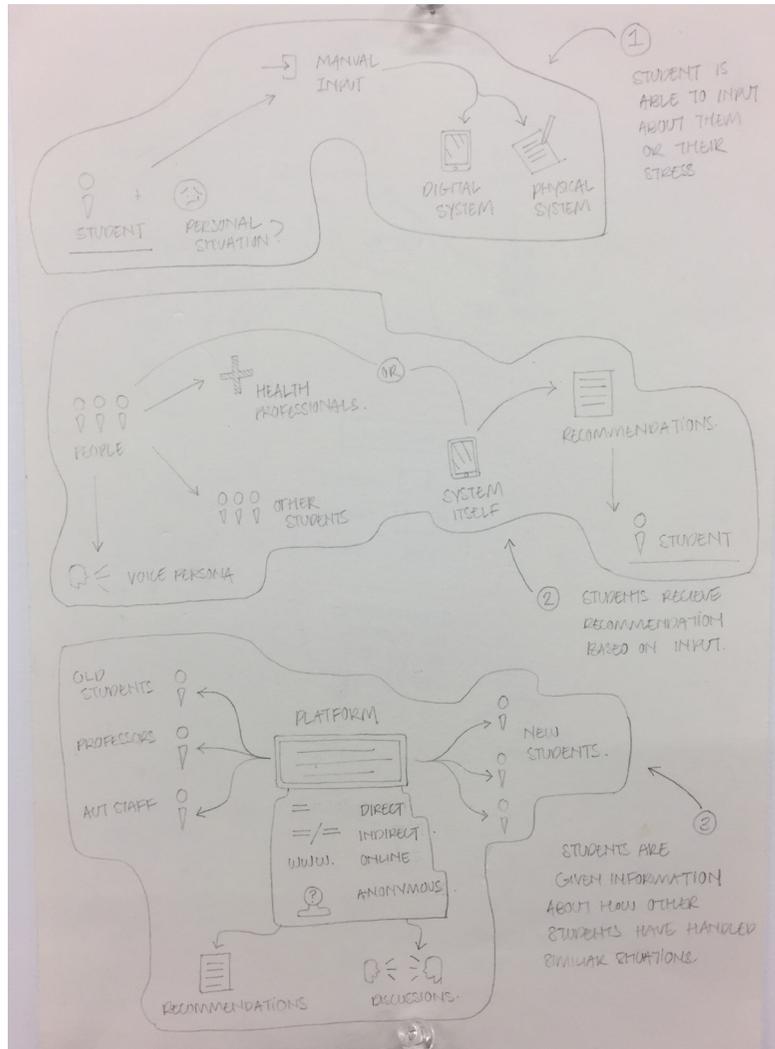


Figure 8. Grouped functionalities exploded into ideas (1).

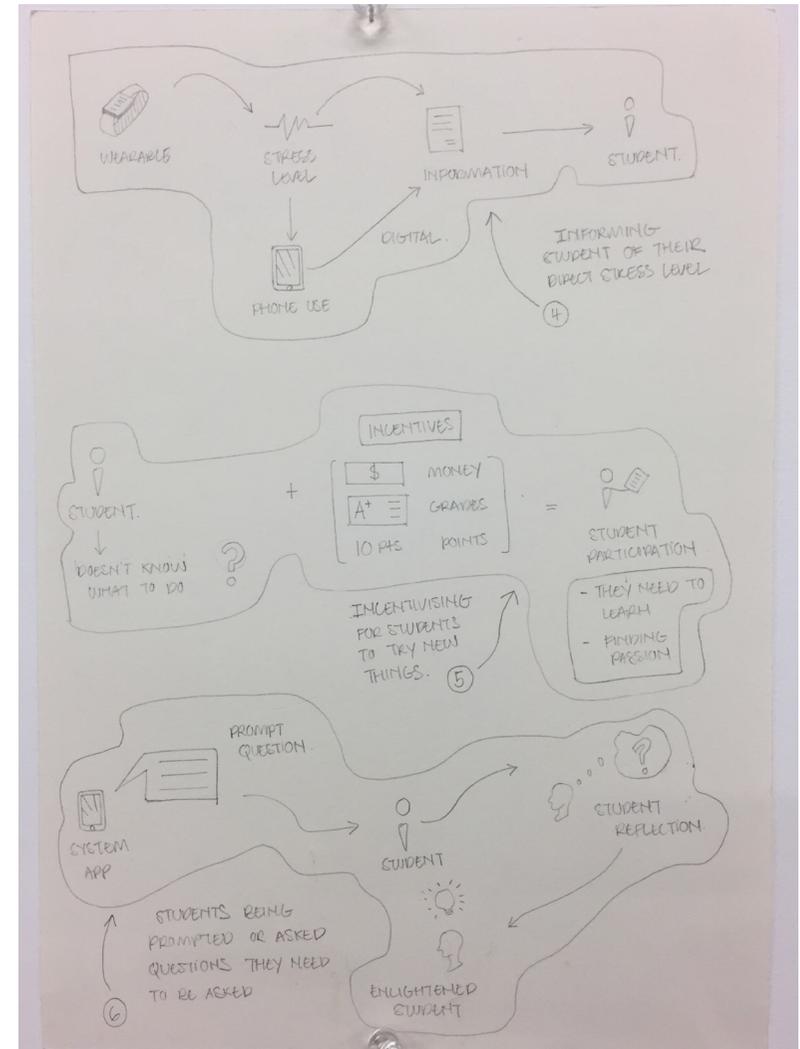


Figure 9. Grouped functionalities exploded into ideas (2).

27

See Contextual research document. Appendix C. (p. 93–96)

28

According to The American Psychological Association, Anxiety can be defined as “feelings of tension, worried thoughts and physical changes like increased blood pressure” (The American Psychological Association, n.d.).

While each grouped functionality is acknowledged, it is not feasible to incorporate all due to the time-frame and scope of the project. Therefore, a user need was chosen based on evidenced commonality amongst interview participants and supportive evidence from both qualitative and quantitative contextual research conclusions. Based on initial brainstorm mapping, this user need correlates with grouped functionalities 1 and 2 (figure 6), therefore they were prioritized.

This user need suggested that students need to be aware of and detach from stressful situations that are out of their control because it will continue to stress them out even though they cannot do anything about it. The need is reflective of stress and stress coping described in Lazarus and Folkman’s stress coping theory, relative to the concept of the perception of stressful events.<sup>27</sup> Literature also suggests the user need is reflective of anxiety,<sup>28</sup> which accounts for significant portion of stress amongst university students (Center for Collegiate Mental Health, 2019).

## Creating a direction of empathy

29

It would not be feasible to account for the goals, motivations and needs of three personas, due to time constraints.

To gain a more holistic understanding of the end-user and surrounding contexts beyond stress-related user needs, personas and scenarios were developed. Goals and motivations were extracted from insights and grouped, resulting in three different personas (figures 10–12), who are linked through the context of their stressful situations at university. Persona one whose goals and motivations matched those of the chosen user need, was prioritized to keep a sense of direction.<sup>29</sup> A scenario was constructed that corresponded to a motivation and goal of persona one (figure 10), exploring the role of the chosen functionalities in helping them achieve the goal.



## PERSONA 1

1st Year Business Student

Primary

Currently a first year bachelor of business persona one is in their second semester. Having moved from Wellington up to the Auckland University of Technology and is staying at the student apartments. Persona one aims to socialise and make new friends at university while also finding out & learning about business as an industry and degree. Persona one wants to experience university and all it has to offer.

## GOALS & MOTIVATIONS

- Persona one wants to form new relationships with friends and colleagues.
- Persona one wants to experience everything about university as far as socialising, partying and working with others.
- Wants to find out what they like about business as a degree.
- Build on their current social media image on snapchat, instagram and facebook.
- Seeks validation from their highschool peers as well as newly made friends at university.
- Comfortably live alone and adapt to new responsibilities.
- Understands the importance of mental health

## BEHAVIOURS

- Takes a particularly long time to understand what they need to do in order to finish an assignment.
- As the semester has progressed, persona one has been less frequently attending classes.
- Tends to leave assignments to the night before they are due and proceeds to stay up that night to meet the deadline, leading to surmounting stress build up towards the deadline.
- Constantly asks classmates and colleagues for guidance on how to approach assignments.
- Calls their family down at Wellington from time to time to update them as well as seek comfort from them when feeling homesick and stressed in their new environment.
- Tends to compromise their university work for social and extra-curricular activities.
- Constantly checks their mobile phone, particularly his social media applications in order to juggle his social media needs, extra-curricular events and academics.
- Procrastinates at home after attempting to stay at home and trying to do work (watching recordings of lectures).
- Slowly starting to learn to live independently and do mundane chores and tasks on their own.
- Participates in a social and/or extra-curricular activity in and out of university every week.

*"Persona one wants to have fun experiencing the social aspects of university, as a first year student this has led to prioritising social activities. This has led to his social and extra-curricular activities to take the bulk of their time outside lectures for most of the semester in order to meet new friends. Persona one is also adjusting to university as this is still just his first semester and he still has academic tendencies from highschool.*

*As a result, persona one has underestimated the amount of time to complete their two previous assignments which are worth a total of 35% of the final class grade and has rushed to finish them within two days of the submission date.*

*They feel anxious about the grades that he will get about those submissions and is anxious about the deadline for their latest assignment. They especially feel socially anxious about what their peers and classmates will say if they were to get a bad grade on his previous assignments"*

Figure 10. University student persona one, the chosen persona to drive the project's design process.



## PERSONA 2

3rd Year Psychology Student

Primary

Current a 3rd year psychology student at the University of Auckland, persona two currently lives in St. Heliers Bay and commutes to university. Persona two is looking to finish their final year of psychology and aims to be a sports psychologist after graduating.

### GOALS & MOTIVATIONS

- Values their social relationships and prioritises them above everything.
- Wants to be sports psychologists for a large fortune 500 company after graduating university.
- Wants to appeal to their peers, friends and her social network in general.
- Wants to be better or at least on par with their university colleagues in terms of academics.
- Wants to keep constant connection with their friends at university.
- Feels like they are doing well and doing what they want's as they surrounds herself with people who also feel the same way
- Aims to balance both their social life, university and outside commitments in order to maintain a good well-being.

### BEHAVIOURS

- Regularly goes to the gym and lifts weights
- Is in constant contact with friends both physically and digitally through facebook messenger / social media.
- Looks to contact friends if they are unsure about a certain situation or predicament for advice.
- Uses their mobile phone frequently as a communication tool for both friends and family.
- Can compromise grades due to social commitments and percieved obligations.
- Sometimes participates in extra activities they know they may not want to do, just because their friends are doing it.
- Plans their week in advance; accompanying university, social relationships and other events through a calendar application on ther phone. Although is quite fluid in changing and adapting depending on the day.
- Keeps tabs on their social media use due to overuse in the past by setting boundaries in ther academic routine, this has lead small brief uses of her mobile phone during university.
- Goes through periods of self-reflection after negative situations have happened (either academically or socially).
- When they feel overwhelmed by something, particularly goes to other external activities (i.e; going to the gym, talking or playing video games with their friends) to keep ther mind off it.



### PERSONA 3

Aspiring Software Engineer

Primary

Currently a post-graduate software engineering and business coinjoint degree student at the University of Auckland. Persona three is originally from Tauranga, and is in Auckland during semesters, staying at an apartment with three other room mates while within walking distance to the city campus. Persona three aims to work at a big technology firm after graduating and find success in the field.

### GOALS & MOTIVATIONS

- Passionate about what they are studying for their honours year as a software engineer.
- Maintain a great relationship with both colleagues, professors and university staff alike.
- Learn the most they can from his post-graduate classes and make connections through classes.
- Work in a high-end technology firm in New Zealand or Australia as a software engineer.
- Feel a great sense of accomplishment and positive self-efficacy
- To effectively handle university courses in the most efficient way.
- Develop the appropriate work ethic and repertoire of skills before leaving university.
- Feels the need to do well at university and get the best possible grades for every paper.

### BEHAVIOURS

- Likes to generally plan out his upcoming week through a personal calendar and task list and attempts to stick to it as best as he can.
- Prioritises university related activities and does not mind sacrificing other extra-curriculars.
- Attends all classes in all enrolled courses.
- Occasional video chat and/or messaging with immediate family from Tauranga.
- Treats university like a full-time job and stays at university from 9am - 5pm on weekdays while sometimes coming in on the weekends for extra studying or catching up on work, usually in the UoA library.
- Works part-time at a local retail store, for extra income to pay for rent and food outside of university fees.
- Tends to feel bad about getting a bad grade from a class, although this happens rarely now adays.
- Incrementally works towards deadlines through planning and allocating hours based on paper importance.
- Employs the use of many mobile and web applications to keep tabs of everything relative to his routine and academics.
- Brings a laptop and a mobile phone to university because that is the only thing they feel the need to bring to do what they want on most days.

Figure 12. University student persona three.

## Form to function

30

See Distilling Process  
Document  
Appendix C.  
(p. 101)

A multi-thread scenario (figure 14) was used to explore and ideate on the functionalities, translating them into wireframes. The scenario and persona chosen are a catalyst for contextualizing the multi-thread scenario. Mobile-phones were chosen as the medium, based on interview data<sup>30</sup> and analysis as the appropriate digital technology towards designing for university students.<sup>31</sup>

31

A key finding from the interviews conducted were that mobile-phones were heavily integrated into the lives of university students.

The very initial concepts of the eventual first prototype (figures 16–18) stem from each interaction between the user and the prototype (represented through grey labeled rectangles in figure 14). Through this exploration, the multi-thread scenario enabled identifying of functions needed for the interaction to work and therefore the required screen components (i.e; buttons and on-screen text).

While each interaction is explored not all are used. In this case, the fourth through to the sixth interaction were discarded (see figure 16). They were not included in the prototype, because they were seen as irrelevant steps within the scenario to achieving the user need.

32  
Adobe Experience Design (XD) is a design program part of the Adobe Creative Cloud that is specifically for designing digital user interfaces.

Each drawn wireframe was then digitally created through Adobe Experience Design<sup>32</sup> into the first digital prototype (figure 13). This prototype would reflect the flow of interaction to achieving corresponding goal of the multi-thread scenario and the design solution that addresses the corresponding user need.

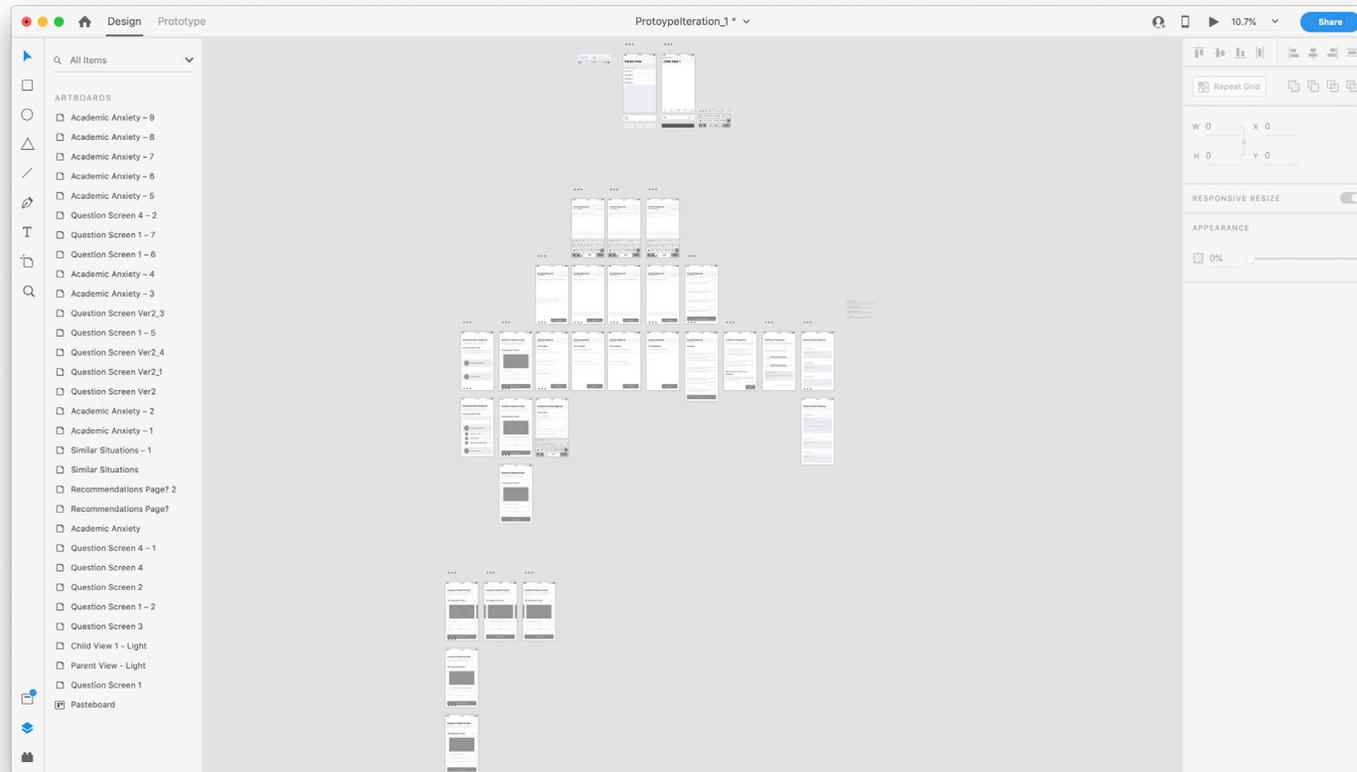


Figure 13. Adobe XD's interface showing overall flow of screens for the first prototype.

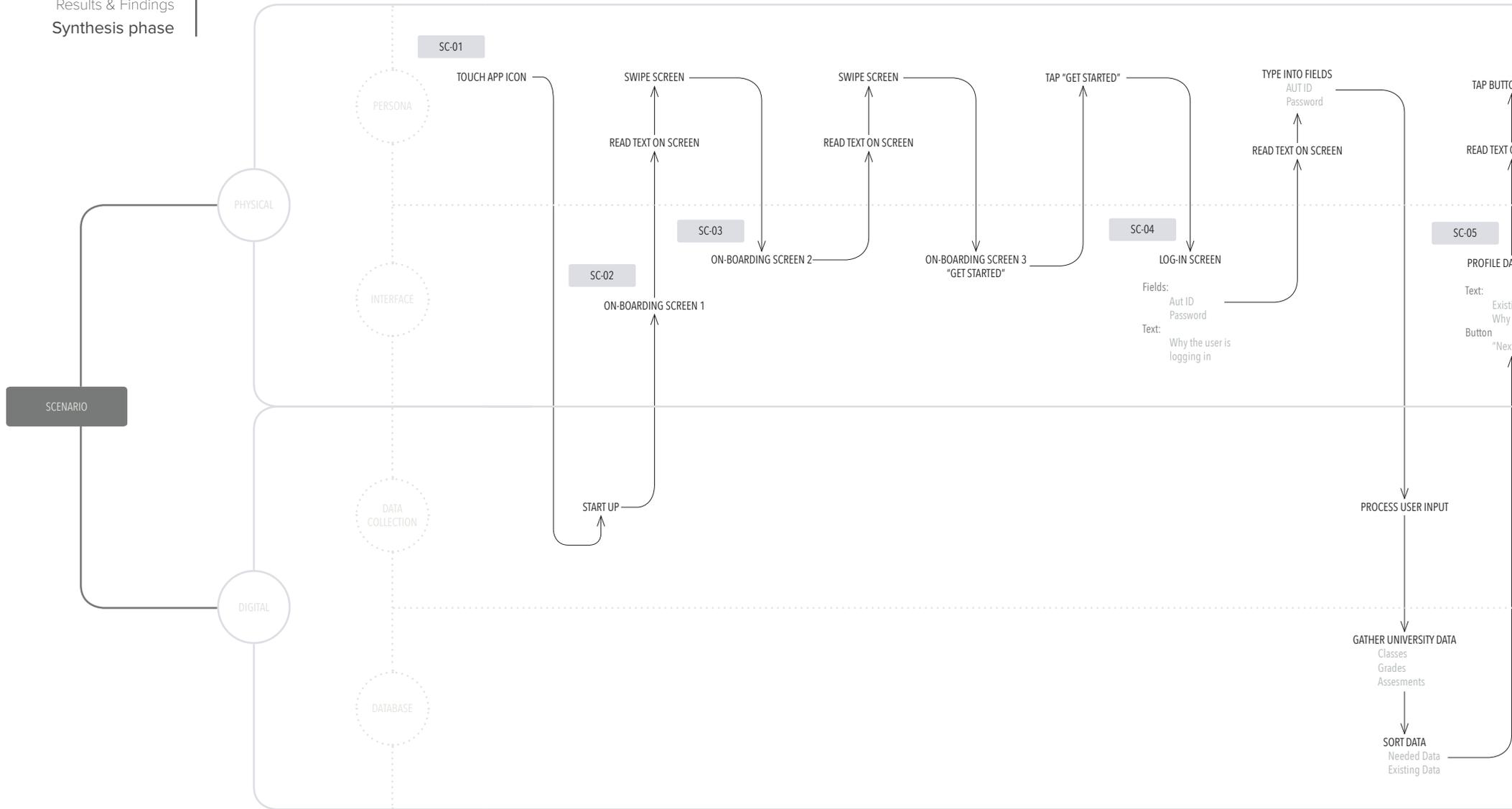
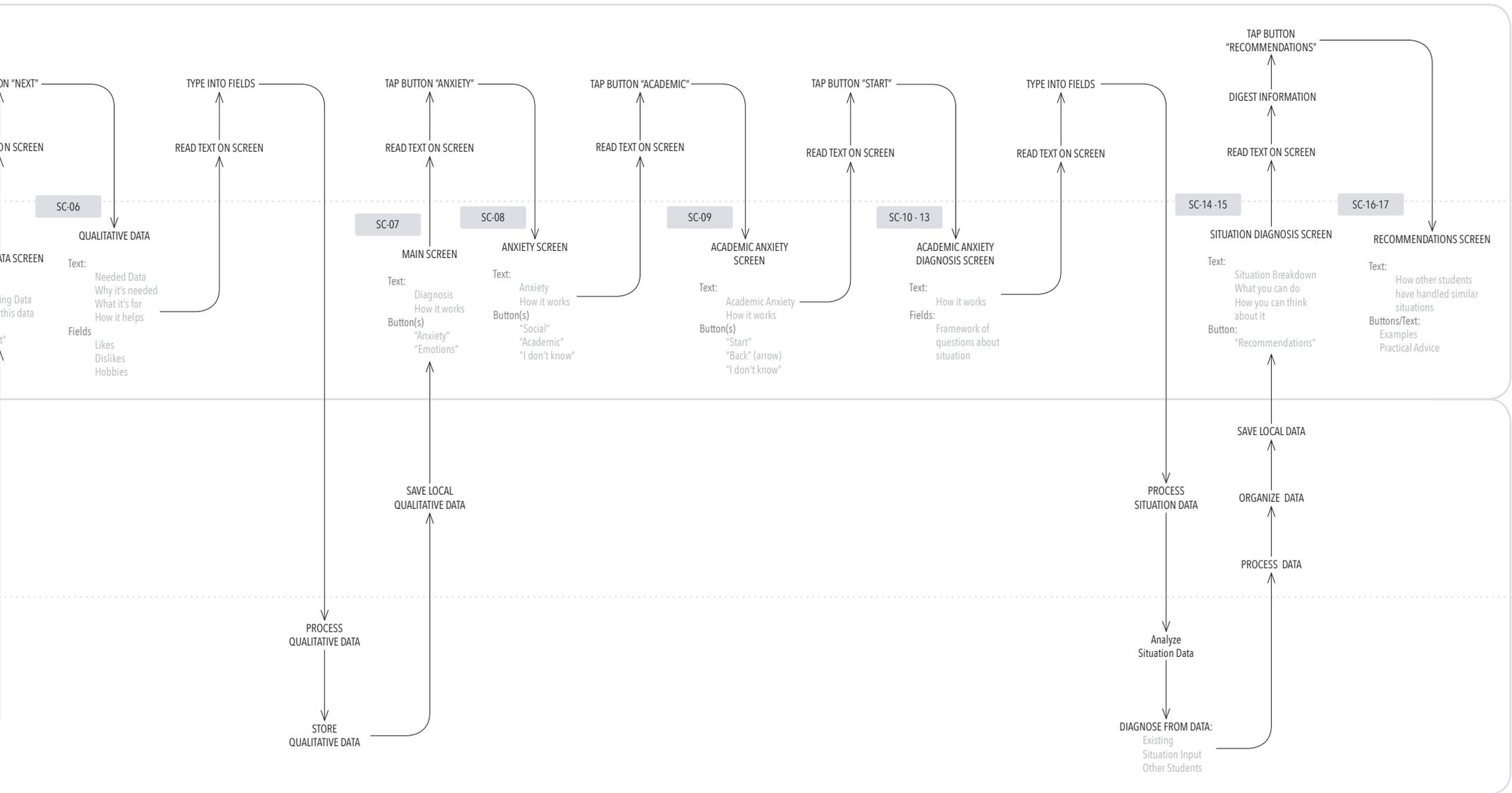


Figure 14. Multi-thread scenario.



33

See Competitive Audit Document Appendix C. (p. 92)

34

ML is a subset of Artificial Intelligence, is used for systems to learn, recognize and improve through algorithms based on data (Mueller and Massaron, 2016, pp. 9–20).

Big-data is referred to data-sets that not only have breadth but depth in the types of data variables involved.

Conclusions from this data typically are used to solve problems (Mueller and Massaron, 2016, pp. 23–28).

35

Apple's elements an guides for designers: <https://developer.apple.com/design/resources/>,

Renowned American psychologist Judith Beck's cognitive conceptualization theory psychologically underpins how the prototype's functionalities would theoretically alleviate stress relative to the user need.

Judith Beck's cognitive conceptualisation theory is the underlying framework for understanding the situations of patients and working with them to improve their situations, within Cognitive Behavioural Therapy (CBT). Stress and anxiety are two of the common topics that CBT deals with, giving those involved an informed perspective on their stressful and/or anxiety related situations.<sup>33</sup> An informed perspective is therefore the desired outcome for the end-users of the prototype.

The conceptualisation theory has many levels of competence as more variables are introduced that need to be understood (Beck, 2011, pp. 17–45). In this project the level of competence considers the emotions, behaviours, thoughts and reactions of people as they relate to stressful situations (figure 15).

While current capabilities of Big Data and Machine Learning (ML)<sup>34</sup> technology underpins the technical side of the functionalities. The mobile phone intended for the prototype is an iPhone, therefore the prototype was designed through the use of Apple's iOS user interface elements and human-interface guidelines (figures 16–18).<sup>35</sup>

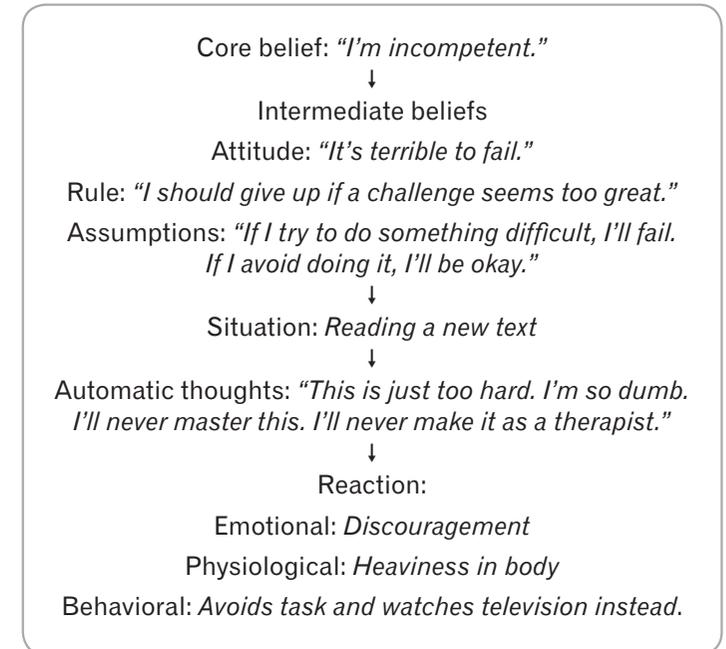


Figure 15. Example of the extent of the cognitive conceptualisation theory used in this project (Beck, 2011, p. 37).



Results & Findings  
Synthesis phase

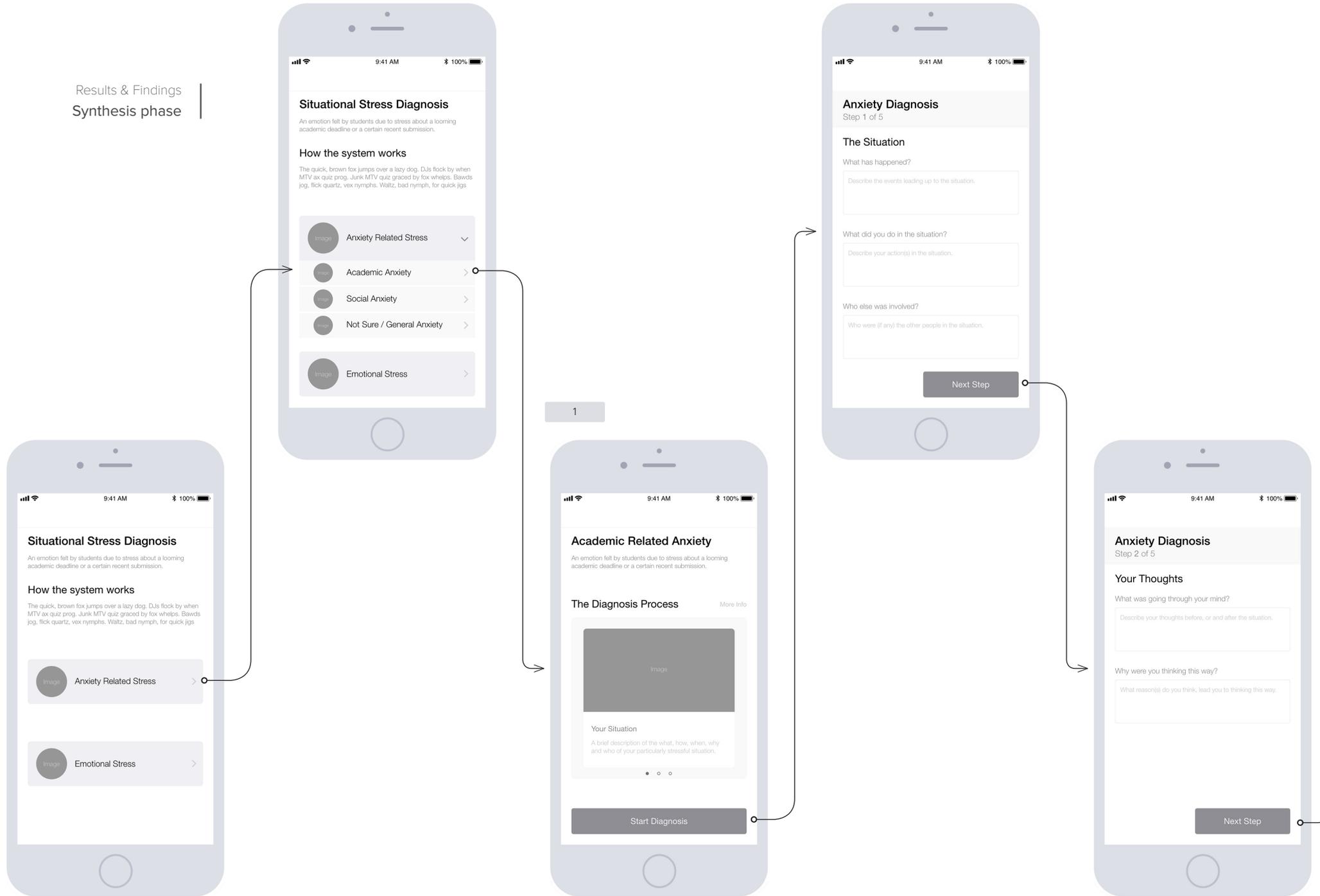
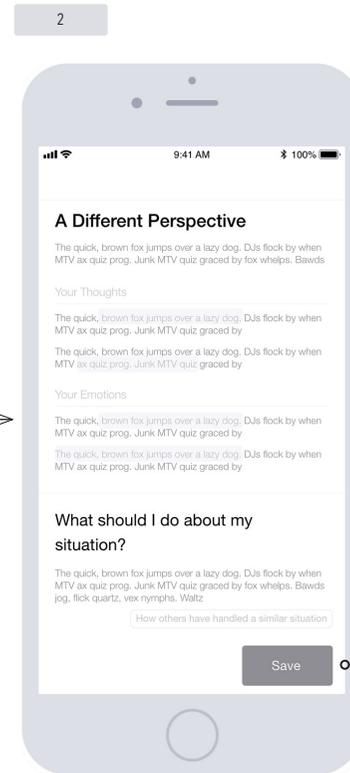
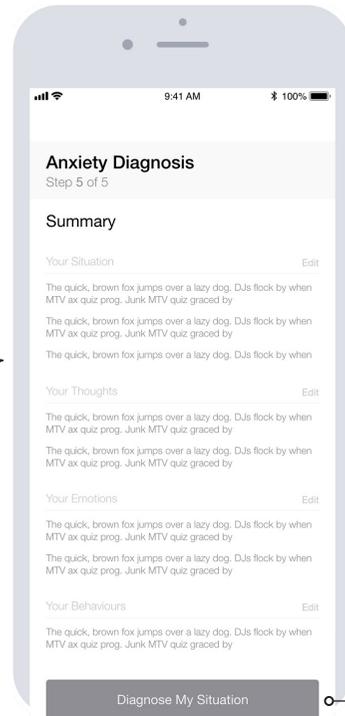
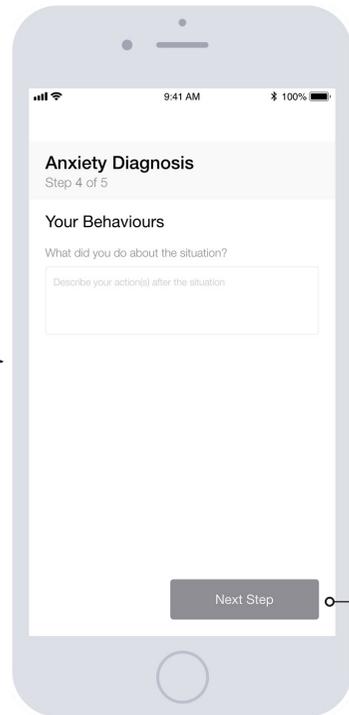
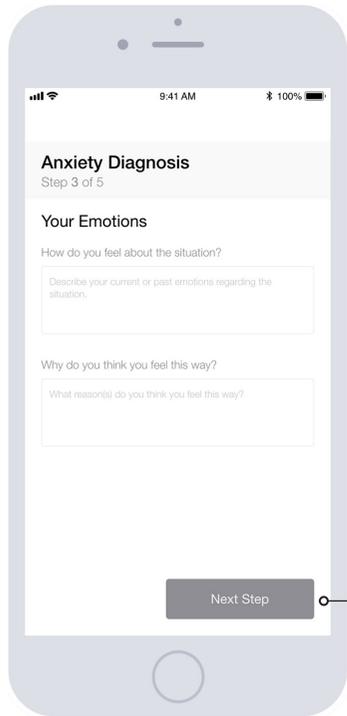


Figure 16. Situational stress diagnosis prototype, end to end flow.



1-A

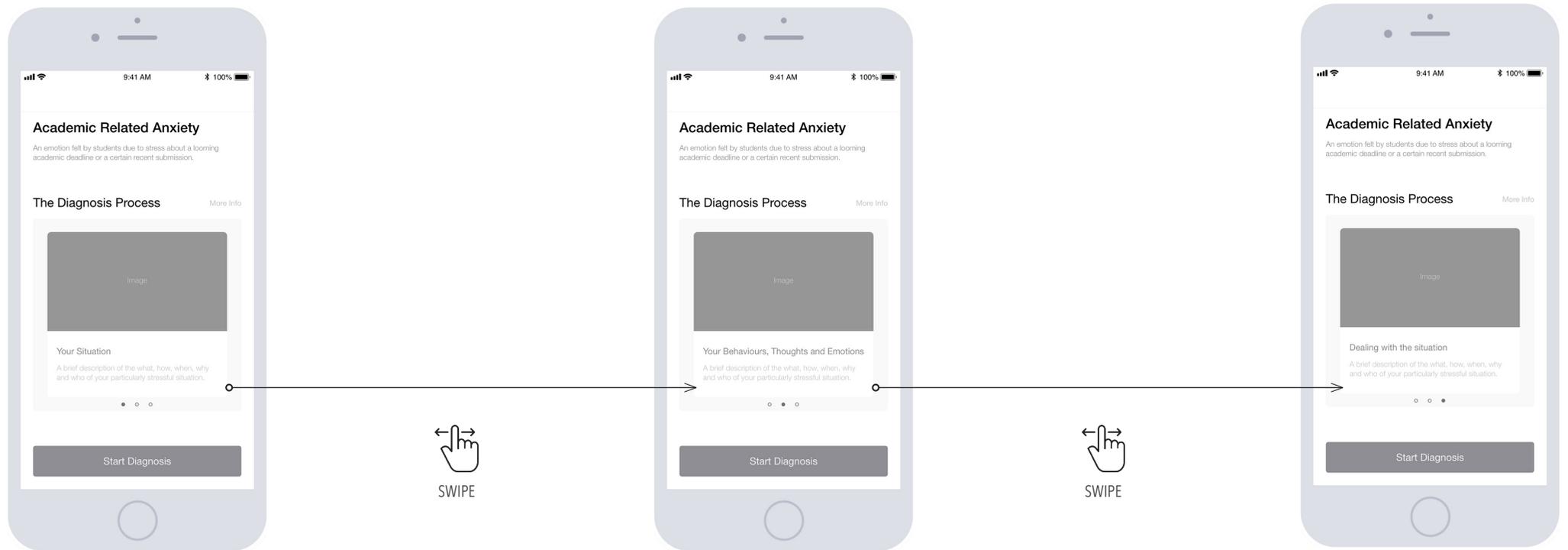


Figure 17. Situational stress diagnosis prototype, diagnosis process on-boarding flow.

Results & Findings  
Synthesis phase

2-A

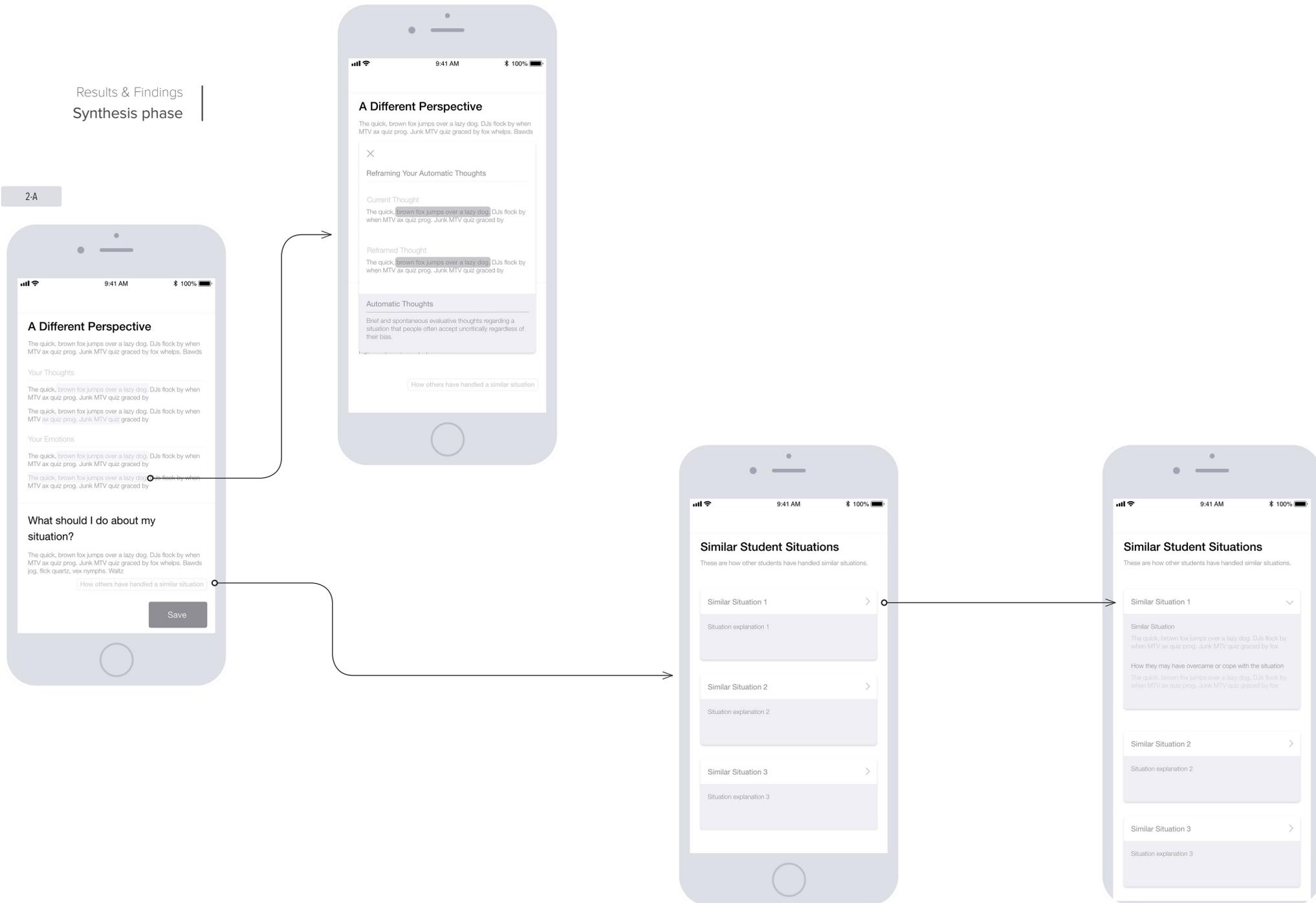


Figure 18. Situational stress diagnosis prototype, stress recommendations and explanations.

36

As each usability test would need a separate ethics approval from AUTEK, it would not be feasible to attempt multiple for the project due to time constraints.

37

Jessica Enders is a renowned user experience specialist who is the former owner of Formulate Information Design (<https://www.formulate.com.au/>).

## Internal Testing

Although usability testing is the primary user feedback method for improving the prototype, the need for ethics approval limits its use within this project.<sup>36</sup> While the usability test was being ethically approved, the prototype was iteratively improved twice through two stand-alone design critiques.

The stand-alone critiques provide feedback on general usability within the prototype as the critic (supervisor) is not an end-user. Obvious usability problems were therefore improved (figures 19–27), giving room for the usability test to focus more on feedback regarding the key theoretical ideas behind the prototype.

A consistent part of the feedback was that, the essential interaction problems were regarding readability of the questions and input from users, as this is similar to form filling, Jessica Enders'<sup>37</sup> Designing UX forms book was used to inform design changes.



Results & Findings  
Refinement phase

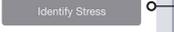
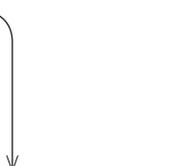
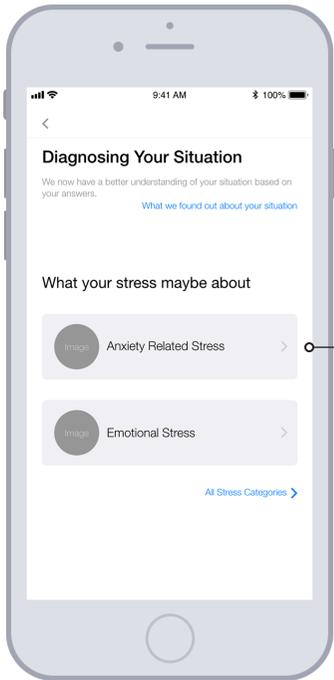
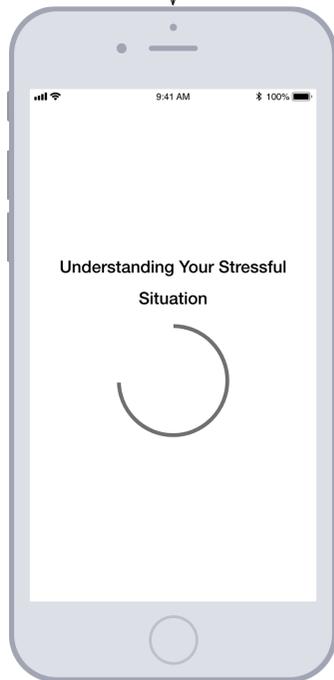
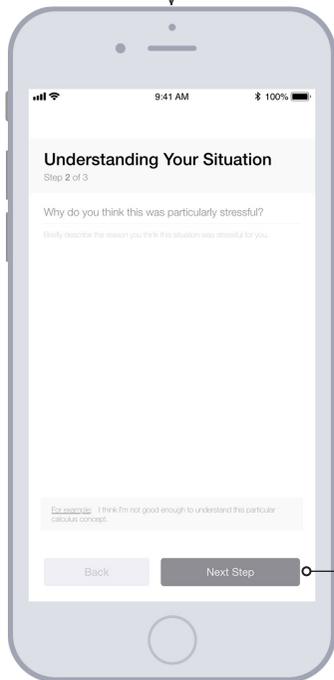
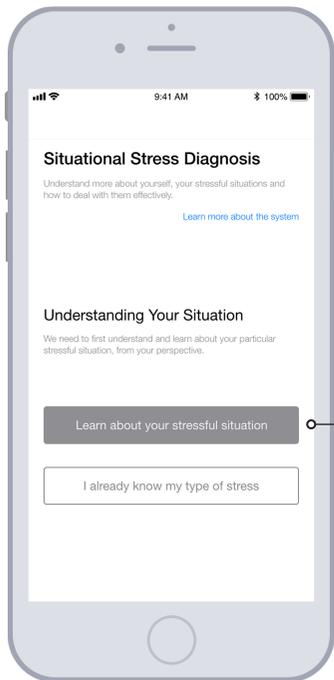
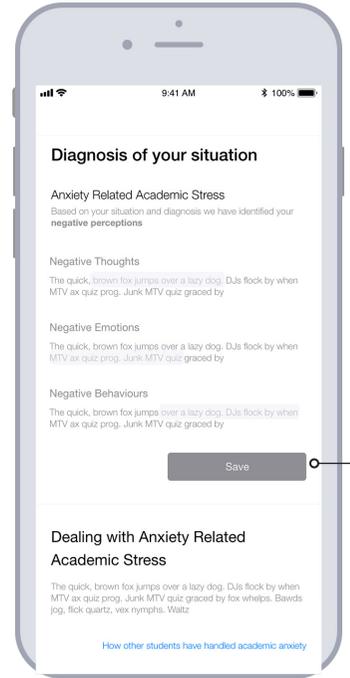
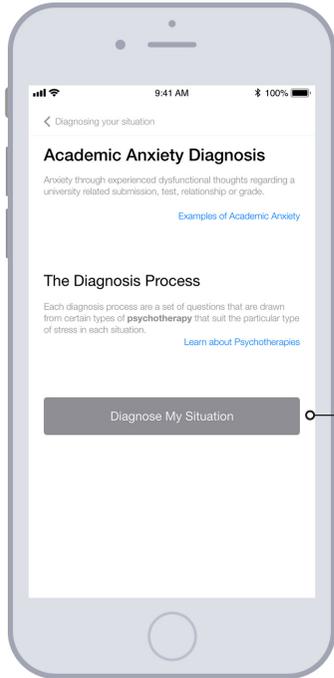
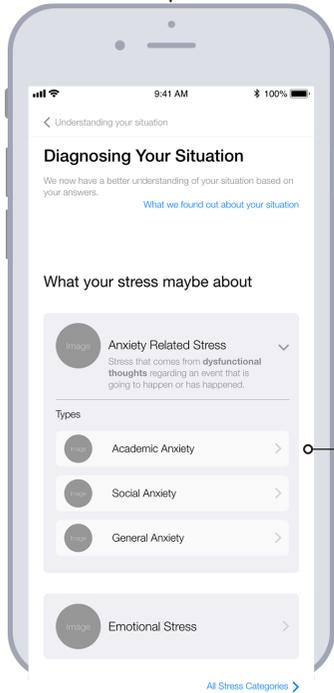


Figure 19. Situational stress diagnosis (Iteration one), end-to-end flow.

5



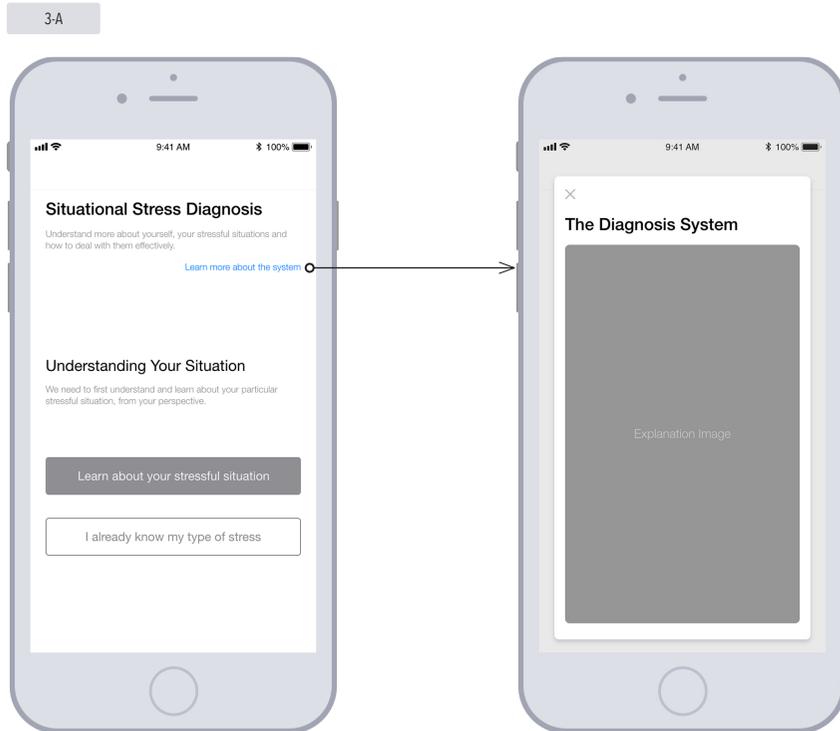


Figure 20. Situational stress diagnosis (Iteration one), diagnosis system explanation.

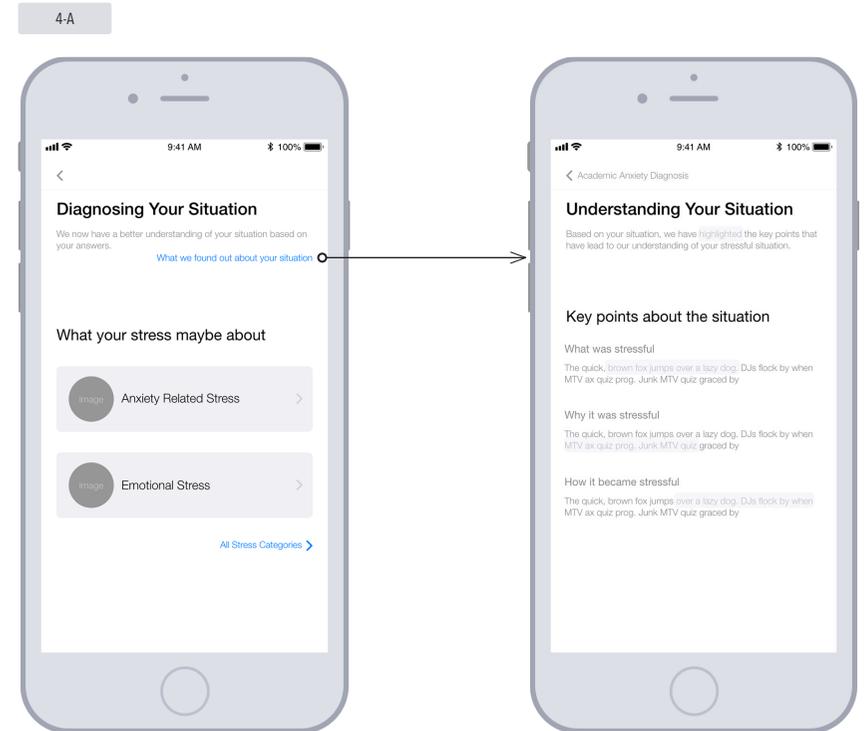


Figure 21. Situational stress diagnosis (Iteration one), breakdown of stressful situation.

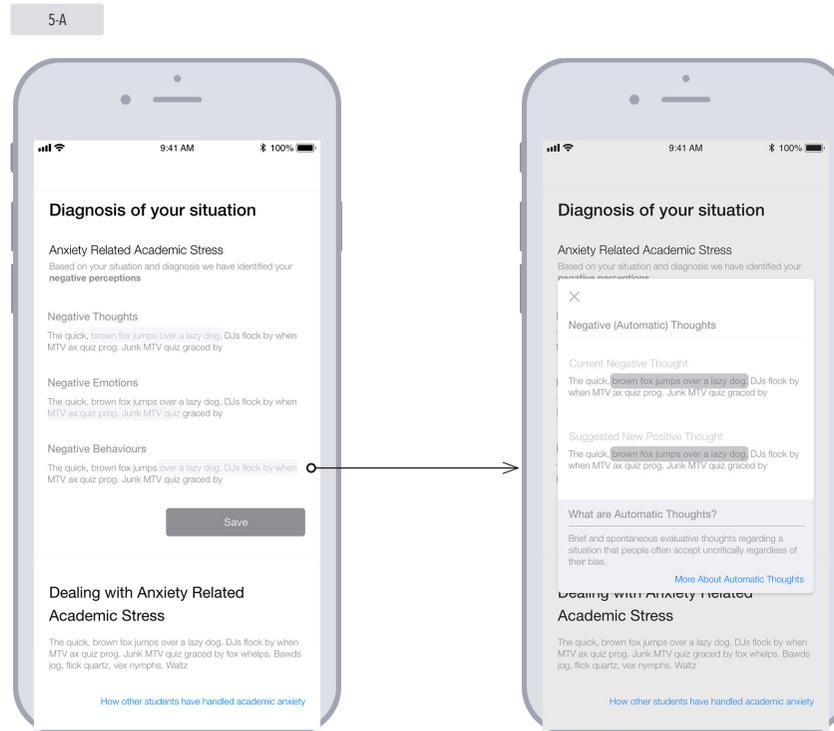
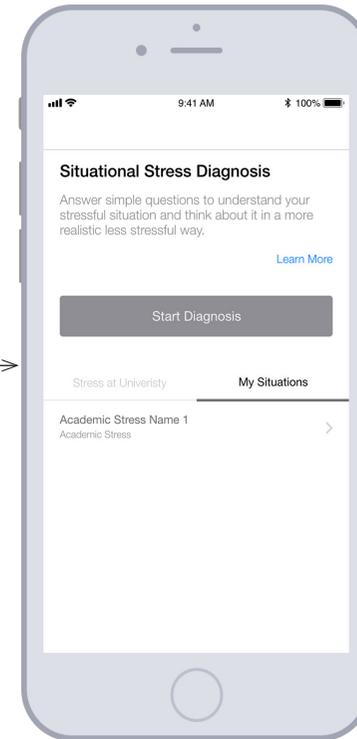
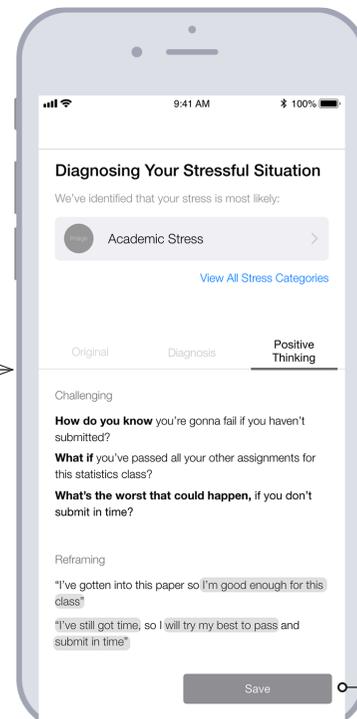
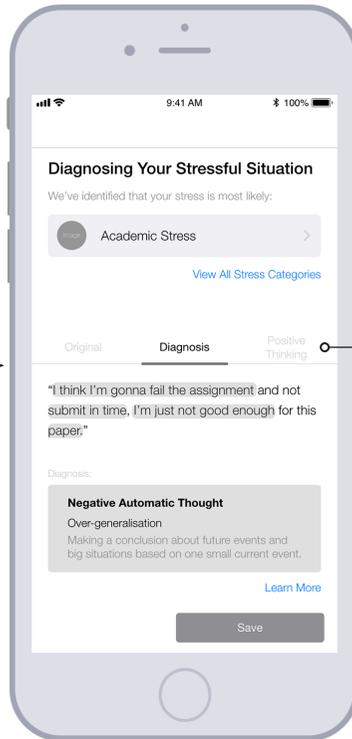
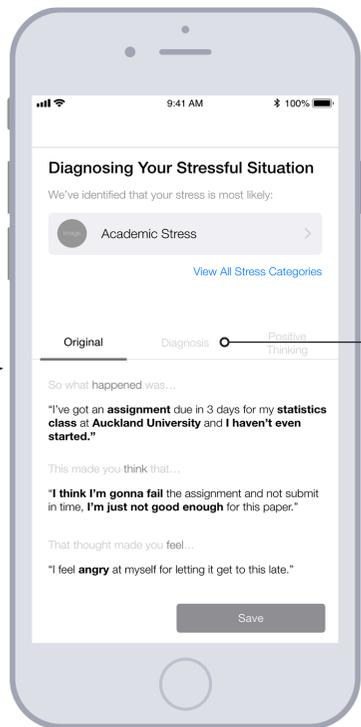
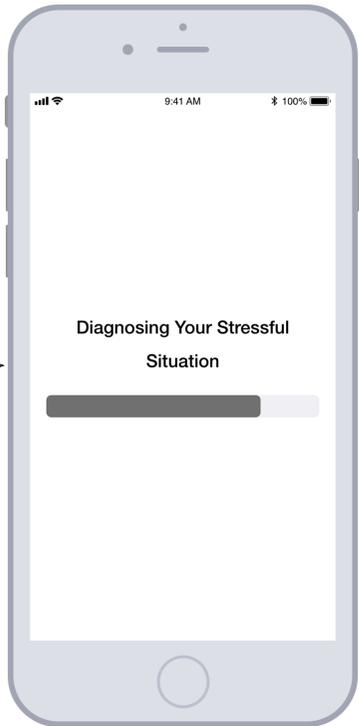


Figure 22. Situational stress diagnosis (Iteration one), details explaining stress in the situation.

Results & Findings  
Refinement phase



Figure 23. Situational stress diagnosis (iteration two), end-to-end flow.



Results & Findings  
Refinement phase

7-A

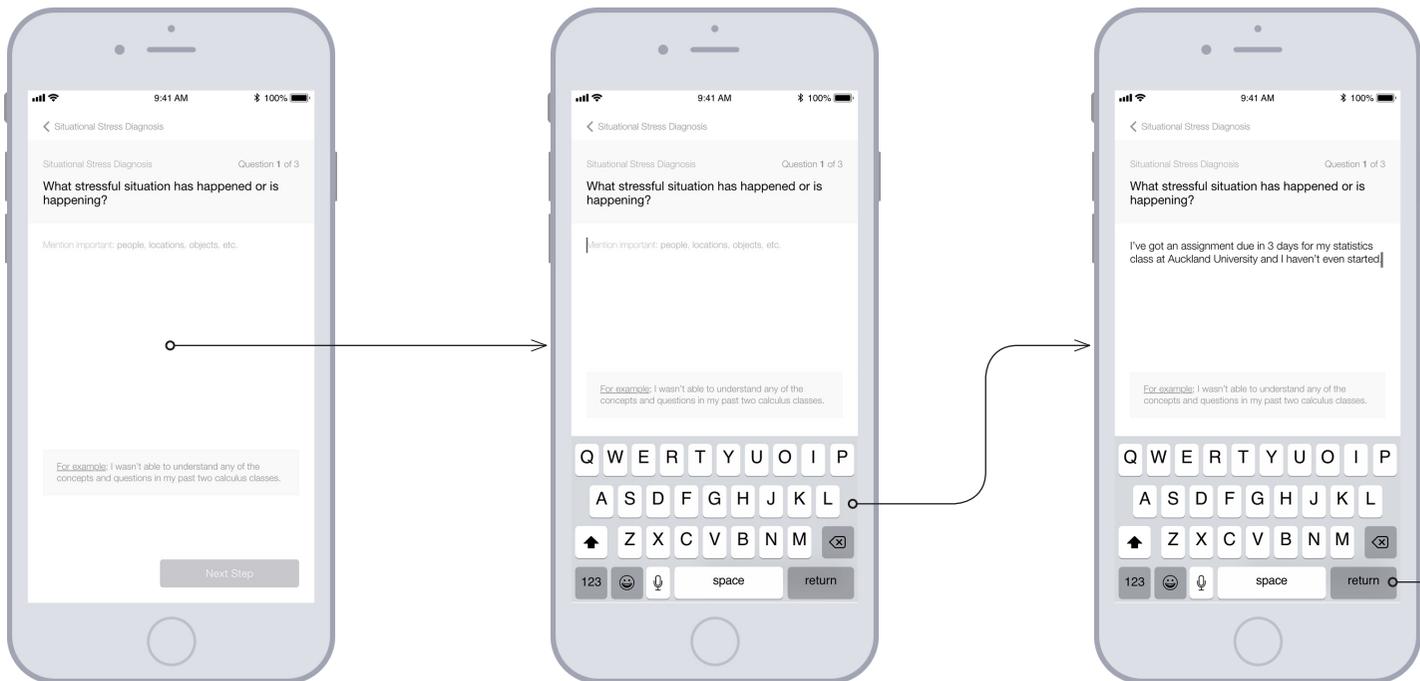


Figure 25. Situational stress diagnosis (iteration two), question and answer flow.

6-A

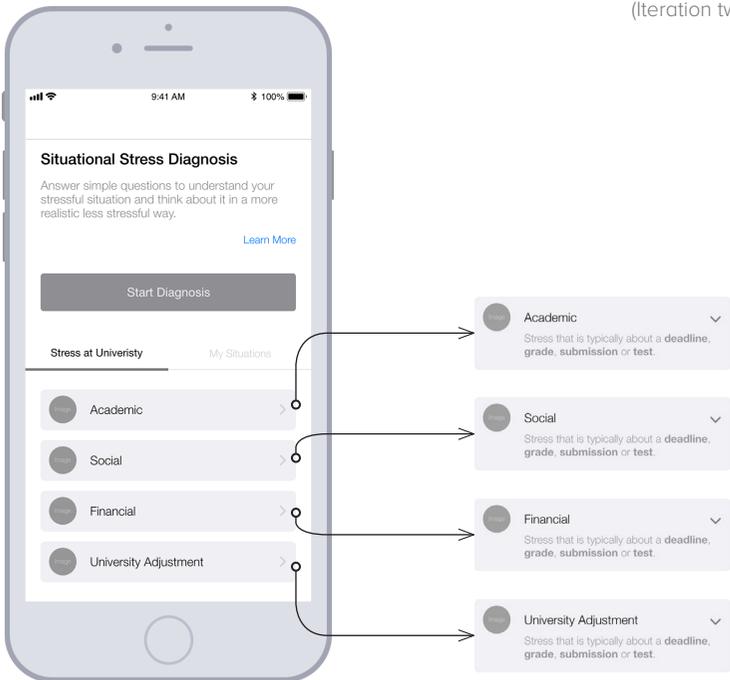


Figure 24. Situational stress diagnosis (iteration two), types of university stress.

8-A

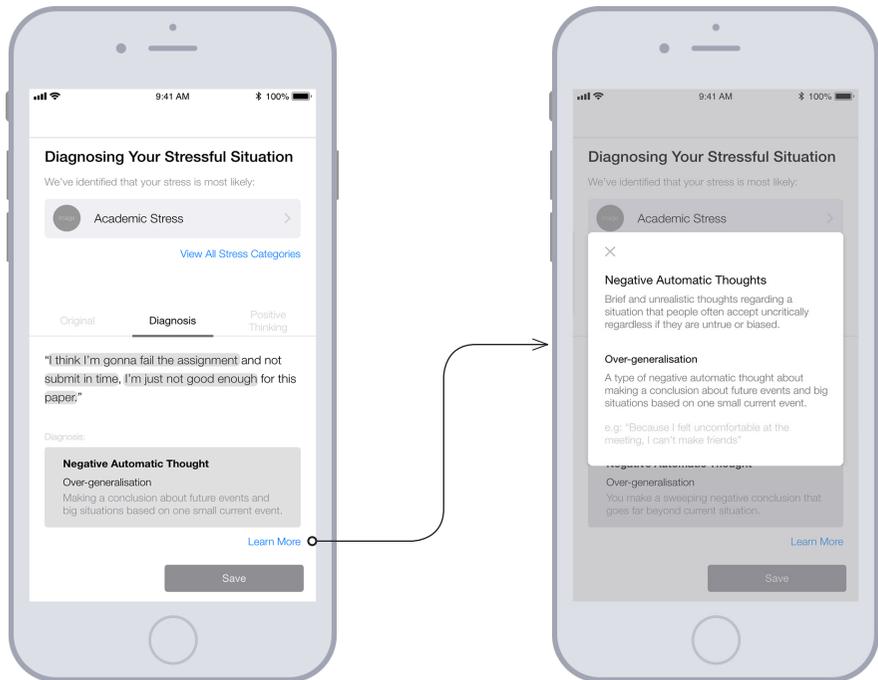


Figure 26 Situational stress diagnosis (iteration two), explaining negative automatic thoughts.

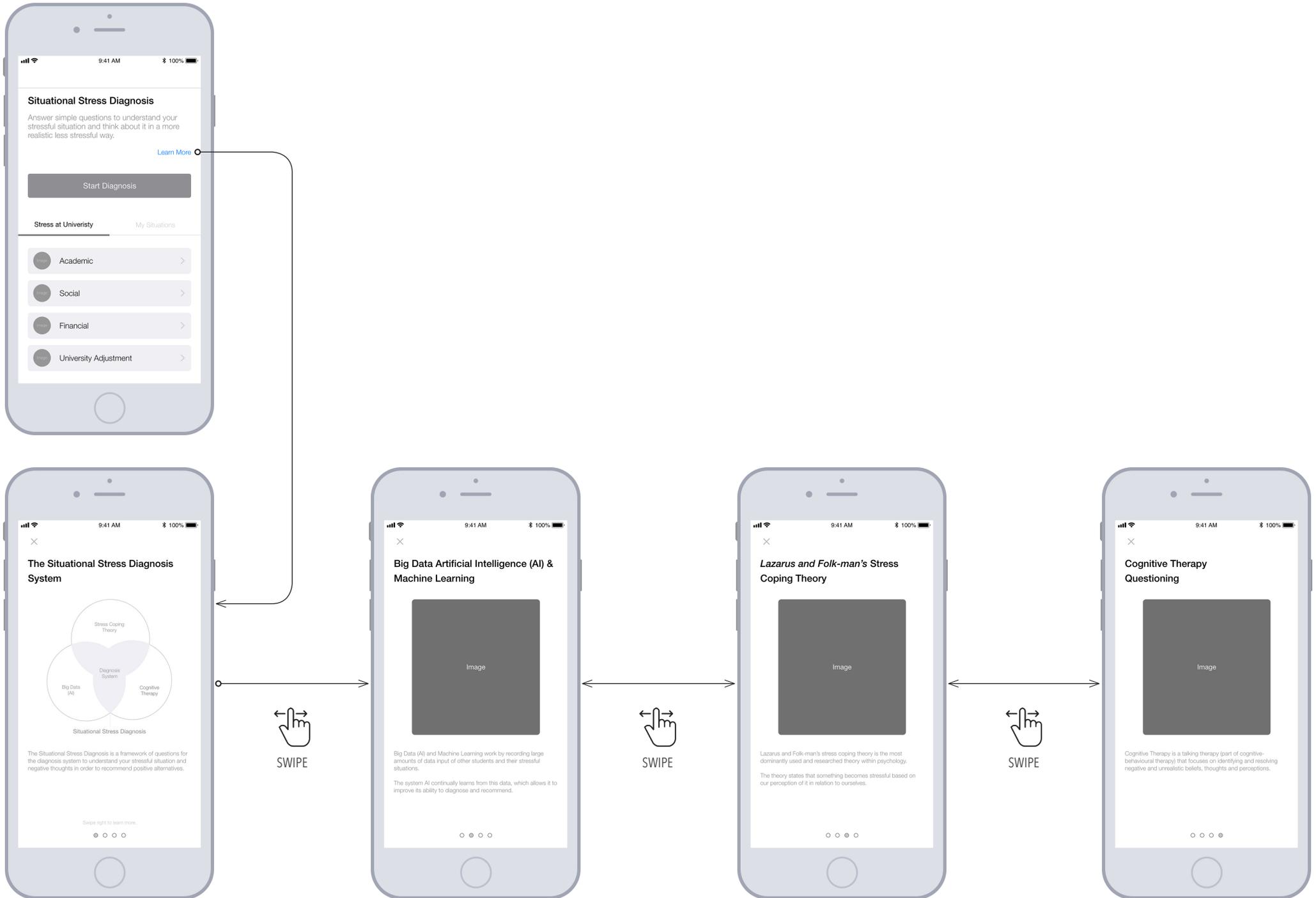


Figure 27. Situational stress diagnosis (iteration two), diagnosis system theoretical underpinning

## Voice Input

38

Google's Conversation Design Guidelines (Google, Inc., n.d.) and Mule Design's Co-founder Erika Hall's guide to conversation design (Hall, 2018).

39

A system persona is the conversational partner of the end-user to the system acting as the "front-end" (Google, Inc., n.d.).

40

A conversational flow map, maps out the different avenues that the VUI can take depending on the responses that the user gives (Vessem, n.d.)

Based on the assumption that the prototype would be used while the end-user is still stressed, usability feedback from the second design critique suggests that, the typical mobile-phone interaction mode (screen tapping) maybe inadequate. As a result, voice interaction was hypothesized as more appropriate. Through a range of Voice-user interface (VUI) design guidelines,<sup>38</sup> a VUI prototype was created.

To emulate a human-centric VUI, a system persona<sup>39</sup> was created as the baseline reference for the tone and feel of the VUI. The system persona and user persona 1 drove the design of the conversational flow map (figure 28).<sup>40</sup>

**Refinement phase**

41

Watson is IBM's cloud platform of AI ready applications (IBM, n.d.), of which their AI powered text-to-speech service was to create the VUI audio lines in this project.

42

WOZ usability testing is a type of usability test specifically geared toward VUI's, they work through the tester acting as the system and referring to the conversational flow map while conversing with a user (Google, Inc., n.d.).

43

VUI System Dialogue sheet.  
Appendix C.  
(p. 100)

The high-level conversational flow was used to identify conversational components and their corresponding voice lines for the prototype. IBM Watson's<sup>41</sup> cloud speech services were then used to code and transcribe the lines into audio. This involved using one of their pre-made voices and learning specific code to change the tone and feel of the voice to match the system persona. Wizard-of-OZ (WOZ)<sup>42</sup> is a specific usability test for VUI prototypes and would be used for this project's prototype.<sup>43</sup>

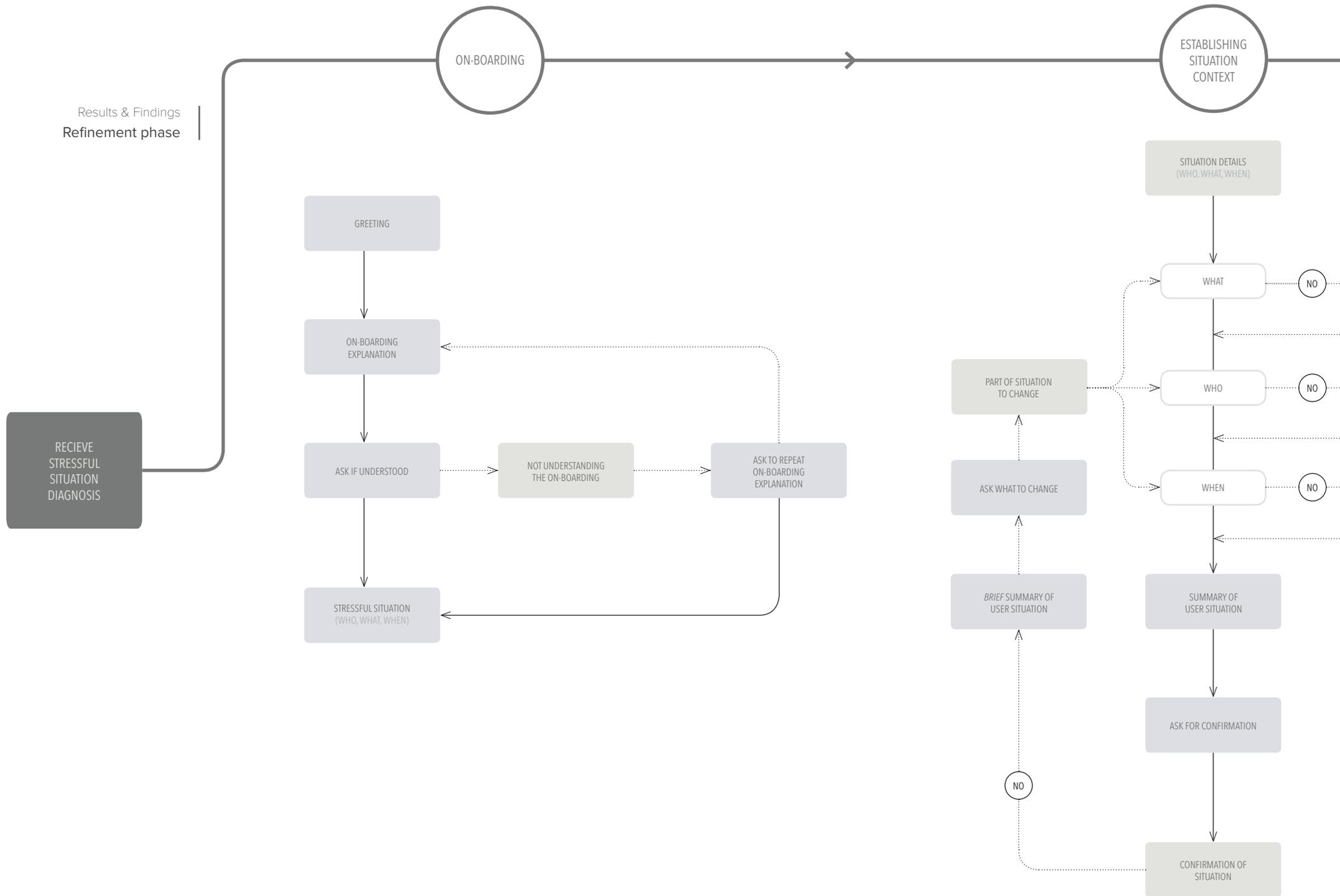
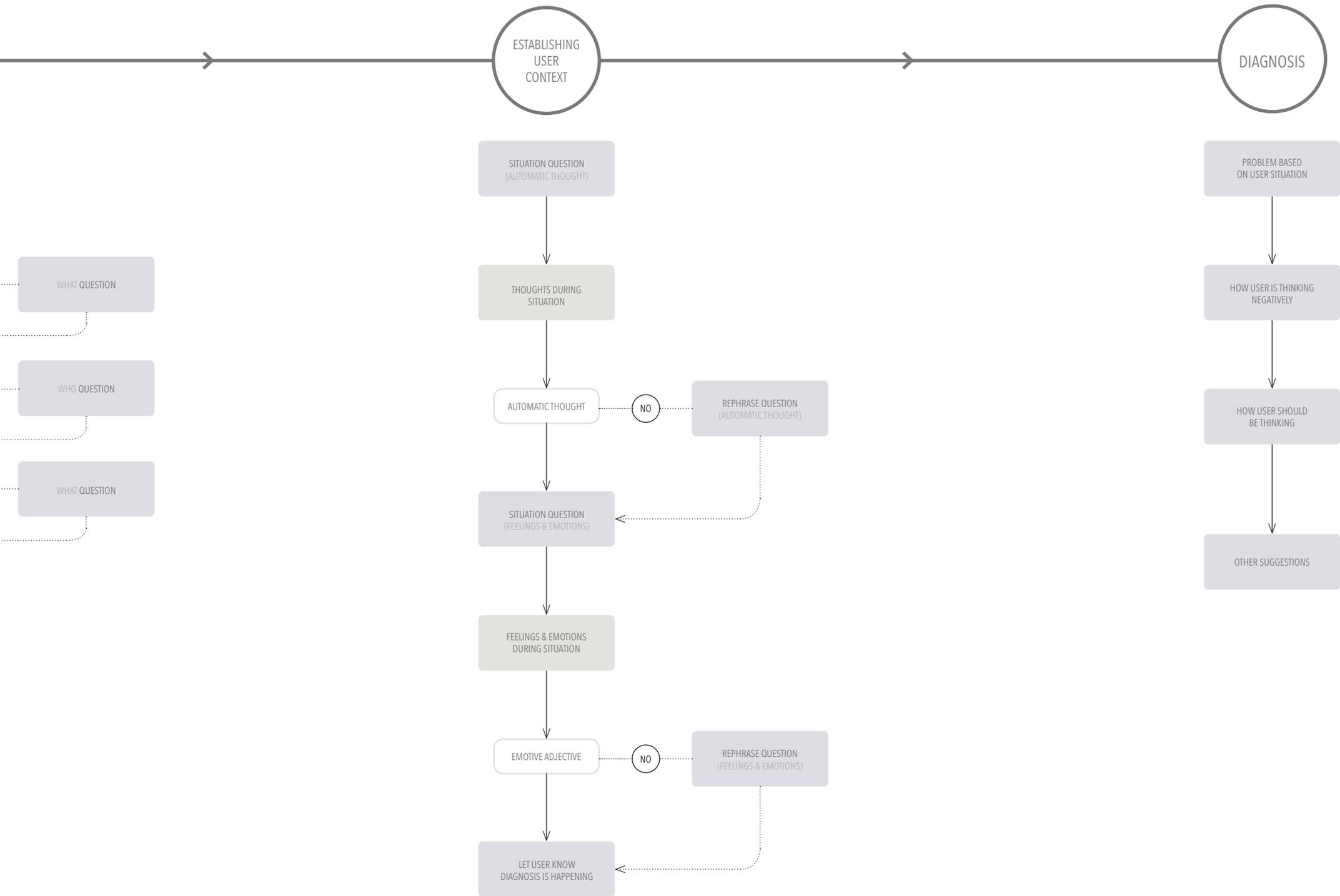


Figure 28. VUI conversational flow map, outlining different sections of the conversation.



## User testing, feedback and iteration

44  
Usability expert Steve Krug suggests that for usability testing, particularly on a budget, 3 to 5 participants are enough to discover 80% of problems. (Krug, 2009, pp. 38–50).

45  
See Ethics approval documents Appendix A. (p. 76)

46  
Usability Testing Plans for Prototype one and Prototype 2. Appendix B. (pp. 83–86)

Two usability tests were conducted for both prototypes with two new students and a participant from the interviews,<sup>44</sup> to test each prototype once. This test was approved as an amendment to the ethical approval of the interviews conducted in phase 1.<sup>45</sup>

Initially, the aim of the tests was theoretical and practical usability feedback. However, for ethical reasons (discussed in the next chapter), the aim of the test is for practical usability feedback, although theoretical feedback is welcome.

The usability tests were both audio and video recorded through a MacBook pro and Go-pro Hero 3 (figures 29 and 30), allowing for both. Each participant was able to choose a pre-written scenario that would contextualize the task they were given to complete on the prototype. Post-test questions as follow-ups to observations by the researcher during the test.<sup>46</sup>

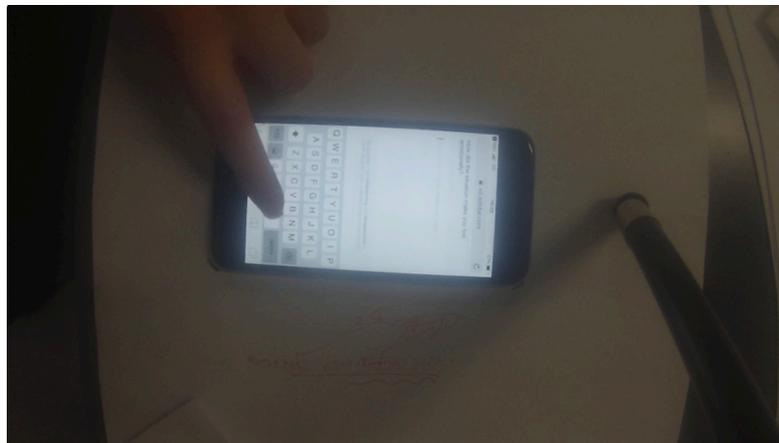


Figure 29. Usability testing, Go Pro Hero point-of-view.

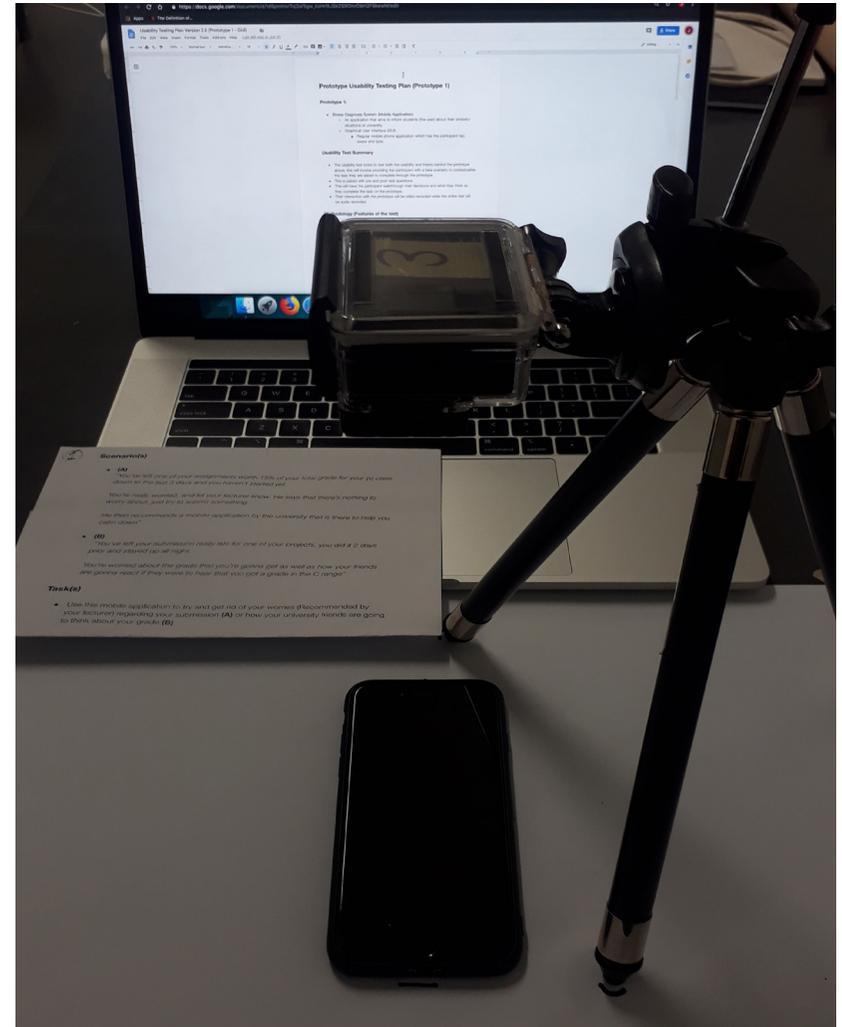


Figure 30. Usability testing kit.

47

Ubiquitous nuisances are minor problems many people encounter, while corner cases are very impactful problems that very few people are going to encounter (Krug, 2009, p. 105).

48

Usability Expert Steve Krug, advocates that deviating too far from the tested prototype has consequences for both the user and the designer, that might not be worth the time and resource (Krug, 2009, pp. 110–120)

49

Fundamental problems behind the strategy of the product that can't be remedied through simply changing aspects of the design that are visual (Schade, 2013).

50

The use of conversational and visual components that correspond into one form of interaction. (Google, Inc., n.d.).

Project time was key factor in creating the metric to prioritize the usability findings, meaning ubiquitous nuisances and corner cases<sup>46</sup> would be disregarded as they are often rare and insignificant problems (Krug, 2009, p. 105).

Common findings were first grouped then prioritized, based on severity through two conditions; perceived frequency of the user encountering the problem and the problem's capacity to inhibit the intervention from addressing the user need. Grouping was based on which part of the prototype the feedback was for.

While the overall approach to using feedback were to make the simplest changes that would remedy that solution,<sup>48</sup> although not a focus, large-overarching problems<sup>49</sup> were still taken into consideration.

The key findings were based on the mode of interaction, which sought users/participants finding that typing might not be appropriate when stressed (as the assumed state of mind of the user while using the prototype). At the same time, participants preferred voice as an interaction mode, as this reflects how they would deal with similar situations, except talking to someone they know. However, the more long-winded responses of the system persona maybe a problem in terms of comprehension, given the user is stressed. Therefore, a key change within the prototypes, is the combination of both voice and user-interface elements. This implementation of adapted visual and conversational components,<sup>50</sup> the general usability findings from the test were still considered and implemented along with the new mode of interaction.

Although this is a relatively big change that goes against Krug's philosophy, the mode of interaction is crucial in order for the prototype to address the users needs. Therefore, justifying the change to be made (as well as being consistent feedback across all participants).

This would be the final design iteration (figures 31–33 and 35–36) and output for this project. Theoretically, usability testing could be continually performed (an unlimited amount of times) but is not feasible within the time-frame of this project.

In partial submission to the school of Art and Design's end of year exhibition for 2019 at the Auckland University of Technology, I further developed the user interface of the final design iteration. All development was from a visual design perspective, establishing a colour palette, applying consistent type and formulating illustrations, all branded under "Mindscape" (figure 34).

Results & Findings  
Refinement phase

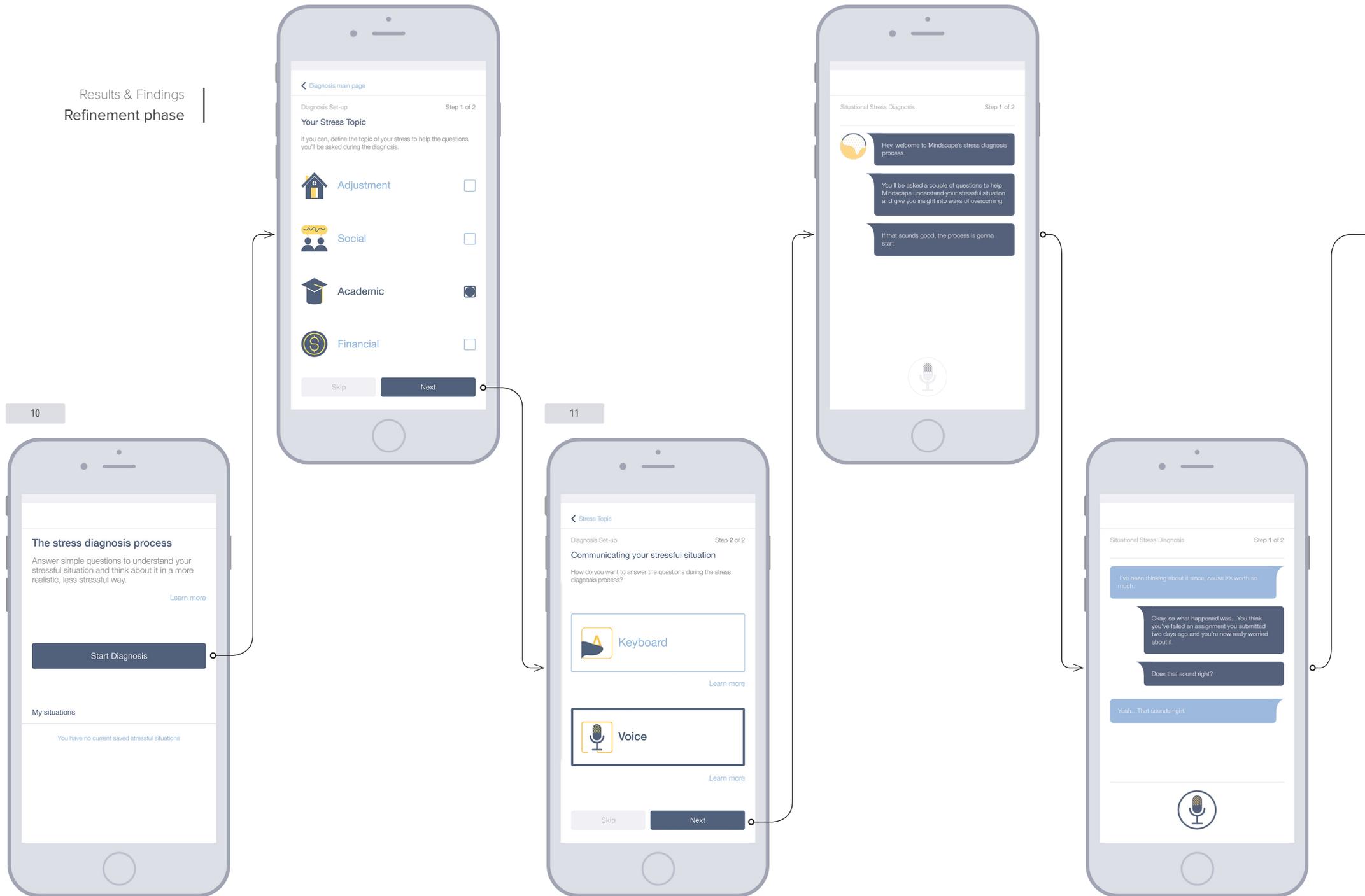
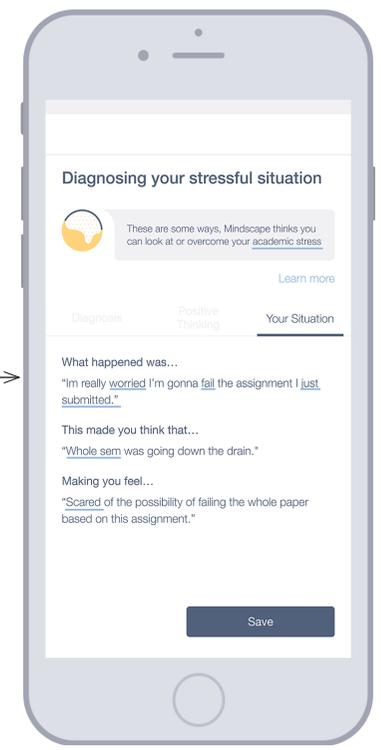
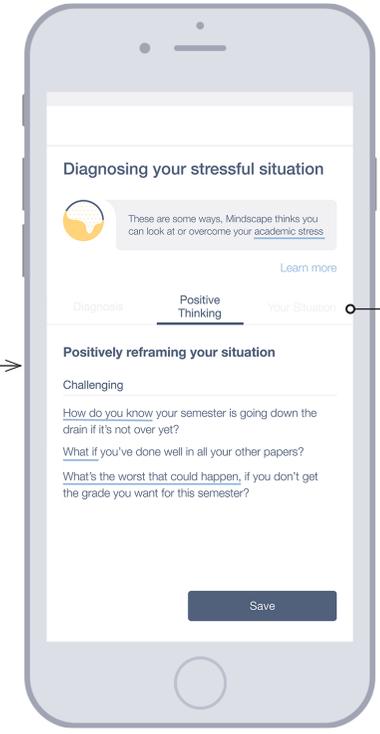
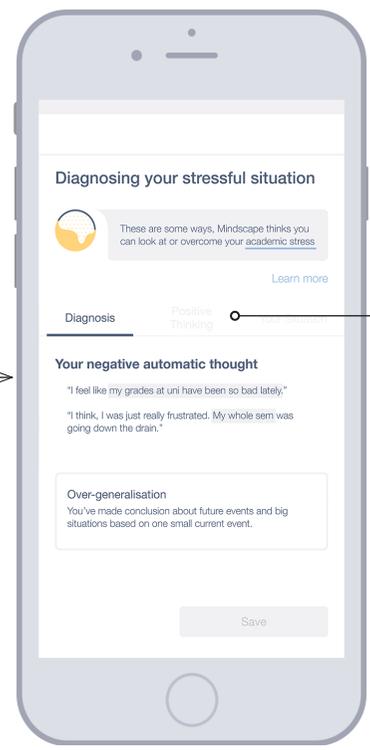
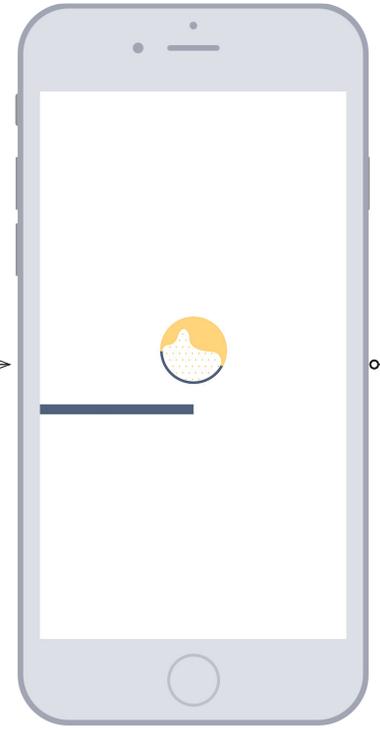
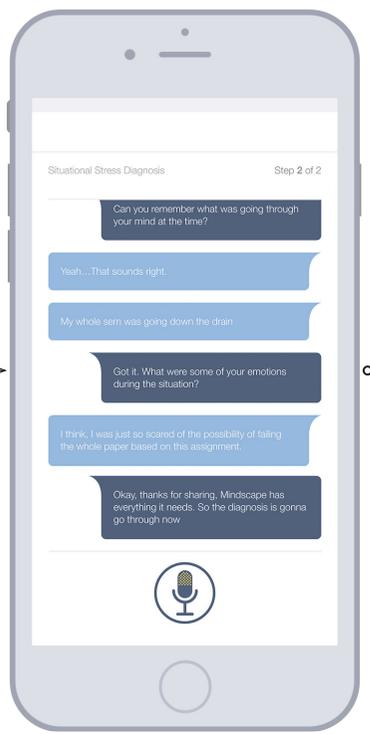


Figure 31. Mindscape, conversational stress diagnosis simulation.

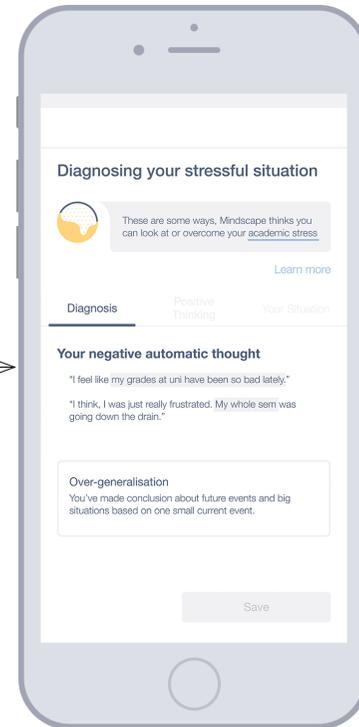
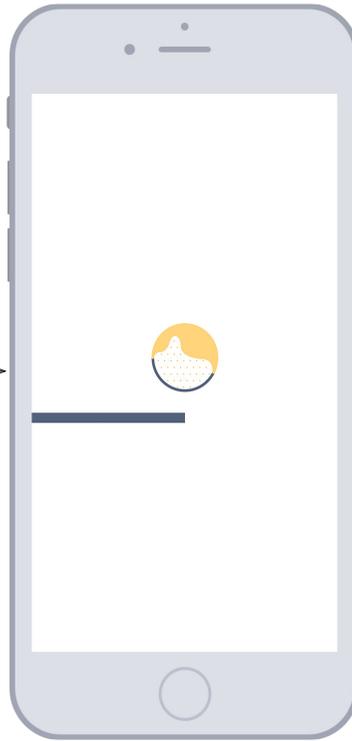
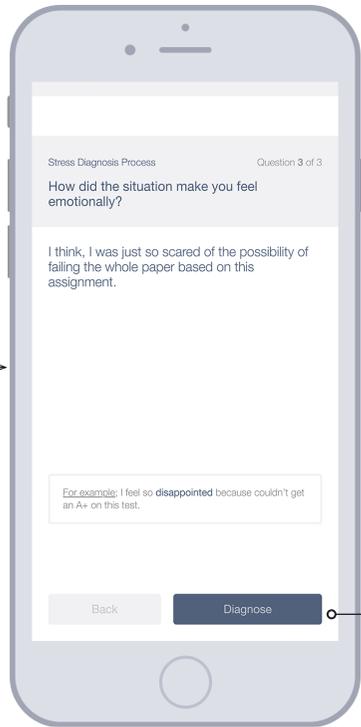
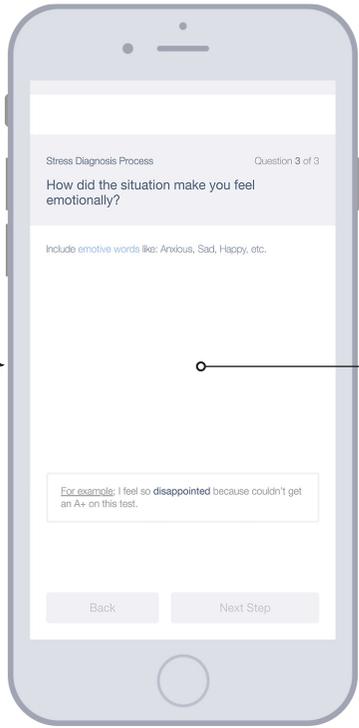


Results & Findings  
Refinement phase

11A



Figure 32. Mindscape, stress diagnosis mobile keyboard interaction.



Results & Findings  
Refinement phase

Figure 33. Mindscape, stress diagnosis theoretical and technological explanation.

10 A

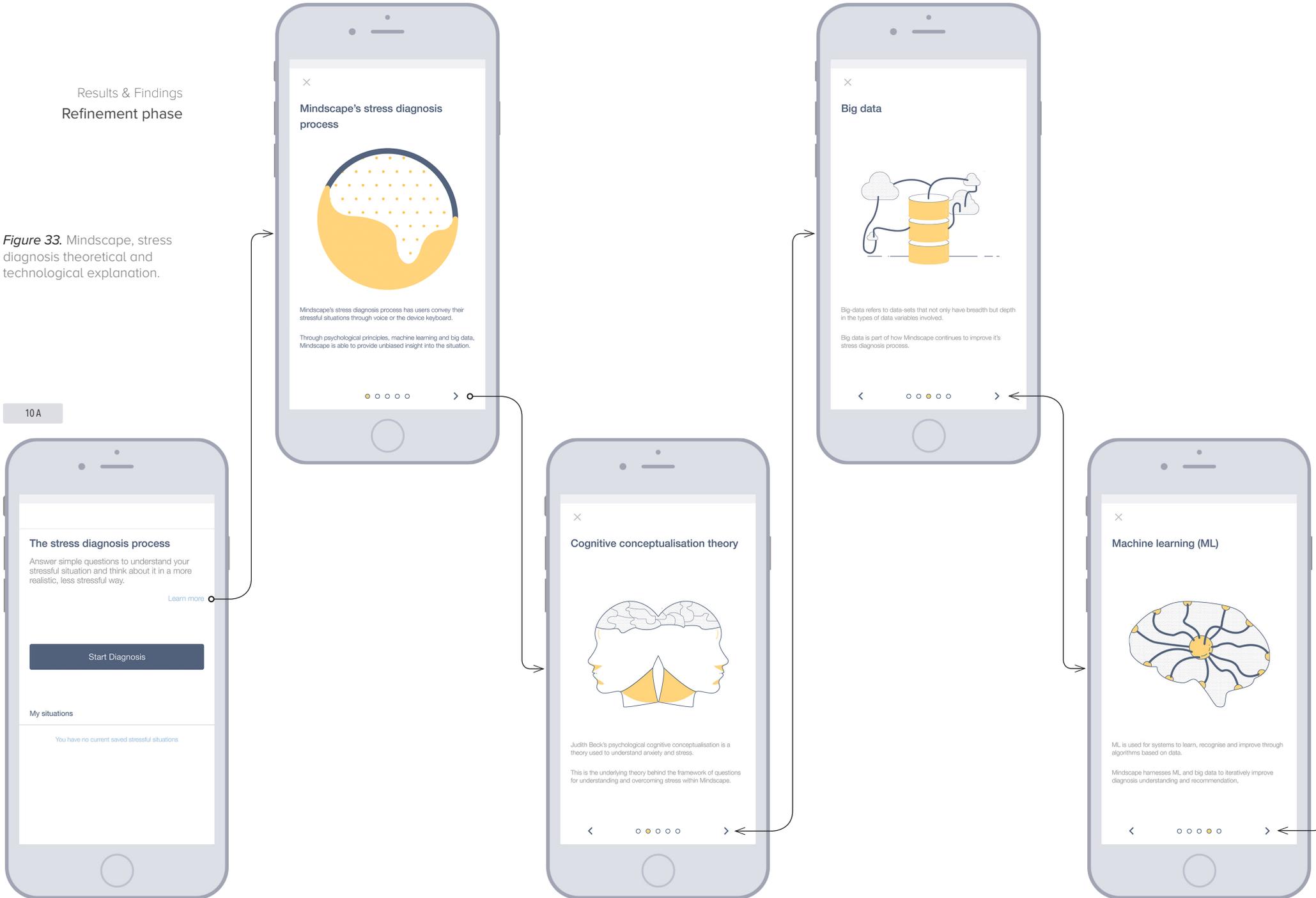
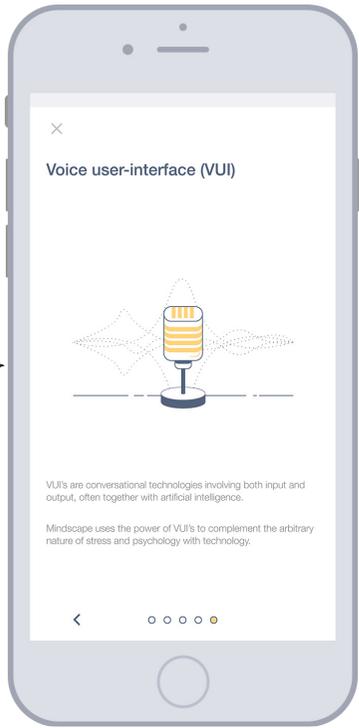


Figure 34. Mindscape, branding, type and colour palette.



# MINDSCAPE

## PRIMARY COLOURS



#FED687



#55617A



#9CB9DD

## SECONDARY COLOURS



#8E8E93



#EFEFF4

## TYPE

### Helvetica Neue

**Aa**

Medium

**Aa**

Regular

**Aa**

Light

Size

20px

16px

14px

12px

Weight

Medium, Regular

Regular

Regular, Light

Light

Results & Findings  
Refinement phase

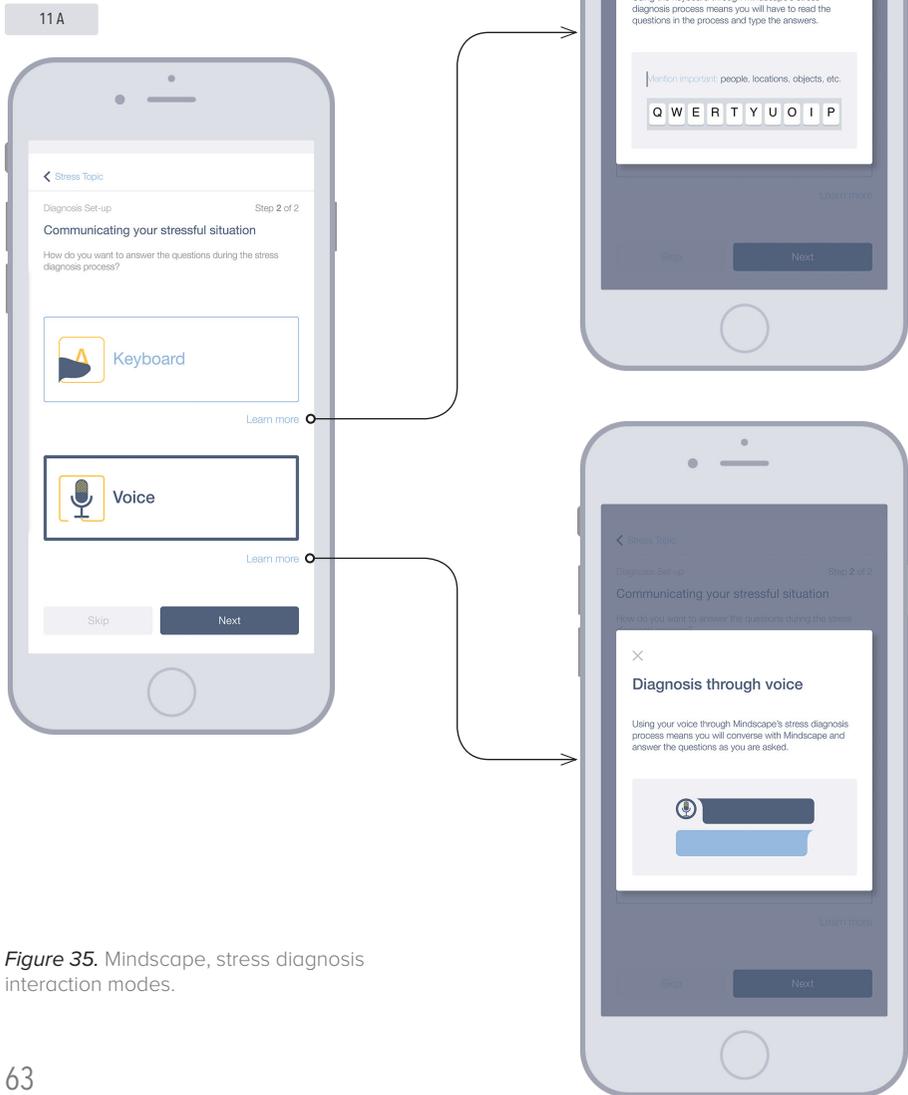
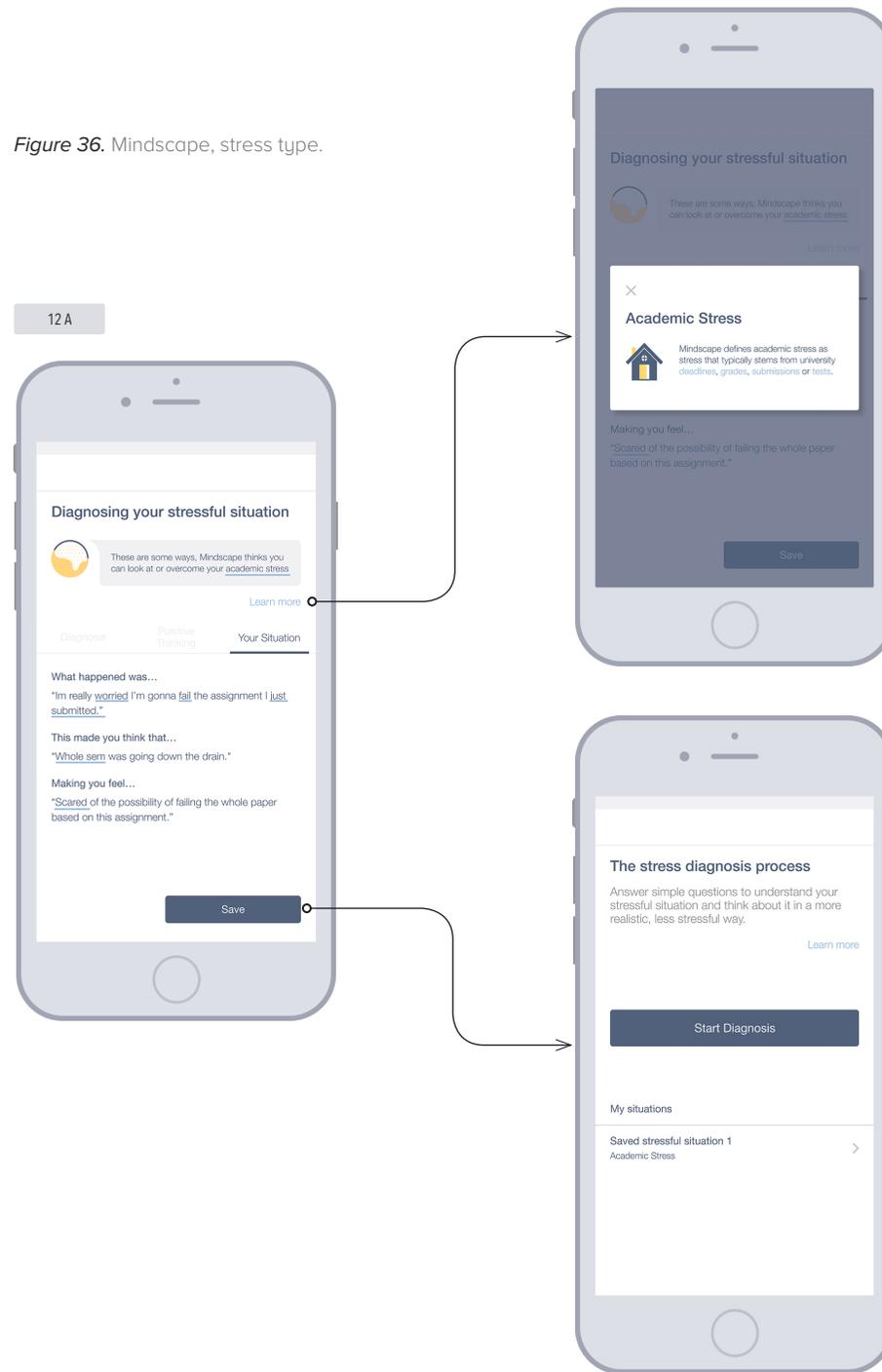


Figure 35. Mindscaple, stress diagnosis interaction modes.

Figure 36. Mindscaple, stress type.



05

**DISCUSSION**

## Discussion

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Design ethnography is the adaptation of the ethnographic approach of holistically understanding a user group (Mabson, et al. n.d., pp. 1–4), which is the whole focus of the say-see-do approach to user research.

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The attached biological, emotional and logistical connotations makes mental health illnesses quite severe in affecting a person (American Psychological Association, 2015).

Competitive auditing enabled understanding of stress interventions features, most information accessible were about their features, not their capacity to actually alleviate stress. This meant strengths and weaknesses, which are significant components of competitive auditing (Schade, 2013) were inconclusive. Furthermore, the comparison of features is subjective (Still and Crane, 2017, pp. 135–137), opposing the often strict and objective nature of current healthcare practices (Rivas, 2018). Perhaps, competitive auditing within digital health would benefit as a group method, conducted by medical professionals and stakeholders in addition to the designer.

As a complex and foreign subject, prominent theories and conclusions from contextual research on stress were used to inform methods throughout the project. The use of theoretical perspectives within this research works toward a compromise between UCD and digital health, as it is a staple practice within digital health and/or healthcare development processes (Birnbaum, et al., 2015, p. 2; Mathews, et al., 2019; Altman, Huang & Breland, 2018). However, with a limited time-frame and project scope there was no room to compare and contrast theoretical perspectives. The conceptual nature of this project means the effects of theoretical perspectives are confined to the project, where this may not be the case in a real-world context. Particularly, as theories are integral to practice and research in healthcare (Alderson, 1998), this means healthcare outcomes would also be affected.

Although, stress itself is complex, presumably there are much more complex and specialized healthcare contexts that would overwhelm an uninformed designer, particularly contexts that maybe more life threatening. Within this project, contextual research is limited to what the researcher is able to comprehend. In the case of more complex and realistic healthcare contexts, consultation with healthcare professionals within that context would be needed.

Stress as a vulnerable psychological topic brings many implications (particularly chronic stress) (American Psychological Association, 2011) towards digital health and UCD. The main implication explored in this project is that users as patients, may be put in harmful positions, as was the case for the attempt to understand university students and their stress through the research phase.

While planning methods for this project, the say-see-do approach was considered for generative user research, as it compliments design ethnography well.<sup>51</sup> However, as stress is a personal and internal feeling (American Psychological Association, 2011), it cannot be easily observed. This limits the scope for understanding users through observations, that would otherwise be applicable to other contexts and is a significant part of UCD (Still and Crane, 2017, pp. 67–69). This limits the capacity of this project to explore and address the lack of involvement of users amongst digital health and/or health care development processes (Meskó, et al., 2017, pp. 5–6; Birnbaum, et al., 2015, p. 2; Mathews, et al., 2019, p. 2). The subjective nature of interviewing as a self-reporting method may also clash with the objective nature of healthcare practice (Rivas, 2018).

To compensate as the only user research method, a design ethnographic approach planned for the interviews meant a wide and fluid scope of questions regarding stressful experiences of university students. However, this was not deemed ethically appropriate by AUTECH, as the interviewer is not a psychologist and does not have the capacity to deal with dangerous psychological repercussions that the questions may trigger of the participant. Therefore, the interview scope narrowed to understanding how students overcome stress and then towards how students overcome stress through the use of digital technology. While the decision by AUTECH is justified, it limited interviewing as a UCD method. Presumably, this limitation would be more concerning toward health contexts that are higher in severity, such as mental health illnesses.<sup>52</sup>

Judith Beck's Cognitive Conceptualisation Theory used to understand and inform users of their stressful situations, mentioned in the previous chapter.

The context of stress as an internal and/or mental feeling significantly impacted the distilling process. Particularly, the user needs formulated in the process, as they are relative to stress alleviation, which is not an easily measurable outcome. Therefore, complexity is added to the distilling process, particularly methods relative to functionality and the digital prototype. To account for this, contextual research was referred to, for a psychologically evidenced solution<sup>53</sup> that not only met the user need, but was applicable in a digital form. This psychologically nuanced complexity otherwise wouldn't be present if the distilling process were applied to contexts outside of healthcare, digital health or psychology.

The contexts surrounding stress as an internal and personal experience places inhibitive implications to the capabilities of usability testing in this project. In particular, due to ethical reasons, the user/participant is not actually stressed during the usability test. The scenario and task for the usability test in this project therefore, was within the context of persona 1 and the corresponding user need. However, the out-of-context use of the prototype means that any user feedback relative to its effectiveness in actually alleviating stress or addressing the user need, within this project may be invalid. This limits the capability of this project to contribute to one of the current pitfalls of digital health, in evaluating effectiveness in producing improved health outcomes (Mathews, et al., 2019, pp. 1–2). Presumably, this may be evident amongst more psychological healthcare contexts, as usability testing have been conducted within healthcare (Mathews, et al., 2019, pp. 6–8). Furthermore, the conceptual and theoretical nature of the project means that the prototype does not go live and data cannot be gathered, which also inhibits evaluation of effectiveness.

Overall, the practicability of UCD methods within this project had mixed results across the four phases used. Methods that involved end-users were severely limited, this is particularly important to UCD as a method that bases its fundamentals on involvement of end-users. As such, the use of methods which although in UCD theory are practical, are dependent on the context of use.

Compromises from theoretical and practical perspectives from healthcare/digital health were implemented successfully within traditional UCD methods. While the nature of UCD as a design practice includes the use of theoretical perspectives, they are simply used to inform and do not hold the same fundamental weight as in other fields. Theoretical perspectives and theorems within design do not automatically lead to an improved design, in the same way a theory in science leads to an exact outcome (Hoshi, 2012). As such, the feasibility of UCD as applied to digital health and stress amongst university students cannot be definitively concluded in this project. Presumably this means, towards the wider digital health and healthcare contexts, UCD's success may depend on the context and end-user on a case by case basis.

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**CONCLUSION**

## Conclusion

The aim of this project was to explore the feasibility of UCD as a design methodology applied to a digital health context, specifically, stress amongst university students. A full cycle design process consisting of research, analysis, synthesis and refinement phases were used to explore the practicality of UCD methods as they are applied to stress. Design ethnography was employed as a supplementary approach to UCD in order to holistically understand university students as end-users of the design process. Throughout the phases of the design process, the methods used yielded mixed results in terms of their applicability when measured against how they theoretically should be used.

Interviews and usability testing as methods that involved end-users, were limited due to the harmful qualities of stress and its nature as an internal, non-physical psychological healthcare context.

The researcher as primary conductor of these methods would not be equipped to handle any dangerous repercussions. The nature of stress means it cannot be observed easily, limiting the capabilities of not only the methods mentioned above, but presumably most user-centric and /or design ethnographic methods. The lack of observation means the main form of data would be unbalanced toward self-reported methods. This suggests that psychological healthcare contexts may also be limiting in similar ways, as they possess similar qualities to stress, this would be bolstered by more severe or life-threatening contexts. As a result, implying contribution toward the lack of end-user involvement as the biggest perceived factor towards inability to produce meaningful health outcomes (Meskó, et al., 2017; Mathews, et al., 2019, pp. 2–8). This suggests perhaps crossovers between user-centric designers and psychological healthcare experts is needed to formulate psychologically friendly generative user research methods. In particular, a critical view on psychological healthcare practices by designers and healthcare practitioners, maybe able to identify qualitative methods that would be adaptable toward existing user-centric methods.

The complexities of stress as a healthcare topic had many implications toward the design process in this project. In order to account of these complexities, continuous contextual research was conducted throughout the project in order to inform both the researcher and the methods within the project. The non-physical nature of stress hinders the applicability of certain UCD methods particularly due to its practicality and also its aim to produce something tangible. Throughout this process as successful compromise was made using theoretical perspectives gathered through contextual research to inform certain methods. Suggesting a compromise can be made between the rigorousness of theorem use within healthcare (Alderson, 1998; Birnbaum, et al., 2015, p. 2) and the fluidity of design. However, the use of theories and concepts within this project are limited to what the researcher can understand given the time-frame available within the project. It cannot be understated that the cognitive conceptualisation theory (Beck, 2011, pp. 17–45) used in this project had great positive impact on prototyping. However, only a small fraction was understood and therefore used in this project. In a real-world context, it would be more feasible for designers to work with healthcare professionals, particularly as consequences would directly affect health outcomes

Moving forward, the understanding of stress and psychological concepts may not change. Therefore, perhaps a future research direction based on this project would be toward the design community deeply exploring or revamping methods to account for less practical applications. Particularly, working around the problem of involving end-users in potentially harmful user feedback methods and the inability to observe as a crucial part of UCD. While for healthcare practices, the successful integration of theoretical perspectives in this project suggests potential in successful compromise between healthcare and design. Perhaps, giving reason for more healthcare professionals to at least consider design in their practice.

07

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08

**APPENDICES**

# Ethics Approval

## Ethics approval documents



**Auckland University of Technology Ethics Committee (AUTEC)**

Auckland University of Technology  
D-88, Private Bag 92006, Auckland 1142, NZ  
T: +64 9 921 9999 ext. 8316  
E: [ethics@aut.ac.nz](mailto:ethics@aut.ac.nz)  
www.aut.ac.nz/researchethics

7 March 2019

Kei Hoshi  
Faculty of Design and Creative Technologies

Dear Kei

**Ethics Application:** 19/51 Exploring the feasibility of a user-centred design approach towards stress reducing digital interventions for university students

Thank you for submitting your application for ethical review. I am pleased to advise that the Auckland University of Technology Ethics Committee (AUTEC) approved your ethics application in stages at their meeting on 4 March 2019, subject to the following conditions:

1. Clarification of how long participants will need to spend on this research and inclusion of advice about this in the Information Sheet;
1. Provision of revised indicative questions that are more focussed upon how use of an app might assist a student who is stressed rather than on the nature of the stress that the students have experienced;
2. Provision of an assurance that:
  - a. Participants will be advised at the beginning of the interview that the researchers are not counsellors and that they are designing an app to assist people who are stressed;
  - b. A supervisor will be present with the student at each interview given the potential for revelation of sensitive personal information;
3. Provision of an assurance that the researcher's classmates are excluded from this study and inclusion of advice about this in the Information Sheet and advertisement;
4. Inclusion of the current AUT logo on the advertisement;
5. Clarification of where the advertisement will be posted.

*This approval is for the prototype development stage of the research only. Full information about the testing of the developed product needs to be provided to and approved by AUTEC before participants are recruited and data collected for that stage of the research.*

Please provide me with a response to the points raised in these conditions, indicating either how you have satisfied these points or proposing an alternative approach. AUTEC also requires copies of any altered documents, such as Information Sheets, surveys etc. You are not required to resubmit the application form again. Any changes to responses in the form required by the committee in their conditions may be included in a supporting memorandum.

Please note that the Committee is always willing to discuss with applicants the points that have been made. There may be information that has not been made available to the Committee, or aspects of the research may not have been fully understood.

Once your response is received and confirmed as satisfying the Committee's points, you will be notified of the full approval of your ethics application. Full approval is not effective until all the conditions have been met. Data collection may not commence until full approval has been confirmed. If these conditions are not met within six months, your application may be closed and a new application will be required if you wish to continue with this research.

To enable us to provide you with efficient service, we ask that you use the application number and study title in all correspondence with us. If you have any enquiries about this application, or anything else, please do contact us at [ethics@aut.ac.nz](mailto:ethics@aut.ac.nz).

I look forward to hearing from you,

Yours sincerely



Kate O'Connor  
Executive Manager  
Auckland University of Technology Ethics Committee

Cc: [julian.takeda13@gmail.com](mailto:julian.takeda13@gmail.com); Susan Hedges



**Auckland University of Technology Ethics Committee (AUTEC)**

Auckland University of Technology  
D-88, Private Bag 92006, Auckland 1142, NZ  
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www.aut.ac.nz/researchethics

4 September 2019

Kei Hoshi  
Faculty of Design and Creative Technologies

Dear Kei

**Ethics Application:** 19/51 Exploring the feasibility of a user-centred design approach towards stress reducing digital interventions for university students

I wish to advise you that the Auckland University of Technology Ethics Committee (AUTEC) has approved the second stage of your ethics application at its meeting of 2 September 2019.

This approval is for three years, expiring 15 March 2022.

**Non-Standard Conditions of Approval**

1. The committee suggests the Information Sheet would benefit from proof reading.

Non-standard conditions must be completed before commencing your study. Non-standard conditions do not need to be submitted to or reviewed by AUTEC before commencing your study.

**Standard Conditions of Approval**

1. The research is to be undertaken in accordance with the [Auckland University of Technology Code of Conduct for Research](#) and as approved by AUTEC in this application.
2. A progress report is due annually on the anniversary of the approval date, using the EA2 form.
3. A final report is due at the expiration of the approval period, or, upon completion of project, using the EA3 form.
4. Any amendments to the project must be approved by AUTEC prior to being implemented. Amendments can be requested using the EA2 form.
5. Any serious or unexpected adverse events must be reported to AUTEC Secretariat as a matter of priority.
6. Any unforeseen events that might affect continued ethical acceptability of the project should also be reported to the AUTEC Secretariat as a matter of priority.
7. It is your responsibility to ensure that the spelling and grammar of documents being provided to participants or external organisations is of a high standard.

AUTEC grants ethical approval only. You are responsible for obtaining management approval for access for your research from any institution or organisation at which your research is being conducted. When the research is undertaken outside New Zealand, you need to meet all ethical, legal, and locality obligations or requirements for those jurisdictions.

Please quote the application number and title on all future correspondence related to this project.

For any enquiries please contact [ethics@aut.ac.nz](mailto:ethics@aut.ac.nz). The forms mentioned above are available online through <http://www.aut.ac.nz/research/researchethics>

Yours sincerely,



Kate O'Connor  
Executive Manager  
Auckland University of Technology Ethics Committee

Cc: [julian.takeda13@gmail.com](mailto:julian.takeda13@gmail.com); Susan Hedges

# Tools

## Interview Kit (Information sheet)



### Participant Information Sheet

#### Date Information Sheet Produced:

24/01/2019

#### Project Title

Exploring the feasibility of a User-Centred design approach towards stress reducing digital interventions for university students.

#### An Invitation

Hello, my name is Julian Takeda. I'm currently a student pursuing a Master of Design here at the Auckland University of Technology (AUT). I would like to invite you as a student here at AUT to participate in my research. This project aims to understand your stress related experiences as a university student while studying here at AUT.

#### What is the purpose of this research?

The main purpose of this research is to gather data regarding actions that current students at AUT take to manage and/or cope with stress after encountering a stressful situation, the data will be used through a user-centred design process as part of the researcher's master's project to inform the prototype design of a stress-related digital intervention.

As part of completing the researcher's master's project, this research is an integral part of the researcher gaining a Master of Design tertiary qualification.

#### How was I identified and why am I being invited to participate in this research?

Receiving this information sheet means that you have expressed interest in participating in the research based on the recruitment advertisement and meet the inclusion criteria of being at least in their second-year tertiary study at AUT (It is assumed that receiving this means that you have already exchanged emails with the researcher).

#### How do I agree to participate in this research?

If you would like to take part in this research then please contact the researcher (details below) if you haven't already at the time of reading this, and discuss with him a mutually appropriate time between the two of you for the research to take place. Prior to taking part in the research you will be required to fill out and sign two copies of a consent form which will be brought by the researcher.

Your participation in this research is voluntary and whether or not you choose to participate will neither advantage nor disadvantage you. You are able to withdraw from the study at any time. If you choose to withdraw from the study, then you will be offered the choice between having any data that is identifiable as belonging to you removed or allowing it to continue to be used. However, once the findings have been produced, removal of your data may not be possible.

#### What will happen in this research?

After agreeing to participate and following through on the process in participating in this research (described above), you will be interviewed by the researcher one on one, where you will be asked questions regarding how you as a tertiary student have used some form of digital technology to cope with/manage yourself after encountering a stressful situation. One of two of the researcher's supervisors will be present at each interview.

To gather this data, the interview will be audio recorded through the researcher's phone. Each interview will last approximately 45 minutes to 1 hour.

A prototype of a digital technology product will be developed as a result of this research and is projected to be completed by the first week of May 2019. A follow up study that is separate to the interviews in this research, will be based around the testing of the prototype, of which you as a participant in this research will be invited to participate in the follow-up study/user testing of the prototype. The follow-up study is currently projected to begin within the first two weeks of May and is expected to last one week. As the two studies are separated, your participation in this research does not mean you are obliged to participate in the follow-up study.

#### What are the discomforts and risks?

Please keep in mind that although the primary topic is that of the use of digital technology, the accompanying topic and context (stress) is sensitive and/or personal. Therefore, it is important to note that the researchers and supervisors are not counsellors and do not have the background experience of topics/fields relative to stress.

The main discomfort you may experience as a participant is having to reflect on past stressful experiences as a by-product of answer questions on how you overcame them through the use of digital technology. As such you may experience some level of emotional discomfort.

However, upon reading this information sheet and consenting to participation and having any questions you may have answered, it is assumed that you are aware of the level of discomfort and risk you may encounter during the interview.

#### How will these discomforts and risks be alleviated?

You as a participant will be reminded prior and after the interview that as an AUT student you are entitled to AUT Health Counselling and Wellbeing counselling sessions at an unlimited amount and free of charge. You will be informed that to access these services, you will need to:

- drop into our centres at WB219 or AS104 or phone 921 9992 City Campus or 921 9998 North Shore campus to make an appointment. Appointments for South Campus can be made by calling 921 9992
- let the receptionist know that you are a research participant, and provide the title of my research and my name and contact details as given in this Information Sheet

You can find out more information about AUT counsellors and counselling on <http://www.aut.ac.nz/being-a-student/current-postgraduates/your-health-and-wellbeing/counselling>.

#### What are the benefits?

The findings from this research may contribute towards the pool of existing and ongoing research on both stress amongst university students and digital health, therefore aid in the creation of solutions to problems relative to the mentioned topics.

The research will consequently may benefit both the participants and university students in general, as the findings will contribute to creating solutions to their stressful tertiary student experiences.

#### How will my privacy be protected?

Anything you say (data) during the interview that is recorded will be stored digitally as a password protected audio file that is only available to the researcher and my two supervisors. Your privacy and confidentiality will be protected through de-identification, this will be ensured by using a code number as the main way of identifying you as a participant.

This ensures you are not identifiable and any data regarding you will be generalised in anything that comes of this research. These include; the final report, output prototype, and exhibition.

#### What are the costs of participating in this research?

There will be one interview with each Interview length ranging from approximately 45 minutes to 1 hour. A follow up may occur where more questions are asked of you after the interview but this will be asked through email within two weeks of completion of the final interview (there is no particular timeline in which you have to answer).

#### What opportunity do I have to consider this invitation?

I would appreciate it if you could get back to me within 2 weeks (participant selection is on a first-come, first-serve basis).

#### Where will the research take place?

Based on the mutually appropriate time and date discussed between the researcher and participant through email, a corresponding booking will be made for a private study room in the library at the Auckland University of Technology (WA Building).

#### Will I receive feedback on the results of this research?

Results of the research will be available in the final published report at the end of the project as well as a digital summary sheet that will be emailed to each participant.

#### What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, Kei Hoshi, [kei.hoshi@aut.ac.nz](mailto:kei.hoshi@aut.ac.nz), +64 9 921 9999 ext. 5086

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTECH, Kate O'Connor, [ethics@aut.ac.nz](mailto:ethics@aut.ac.nz), 921 9999 ext. 6038.

**Whom do I contact for further information about this research?**

Please keep this Information Sheet and a copy of the Consent Form for your future reference. You are also able to contact the research team as follows:

**Researcher Contact Details:**

Julian Takeda - Researcher  
[Julian.takeda13@gmail.com](mailto:Julian.takeda13@gmail.com)

**Project Supervisor Contact Details:**

Kei Hoshi  
[Kei.hoshi@aut.ac.nz](mailto:Kei.hoshi@aut.ac.nz)  
+64 9 921 9999 ext. 5086

Approved by the Auckland University of Technology Ethics Committee on *type the date final ethics approval was granted*, AUTECH Reference number *type the reference number*.

Interview Kit (protocol)

## Interview Protocol

### Interview Arrangement (up to 2 weeks)

- After the recruitment process (outlined in C.3.5), an email invitation will be sent to each of the 5-8 students. The email will also contain;
  - .i. An information sheet
  - .ii. A consent form
  - .iii. A reminder that they are free to ask about anything regarding the interviews.
- A follow up email to the invitation will be used as a prompt to arrange a **date and time** that is mutually suitable to the researcher, participant and a corresponding study room in the library at the Auckland University of Technology Library – outlined in the information sheet.

### Interview Notes

- Overarching **Aim** of the Interview;
  - .i. Uncover and **understand** how the interviewees have **coped** and/or **managed themselves after encountering a stressful situation through the use of digital technology**;
    - .i.1.1.1. What has worked and what hasn't?
    - .i.1.1.2. How do they perceive their coping/managing mechanisms?
    - .i.1.1.3. (if brought up) How does/do they think this relates to digital technology?
    - .i.1.1.4. Is it effective? Do they think/know its effective?
    - .i.1.1.5. How they came to know about / to use this digital technology to help cope with/manage themselves after a stressful situation.
    - .i.1.1.6. Their thought process behind the use of the digital technology to cope with/manage themselves after a stressful situation.
- Interview Quick Tips;
  - .i. Ask **Why** and **How** to prompt them to give reasons or tell more about a specific part of their answer to the main questions.
  - .ii. Don't ask **leading questions**
  - .iii. Don't be afraid of **silence** and let the interviewee think
  - .iv. If the participant expresses or show some sign of discomfort – briefly stop the interview if you are asking a question and ask them if they are okay.
  - .v. Write notes on any behavioural observations attached to answers
  - .vi. Keep an eye out for vague answers

### • KEY ASSUMPTIONS

- .i. Their level of stress in relation to the time of the year / semester
- .ii. How their stress coping has changed as they've gone through university
- .iii. Their understanding of their own stressors and stress
- .iv. Time Management, Organisation and Balance
- .v. Higher overarching goals at university in relation to stress
- .vi. Intervention POV;
- .vi.1. **Personalisation**
- .vi.2. **Self-learning**
- .vi.3. **Social Involvement**

### Interview Question Guide

- Introduction and set-up (5 minutes)
  - .i. Introduce yourself
  - .ii. Purpose of the interview
  - .iii. What's expected of the interviewee in relation to the purpose of the research
  - .iv. Put forward a copy of the consent form to sign.
  - .v. Remind the participant that the questions in their very nature may prompt them to reflect on past experiences that may evoke **emotional discomfort and risk**.
  - .vi. Remind the participant **my supervisor and I are not counsellors** and do not have the background to match so.
  - .vii. Remind the participants that as students they are entitled to free counselling at AUT.
  - .viii. That they don't have to answer anything if they do not want to.
  - .ix. Set up the audio recording (Mobile Phone) and inform the interviewee when the recording has started.

- Opening Questions – Building Rapport (10 mins)

- i. Build trust and comfortability with the interviewee through conversation.
- ii. Start with ice-breakers and build on them.
- iii. Follow up on your conversation starters – show genuine interest in the interviewee and their answers – **eye contact and nodding**.
- iv. **Example Questions;**
  - iv.1.1.1. So, what have you been up to this weekend?
  - iv.1.1.2. Can you tell me about what you've been doing at university this week?
  - iv.1.1.3. What are your plans for today?
- v. Demographic Information
  - v.1. What they're currently studying
  - v.2. Year of Study
  - v.3. How are you finding your course?

- Main Questions – Questions that should answer your overarching aim (30-40 mins)

- i. When you've felt like you've gotten the answer, move on to another.
- ii. Always refer to your overarching aim.
- iii. **See Indicative Questions** – these are broad starters – **follow up** and **probe** on them
- iv. Be aware of time and don't be afraid to bring the conversation back to focus.

- Reflection – follow up questions to the answers given above (10 – 20 mins)

- i. Reflect on what you've heard and any notes you have written down.
- ii. If there is anything that needs clarification or understanding from what the interviewee has said – follow up on them.
- iii. **Quick Skeleton Examples;**
  - iii.1.1.1. You said earlier that \_\_\_\_\_, can you clarify why this is \_\_\_\_\_.
  - iii.1.1.2. You had mentioned that \_\_\_\_\_, can you tell me how \_\_\_\_\_.
  - iii.1.1.3. You talked about how \_\_\_\_\_, would you be able to tell me why \_\_\_\_\_.

- Wrap Up – Winding down and final notes. (5 mins)

- i. Inform the interviewee that the interview is ending
- ii. Thank them for their time and tell them they have been very helpful
- iii. Ask them what they thought about the interview
- iv. Ask them if they have any questions.
- v. Remind them that the prototype as a result of this interview will go through testing and that they will be invited to participate in that (approx. 2 – 3 months).
- vi. Stop the audio recording.

- Post-interview Thoughts

- i. Give yourself time to wind down and try to absorb the interview.
- ii. Write down any thoughts and ideas that are currently fresh on your mind regarding the interview.
- iii. Go over any notes you have.

Interview Kit (recruitment poster)

## SEEKING AUT STUDENTS TO VOLUNTEER FOR MASTERS RESEARCH



Designing a digital assistance to help university students cope with stress.



### Who is the researcher?

Hello, my name is Julian Takeda, I'm currently a Master of Design student here at AUT. I would like to invite you as an AUT student to take part in my research.



### What will happen?

I will interview you for roughly 40 mins - 1 hour regarding how you have coped with/managed your stress through the assistance of or involving digital technology, some examples are (but not limited to):

- Mobile Phones/Tablets (Applications)
- Computers/Laptops (Websites/Programs)
- Wearable Technology (Fitbit, Applewatch, etc)

This will be held at one of the study rooms in the AUT library (WA) and will be audio-recorded through my mobile phone.

### What is the purpose?

The aim of this research is to gain an understanding of how you as a student have coped with stress through the assistance of digital technology. The responses you give will be used to inform the design of a prototype digital technology that aims to help university students cope with stress.

### Who are you looking for?

- Students who are at least in their second year of university study
- Students who do not mind and are open to sharing how they've used digital technology to assist them in coping and/or managing their stress.

### I'm interested, how do I contact you?

If you have any questions and/or are interested in participating, You can flick me an email at:

[Smh1714@aut.ac.nz](mailto:Smh1714@aut.ac.nz)

Note: Students who are currently enrolled into Spatial Design (Art & Design) and/or are currently being taught by either Kai Hoshi or Sue Hedges are excluded from this study.

Interview Kit (proposed questions)

### Main Questions for Interview Participants

**Project Title:**

Exploring the feasibility of a user-centred design approach towards stress reducing digital interventions for university students.

**Name of Researcher:**

Julian Takeda

**Indicative Questions:**

The following questions are indicative of the nature and topic of questions to be asked of the participants during the interview. As these are prompts, it is expected that each interview will be distinct as each question is expected to be expanded upon with further follow-up questions from the interviewer, and may or may not include all or different questions to the following:

- What forms of digital technology do you currently use in your daily life? (For example, mobile phones, tablets, laptops/computers, wearable technology, etc)
- Would you be able to describe the role of each of these digital technologies in your daily life and/or historically.
- Why do you think they have taken on that role?
- What applications and/or part of the digital technology do you use the most? (For example, which application, program or feature)
- What do you think is the main reason(s) for your use of that application/program/feature?
- Do you have a positive or negative perception of this digital technology(s)?
- Can you described why you think that is?
- Which of these digital technologies has helped you manage and/or cope with stress or a stressful situation.
- Specifically, which part of the digital technology(s) helped you manage and/or cope with stress or a stressful situation?
- Can you describe in what ways specifically this part of the digital technology helped you manage and/or cope with stress or a stressful situation.
- As you go through the coping process would you be able to walk me through your thought process behind perhaps some of the decisions you make?
- How did you come across this? Or come to know about it.
- How often then have you used it?

- Has the role of the digital tech or your perception of it changed at all since you came across this?
- What made this particular part of the digital technology(s) helpful?
- Why do you think this is so?
- If you could improve this digital technology so that it could better help you manage and/or cope with stress, how do you think you would improve it? For example, if you could add any feature to it, physically, digitally, etc.
- Why do you think this would improve it?

Prototype one (Graphical User-interface), usability testing document

## Prototype Usability Testing Plan (Prototype 1)

### Prototype 1:

- Stress Diagnosis System (Mobile Application)
  - An application that aims to inform students (the user) about their stressful situations at university
  - Graphical User Interface (GUI)
    - Regular mobile phone application which has the participant tap, swipe and type.

### Usability Test Summary

- The usability test looks to test both the usability and theory behind the prototype above, this will involve providing the participant with a fake scenario to contextualise the task they are asked to complete through the prototype.
- This is paired with pre and post-test questions.
- This will have the participant walkthrough their decisions and what they think as they complete the task on the prototype.
- Their interaction with the prototype will be video recorded while the entire test will be audio recorded.

### Methodology (Features of the test)

- Moderated & In-Person
  - Someone is physically present (The researcher/facilitator) to guide the procedure of the test.
- Formative
  - A type of usability testing that is used to identify early problems in usability to drive design decisions and iterate on the current design.
- Concurrent Think-Aloud (Testing Method)
  - Understand participants' thoughts as they occur and as they attempt to work through issues within the app they encounter.
    - Through questioning and probing during the usability test.
- Semi-structured interview questions (Post-test)
- Attitudinal

- AUT University
  - WE212
- Date

### Scenario(s)

- **(A)**  
*"You've left one of your assignments worth 15% of your total grade for your (x) class down to the last 3 days and you haven't started yet.*

*You're really worried, and let your lecturer know. He says that there's nothing to worry about, just try to submit something.*

*He then recommends a mobile-application by the university that is there to help you calm down"*

- **(B)**  
*"You've left your submission really late for one of your projects, you did it 2 days prior and stayed up all night.*

*You're worried about the grade that you're gonna get as well as how your friends are gonna react if they were to hear that you got a grade in the C range"*

### Task(s)

- Use this mobile application to try and get rid of your worries (Recommended by your lecturer) regarding your submission **(A)** or how your university friends are going to think about your grade **(B)**

### Equipment

- Printed information
  - Scenario & Task
  - Concurrent Think-Aloud (Testing Method Information)

- AUT University
  - WE212
- Date

#### Scenario(s)

- **(A)**

*"You've left one of your assignments worth 15% of your total grade for your (x) class down to the last 3 days and you haven't started yet.*

*You're really worried, and let your lecturer know. He says that there's nothing to worry about, just try to submit something.*

*He then recommends a mobile-application by the university that is there to help you calm down"*

- **(B)**

*"You've left your submission really late for one of your projects, you did it 2 days prior and stayed up all night.*

*You're worried about the grade that you're gonna get as well as how your friends are gonna react if they were to hear that you got a grade in the C range"*

#### Task(s)

- Use this mobile application to try and get rid of your worries (Recommended by your lecturer) regarding your submission **(A)** or how your university friends are going to think about your grade **(B)**

#### Equipment

- Printed information
  - Scenario & Task
  - Concurrent Think-Aloud (Testing Method Information)

- The scenario and task will be read out-loud to the participant, followed by giving them their own physical copy of both.
- Document Camera (For Physical Screen-Hand Observations)
  - This will involve placing the camera on a small tripod stand that will look down on the hands of the participant as they are using the prototype
  - Nothing of the participant other than their hands will be video recorded.
  - The recording will only start after the pre-test questions have been completed (see procedure below).
- Mobile Phone (iPhone)
  - The prototype will be linked to the iPhone via the Adobe XD application.
- Laptop (Audio Recording)
  - The entire usability test will be audio recorded, using a Macbook Pro Quicktime Player
- Pen & Paper (Observations)
  - The facilitator will be writing down notes as he observes the participant in their attempt to complete the given task.

#### Procedure

- Introduction (approx. 5 minutes)
  - Rapport/Comfortability Questions
    - How are you?
    - How's your week so far?
  - Intro
    - What the usability testing is for
    - What the equipment is for
    - Scenario
    - Task
    - Explaining role of facilitator
    - Explaining the concurrent think aloud method.
    - Signing of consent form
  - First Impression
    - So this is the very first screen, can you tell me what you think of it?
      - What immediately stands out to you?
      - Can you tell what you're supposed to do?
      - Can you tell what it's for?

- Pre-test Questions
  - Could you describe your everyday digital device usage?
    - What you use.
    - How much you use it.
- Testing (approx. 10-15 minutes)
  - Concurrent Think-Aloud Testing
    - Let the participants talk about their decisions and thoughts regarding the app and it's features
    - Ask follow-up questions on their thoughts (Probing During)
      - Do you mean \_\_\_\_?
      - What about that \_\_\_\_?
    - Ask the students to say or write down how they would answer each question in the diagnosis.
- Post-Test Questions (approx. 5 minutes)
  - Follow-Up Questions - Sentence Starters (Probing After)
    - I noticed you had difficulty with (observed difficulty during testing)..
      - Why do you think this feature / question was difficult?
      - Why do you think you did \_\_\_\_?
      - What do you think about \_\_\_\_?
      - What would you change, add or take out to make it easier for you the next time around?
    - Which feature or question do you think you had particular difficulty in? (if no errors observed during the test)
    - What was your overall impression from a micro perspective (Interface Usability)
      - Why & How Follow-up question
      - Was there anything that stood out to you from a usability perspective?
      - Was there anything that stood out to you from a theory perspective with how the prototype is supposed to work?
    - Is there anything you would like to add or comment about?

Prototype two (Voice User-interface), usability testing document

## Prototype Usability Testing Plan (Prototype 2)

### Prototype 2:

- Stress Diagnosis System (Mobile Application)
  - An application that aims to inform students (the user) about their stressful situations at university
  - Prototype 2: Voice User Interface (VUI)
    - Mobile phone application which has the participant verbally interact by conversing with the application (a verbal back and forth).

### Usability Test Summary

- This usability test (WOZ Usability Testing) aims to evaluate the Voice User Interface (VUI) prototype by simulating the verbal dialogue, spoken by the interface and also spoken by the user (dialogue) as a response in a conversation like manner (done between the participant and the tester/moderator).
- This will involve providing the participant with a fake scenario to contextualise the task they are asked to complete through the prototype
- Pre-recorded dialogue will be used to simulate the Voice User Interface where the tester will decide which particular audio to play depending on the participant dialogue.
- Depending on the testing, the participant may be asked questions as they proceed through the prototype with the tester.
- The WOZ usability test is then followed up by post-test questions (although depending on how the test proceeds, participants may be asked on the fly questions during the usability test)

### Methodology (Features of the test)

- Moderated & In-Person
  - Someone is physically present (The researcher) to guide the procedure of the test.
- Formative
  - A type of usability testing that is used to identify early problems in usability to drive design decisions and iterate on the current design.
- WOZ (Wizard of OZ) Usability Test (Testing Method)

- 
- Semi-structured interview questions (Post-Test)
- Attitudinal
  - Type of test that seeks to understand the thoughts and opinions of the user with regard to the prototype.
- Behavioural
  - Type of test that seeks to understand how a user acts and/or uses a prototype.

### Test Objectives

- Evaluating General Usability (Attitudinal & Behavioural)
  - User understanding and interpretation of the dialogue spoken by the voice interface.
    - The kind of responses users are to give to the spoken prompts by the voice interface.
    - General verbal understanding of spoken prompts & dialogue by users.
    - Where information is lacking and where there is too much within the spoken dialogue & prompts.
    - Where visual assistance maybe needed throughout the conversation or interaction with the voice interface.
- Hypotheses
  - Voice is a much more convenient and appropriate form of interaction for the mobile application (in comparison to **prototype 1**).
  - Open questions/dialogue are more appropriate for the topic of the conversation and user input than narrow-focused questions/dialogue.
  - Visual Assistance will be needed on top of the spoken prompt/dialogue.

### Logistics

- Participants
  - 3 -4 current and/or former university students (within 6 months of graduating)
- Moderator / Tester
  - Researcher (Julian Takeda)
- Location

- AUT University
  - WE212
- Date

#### Scenario(s)

- (A)  
*"You've left one of your assignments worth 15% of your total grade for your (x) class down to the last 3 days and you haven't started yet.*  
  
*You're really worried, and let your lecturer know. He says that there's nothing to worry about, just try to submit something.*  
  
*He then recommends a mobile-application by the university that is there to help you calm down"*
- (B)  
*"You've left your submission really late for one of your projects, you did it 2 days prior and stayed up all night.*  
  
*You're worried about the grade that you're gonna get as well as how your friends are gonna react if they were to hear that you got a grade in the C range"*

#### Task(s)

- Consider one of the scenarios above as if you were in the scenario yourself and a voice interface was put in front of you to help you alleviate your worries. To do this, you have to converse with it without really knowing what it's about.

#### Equipment

- Printed information

- Scenario & Task
- WOZ Usability Testing Method information
- Laptop (For recording and playing dialogue throughout the test).
- Printed diagram of the conversation flow (including everything spoken by the tester and participant).

#### Procedure

- Pre-Test (~3 minutes)
  - Introduction
    - What the usability testing is for
    - What the equipment is for
    - Scenario
    - Task
    - Role of the "Wizard" (tester) and the user.
- WOZ Usability Testing (10-15 minutes)
  - Start audio recording on laptop.
  - WOZ Usability Test
    - Start with the very first spoken prompts and converse with the participant, choosing what to spoken prompts to play in response to what the participant says and also following the original diagram conversation flow.
    - It does not matter if the conversation goes away from the original diagram conversation flow, try to create responses on the spot that replicate how and what your voice interface would say.
- Post-Test (5 minutes)
  - Follow-Up Questions - Sentence Starters
    - I noticed you had difficulty with (observed difficulty during testing)..
      - Why do you think this (particular dialogue) was difficult?
      - What would you change, add or take out to make it easier for you the next time around?
    - Which question(s) do you think you had particular difficulty in? (if no errors observed during the test)
    - What was your overall perception of the voice interface and it's persona/atmosphere when conversing?

- AUT University
  - WE212
- Date

#### Scenario(s)

- (A)  
*"You've left one of your assignments worth 15% of your total grade for your (x) class down to the last 3 days and you haven't started yet.*  
  
*You're really worried, and let your lecturer know. He says that there's nothing to worry about, just try to submit something.*  
  
*He then recommends a mobile-application by the university that is there to help you calm down"*
- (B)  
*"You've left your submission really late for one of your projects, you did it 2 days prior and stayed up all night.*  
  
*You're worried about the grade that you're gonna get as well as how your friends are gonna react if they were to hear that you got a grade in the C range"*

#### Task(s)

- Consider one of the scenarios above as if you were in the scenario yourself and a voice interface was put in front of you to help you alleviate your worries. To do this, you have to converse with it without really knowing what it's about.

#### Equipment

- Printed information

- Scenario & Task
- WOZ Usability Testing Method information
- Laptop (For recording and playing dialogue throughout the test).
- Printed diagram of the conversation flow (including everything spoken by the tester and participant).

#### Procedure

- Pre-Test (~3 minutes)
  - Introduction
    - What the usability testing is for
    - What the equipment is for
    - Scenario
    - Task
    - Role of the "Wizard" (tester) and the user.
- WOZ Usability Testing (10-15 minutes)
  - Start audio recording on laptop.
  - WOZ Usability Test
    - Start with the very first spoken prompts and converse with the participant, choosing what to spoken prompts to play in response to what the participant says and also following the original diagram conversation flow.
    - It does not matter if the conversation goes away from the original diagram conversation flow, try to create responses on the spot that replicate how and what your voice interface would say.
- Post-Test (5 minutes)
  - Follow-Up Questions - Sentence Starters
    - I noticed you had difficulty with (observed difficulty during testing)..
      - Why do you think this (particular dialogue) was difficult?
      - What would you change, add or take out to make it easier for you the next time around?
    - Which question(s) do you think you had particular difficulty in? (if no errors observed during the test)
    - What was your overall perception of the voice interface and it's persona/atmosphere when conversing?

## Process documents

### Competitive audit document

#### Competitive Audit

##### Introduction

Coping with and/or managing stress can be described as how someone looks to; remove or lessen the stressors within their environment, changing their perception of how harmful a particular stressor is or attempt to diminish the anticipated effects of encountering/experiencing the stressor.<sup>1</sup>

##### Intervention Literature Classification

Stress management interventions are interventions that typically aid in doing any of the 3 descriptions mentioned above. Stress management literature has typically classified interventions based on what specific part and how they are trying to manage stressful experiences as well as the level in which this occurs.<sup>2</sup> Holman et. al describes 2 types of classifying interventions across 2 levels;<sup>3</sup>

##### Primary Interventions

Focused on removing the stressors themselves and improving overall well-being

##### Secondary Interventions

Focuses more on the aftermath of encountering a stressor, particularly reducing severity or duration of experienced stress as well as stopping its effects from growing.

##### Tertiary Interventions

Tertiary interventions are for more dire situations of which someone seeks rehabilitation due to psychological ill-health.

##### Intervention Levels

Along with Holman et. al's classification, interventions can occur on two levels, at an individual level (focused developing and/or helping a specific person manage their stress) or an organizational level (where an intervention is focused on changing an entire organization and its practices to better help those within the organization to manage their stress and/or encounter less stressors).

<sup>1</sup>Robotham, David. 2008. "Stress among Higher Education Students: Towards a Research Agenda." *Higher Education: The International Journal of Higher Education and Educational Planning* 735-746.

<sup>2</sup>Holman, David, Sheena Johnson, and Elinor O'Connor. 2018. "Stress management interventions: Improving subjective psychological well-being in the workplace." *Handbook of Well-Being*. Salt Lake City, UT, US: DEF Publishers

<sup>3</sup>ibid.

#### Intervention Audit

For this particular audit, a range of interventions were examined were across both commercial/public and conceptual spaces (mainly research paper based), while also covering a spectrum of technological non-technological interventions. While the research overall focuses primarily on university students as a user group, the audit was not limited to interventions that specifically focused on university students.

##### Mobile and/or Tablet applications

Commercial Mobile and/or Tablet applications were found through Google Play store for Android applications as well as the App Store for iOS applications, of which the top three applications were selected through a category and word search based on their downloads, reviews and average rating. These include Headspace, Calm and Pacifica.<sup>4</sup>

Although there are nuances and variations between the app, fundamentally, what these apps offer are quite similar, I suspect this could be a result of the design constraints of a mobile phone and/or tablet application.

The consistent premise of the applications was the delivery of both audio and visual content to the user (of which sometimes instructed the user to do something physically while using the application). Examples of such content are; tutorials, videos, exercises, stories, sounds, etc.

Much of the content and the branding of the applications are predicated on digitization of physical and/or mental activities to allow the user to manage and/or cope with a combination of stress, anxiety and depression. The most consistent examples are; mindfulness/meditation, breathing exercises and cognitive behavioral therapy exercises. Users are often able to choose topics or categories that may or may not be reflective of stressors in their lives, allowing for customization and/or individualization.

Past the primary content, there are some variations where overall wellbeing are considered rather than just managing and/or coping with stress. For example, Calm branches into yoga, sleep stories and soundscapes which are more focused on relaxation. While Pacifica has gone quite in depth in tracking through health in general, journaling and emotions/mood for the user while also providing add-ons for organizations who want to endorse the app, such as universities and/or clinics. Headspace is solely focused on mindfulness and meditation, contains much more breadth and depth in their audio/visual content (guided, unguided and customizable meditations).

Two other mobile applications were examined, which are university endorsed applications, the AUT Resilience application and YOU by Grit Digital Health. Contrary to commercial applications, these

<sup>4</sup>Headspace Incorporated. 2014. *Headspace*. June. Accessed March 8, 2019. <https://www.headspace.com/>; Calm.com Incorporated. 2016. *Calm*. December 1. Accessed March 4, 2019. <https://www.calm.com/>; Pacifica Labs Incorporated. n.d. *Pacifica: Reduce stress. Feel happier*. Accessed March 3, 2019. <https://www.thinkpacific.com/>

applications are often created through a collaboration between digital agencies, developers and universities, this allows a more tailored application towards the specific university and its students.

YOU is a web/mobile platform that was initially developed as a collaboration between Grit Digital Health and Colorado State University, developed to focus on mental health but through a student-centered approach is now an all-encompassing platform for student well-being and success. Since then it has been integrated into the digital ecosystem of Colorado State University and has been endorsed by other universities. Specifically, "THRIVE" a key area that focuses on physical and mental wellness enables students to "assess, sustain and proactively care for their health amidst the stress of college life" as well as giving exposure to counselling centers. Contrary to other mobile and/or tablet applications, the platform through individual feedback from surveys and questionnaires, individualizes the system and content based on the particular student.<sup>5</sup>

The AUT Resilience, is a mobile application endorsed and released by the Auckland University of Technology, similarly to the commercial applications mentioned above uses instructional audio that covers 6 different topics and 1 general topic. However, this is all the application offers, there is no visual aspects to the content.<sup>6</sup>

Based on the examined mobile applications, it seems that they mostly coincide within Holman et al's secondary intervention category, of which they essentially train the user to help them deal with stressful situations and/or stressors, rather than identifying and/or removing the stressors. The exception is that the YOU web/mobile platform, where the platform acts as an extension of the existing mental health interventions by the particular endorsed university.

#### Commercialized Wearables

Three commercial smart watches and/or wearable trackers were chosen based on popularity, reviews, sales and branding, of which the latest version of each were examined. These include Apple Watch Series 4, Fitbit Ionic (smart watches) and The Garmin Vivo Smart 4 (wearable tracker).<sup>7</sup>

Fundamentally, the nature of trackers and smart watches are that they track biomarkers through (typically built-in) biosensors which convert the biomarkers into data and relay it back to the user through the interface of the tracker and/or accompanying mobile/web application.<sup>8</sup> While trackers

<sup>5</sup>Health, Grit Digital. 2016. "YOU at college." *Grit Digital Health Website*. Accessed March 25, 2019. <https://youatcollege.com/>.  
<sup>6</sup>Apple Incorporated. n.d. *App Store Preview: AUT Resilience*. Accessed March 27, 2019. <https://itunes.apple.com/nz/app/aut-resilience/id1279781347?mt=8>. The Auckland University of Technology. 2017. *AUT helping students build mental strength*. October 10. Accessed March 5, 2019. <https://www.auckland.ac.nz/news/aut-helping-students-build-mental-strength>.  
<sup>7</sup>Apple Incorporated. 2018. *Apple Watch Series 4*. September 18. Accessed March 7, 2019. <https://www.apple.com/nz/apple-watch-series-4/health/>. Fitbit Incorporated. 2017. *Fitbit Ionic*. October 1. Accessed March 9, 2017. [https://www.fitbit.com/fitbit/fitness-tracker/CJKCDjwqHBRcNARIsAFKjKAx2eTCT7s2Vc-DWgcOOEnYx9km\\_Bqj3YN48K1E1w3w3g\\_jCZsEYsAjJHEALw\\_wb8Kpdrcc-aw.ds](https://www.fitbit.com/fitbit/fitness-tracker/CJKCDjwqHBRcNARIsAFKjKAx2eTCT7s2Vc-DWgcOOEnYx9km_Bqj3YN48K1E1w3w3g_jCZsEYsAjJHEALw_wb8Kpdrcc-aw.ds). Garmin Limited. 2017. *Garmin: Vivosport*. September 1. Accessed March 10, 2019. <https://www.garmin.com/en/NZ/NZr/574692>.  
<sup>8</sup>Bhalla, Nikhil, Pawan Jolly, Nello Formisano, and Pedro Estela. 2016. "Introduction to biosensors." *Essays In Biochemistry* 1-8; Strimbu, Kyle, and Jorge Tavel. 2010. "What are biomarkers?" *Current Opinion in HIV and AIDS*. 463-466.

give suggestions to users to help manage themselves, primarily their goal is to inform the user of information regarding their physical and mental health.

However, of the examined commercial smart watches and trackers, they focus on health as a whole and beyond. Consequently, stress management and tracking in the case of the examined products, a small bi-product of what they are capable of or what their focus is.

The basis of tracking measurements of stress typically uses an on-board heart-rate monitor, of which the measurement is called Heart Rate Variability (HRV)<sup>9</sup>, this is then considered, measured and an application on the phone will give suggestions based on the measurement.

For example, the breathing app on the Apple Watch are instructional meditative breathing exercises that consider Heart Rate Variability data, of which you can view on the dedicated "Health Data" application on your Apple Watch. This allows you to match corresponding breathing data and also track your HRV. Though, this does not help the user to directly manage their stress, they are given much more information about when and what of their stressors, as well as practice of breathing exercises when stressful encounters do happen.

Similarly, the Fitbit Ionic, through an available application called "Relax", uses the on-board heart rate monitor to detect Heart Rate Variability activity and based on measurement recommends personalized breathing exercises. While the Garmin Vivo Smart, presents a stress level score at any point during the day, of which the user is able to start breathing exercises if its scores is high.

It is important to note that just like mobile phones, smart watches are able to use applications, therefore it is not out of the question that theoretically, an application that focuses on stress management in combination with the stress tracking capabilities of smart watches is possible.

Based on the examined commercial smartwatches and wearable trackers, they seem to overlap mostly (although not by much) with Holman et al's secondary intervention category. This is due to tracking as the main purpose of the watches and trackers, which in of itself is predicated on data and information of the user regarding their stress, rather directly aiding the user to deal with stressors and/or stress.

<sup>9</sup>Hernando, David, Surya Roca, Jorge Sancho, Álvaro Alesanco, and Raquel Bailón. 2018. "Validation of the Apple Watch for Heart Rate Variability Measurements during Relax and Mental Stress in Healthy Subjects." *Sensors*.

### Stress Focused Wearables

Based on competitive auditing of commercial smartwatches and wearables, further research was conducted on wearable technology that more acutely focused on stress management and/or coping.

A range of wearables were examined, of which similarly to commercial smart watches and trackers, comprised of a physical sensory device that was linked to a web and/or mobile application. A total of 4 focused wearable technology interventions were examined; the Thync Relax Pro, Pip, Touchpoints, and Melomind.<sup>10</sup>

However, fundamentally, the detection method varied heavily across the interventions, contrary to the commercial smart watches and trackers. For example, the Thync Relax Pro focuses on relieving chronic stress through neurostimulation, occurring through gentle electrical nerve stimulation at the bottom of the neck which activates particular nerve pathways, communicating to the brain to help control mood, stress and sleep. Similarly, touchpoints are a pair of wristwatch wearables that use bilateral alternating stimulation tactile technology (BLAST), that use gentle and alternating vibrations to the body to alternate the body's biological stress responses. Contrary to commercial wearables, these actively reduces stress without effort from the user levels physiologically as they occur through touch.

On the other hand, the Melomind uses neuro-feedback technology (through an electroencephalogram (EEG) biosensor)<sup>11</sup> integrated into headphones, to measure brain activity and relaying this back to the user in the form of sound, during Melomind training sessions. Simultaneously the sessions are to help the user train their brain's capabilities to relax through neurofeedback, of which specifically train neural connections responsible for alpha waves, the waves that are engaged within the brain when a natural process of relaxation occurs. As an intervention, the melomind trains the user's capabilities of relaxation, presumably so that they can combat stressful situations when they arise through relaxation.

The Pip is a real-time stress indicator that measures variations in electrodermal activity (EDA), a stress measurement that is based on electrical activity of the sweat glands, of which is detected through the fingertips. Through its 5 accompanying applications, the pip relays real-time stress levels through auditory and visual representations while at the same time offering recommendations to reduce.

Similarly, to the commercial wearables, the wearable usually is accompanied by an application, however the commercial wearables themselves have built-in interfaces while the focused wearables

<sup>10</sup> Incorporated, Thync Global. 2017. *Thync: Breakthrough Bioelectronic Therapies*. Accessed March 12, 2019. <https://www.thync.com/>

Langley, Hugh. 2017. *Thync Relax Pro review: The wearable stress killer*. July 8. Accessed March 14, 2019. <https://www.wearable.com/news/tech/thync-relax-pro-review/>; MyBrain Technologies. 2018. *Melomind*. Accessed March 13, 2019. <https://www.melomind.com/>; 2014. *Pip: See the Difference*. Accessed March 11, 2019. <https://thync.com/>; 2019. *The Touchpoint Solution*. Accessed March 13, 2019. <https://thetouchpointsolution.com/>

<sup>11</sup> Blocka, Karla. 2017. *EEG (Electroencephalogram)*. September 14. Accessed March 27, 2019. <https://www.healthline.com/health/eeeg>

are mostly comprised of the biosensor. Based on the examined stress focused wearables, the accompanying application are necessary for the wearable to function as well as typically display all individual stress information and any stress relieving recommendations and/or methods.

While the Thync Relax Pro and Touchpoints are much more passive in the sense that they lack user interaction much like the commercial wearables which are focused on passive tracking, unlike the commercial wearables they detect, track and deal with stress in real-time.

Interestingly, the Melomind falls in line more with the examined commercial mobile applications in the sense that it is focused on training the individual but doing so in a physiological way (neurofeedback influencing alpha brain waves) rather than being primarily based on meditative practice.

### Personalized and Anecdotal Interventions

Previous literature research regarding stress interventions amongst university students and in general have consistently noted of the nature of stress as a very subjective experience, particularly on the notion that an external situation that is perceived as stressful and induces stress could be perceived otherwise by another person.<sup>12</sup> As such, it is common for people to create an intervention based on their subjective experience and situation.

Based on this conclusion, secondary research through online internet forums (questionnaires) and studies were examined to gather anonymous qualitative data on personal subjective interventions.<sup>13</sup> A thematic analysis was used to categorize the interventions. The resulting categories are; exercise, dietary related, escapism, hobby related, productive and meditative.

Interestingly, a majority of these personal interventions did not include any digital and/or technological components, of those that did, for the most part acted as more of a mediator or enabler rather than being fundamentally the intervention itself.

<sup>12</sup> Robotham, David. 2008. "Stress among Higher Education Students: Towards a Research Agenda." *Higher Education: The International Journal of Higher Education and Educational Planning* 73S-74S.

Pitt, Adele, Florin Oprea, Geraldine Tapia, and Marion Gray. 2018. "An exploratory study of students' weekly stress levels and sources of stress during the semester." *Active Learning in Higher Education*.

*The American Institute of Stress*. 2018. *What is Stress? September 20*. Accessed March 20, 2019. <https://www.stress.org/daily-life>

<sup>13</sup> 2016. AskReddit: [Serious] How do you deal with stress? October 6. Accessed March 21, 2019. [https://www.reddit.com/r/AskReddit/comments/3nmi1/serious\\_how\\_do\\_you\\_deal\\_with\\_stress/](https://www.reddit.com/r/AskReddit/comments/3nmi1/serious_how_do_you_deal_with_stress/);

2017. AskReddit: [Serious] Redditors, what healthy ways do you deal with stress? August 15. Accessed March 21, 2019. [https://www.reddit.com/r/AskReddit/comments/4tmi7/serious\\_redditors\\_what\\_healthy\\_ways\\_do\\_you\\_deal/](https://www.reddit.com/r/AskReddit/comments/4tmi7/serious_redditors_what_healthy_ways_do_you_deal/);

Lee, Kwangyoung, and Hwasung Hong. 2018. "MindNavigator: Exploring the Stress and Self-Interventions for Mental Wellness." *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. Montreal QC, Canada: ACM. 1-14;

### Psychotherapies

Based on the audit of personal and anecdotal stress reducing interventions, a conclusion has been drawn that non-digital interventions are important to understand the landscape of stress reducing interventions as a whole.

As a result, research into psychological and/or therapeutic interventions was conducted of which psychotherapies were found, the most appropriate types of psychotherapies were then chosen with regard to stress and university students as a user group, leading to three psychotherapies that were examined; Cognitive Behavioral Therapy (CBT), Mindfulness Based Stress Reduction (MBSR) and Mindfulness Based Cognitive Therapy (MBCT). Psychotherapies are collaborative treatments that are grounded on the relationship between a patient and a psychologist, where anything from a specific situation to a mental health problem is diagnosed, understood and a solution is created for the patient. The psychologist acts as a neutral and objective perspective.<sup>14</sup>

CBT is a psychotherapy that primarily focuses on solving current problems and changing the way the patient thinks and behaves in relation. While there can and have been many variations depending on variables such as; specific cases, disorders, settings, etc., most are based on Aaron Beck's 1976 model (described above).<sup>15</sup> Similarly to CBT, typical MBSR programs largely incorporate awareness of emotions and thoughts. Also, similarly, collaborative co-creative inquiry is consistent throughout most programs, of which the therapist emphasizes that while he is the teacher, the patient is the expert. A key difference is the preceding mindfulness training/practice, largely predicated on training attention and focus.<sup>16</sup> MBCT is an adaptation of MBSR, that has very similar structure and overlap, however, it is more specifically focused and catered towards people with depression and have problems with depression relapse. A fundamental difference to MBSR is explicitly targeting recognition of low mood and negative emotions/thoughts as well as accompanying symptoms.<sup>17</sup>

From an intervention perspective, a key difference from those previously examined is there is a large social aspect to psychotherapies and often involves external objective influence either through the therapist or other patients as part of group adapted programs, particularly to wearables and mobile applications. Interestingly, the examined mobile applications while drawing from fundamental aspects of psychotherapy, mostly lack social involvement.

A Fundamental difference is that therapies require constant reflection and personalized plans and/or tools to manage their stress, which is a result of the patient themselves. Wearables on the other hand

are primarily trackers and sometimes require the patient to be passive. A specific focus on perspective and understanding of what and why stress and its symptoms are occurring is also quite different to the previously examined interventions. For example, while personalized interventions are a result of active engagement from patients, while people have reported reduction in stress, there has rarely been mention of actual understanding of stressors, thoughts and emotions.

<sup>14</sup> The American Psychological Association. n.d. *Understanding psychotherapy and how it works*. Accessed April 6, 2019.

<https://www.apa.org/helpcenter/understanding-psychotherapy>.

<sup>15</sup> Beck, Judith S. 2011. *Cognitive Behavior Therapy, Second Edition: Basics and Beyond*. New York, NY, US: Guilford Press.

<sup>16</sup> Felder, Jennifer N., Sona Dimidjian, and Zindel Segal. 2012. "Collaboration in Mindfulness-Based Cognitive Therapy." *Clinical Psychology: In Session* 179-186.

Sharma, Manoj, and Sarah E. Rush. 2014. "Mindfulness-Based Stress Reduction as a Stress Management Intervention for Health Individuals: A Systematic Review." *Evidence-Based Complementary and Alternative Medicine*.

<sup>17</sup> University of Massachusetts Medical School. n.d. *MBCT & MBSR: The Differences*. Accessed April 3, 2019.

<https://www.umassmed.edu/cfm/mindfulness-based-programs/mbct-courses/about-mbct/mbct-mbsr-differences/>.

Contextual research document

## Contextual Research

### Introduction

Stress can be defined as the body's physiological response and/or reaction when it must adapt, cope or adjust in some way. This can be both helpful and harmful to a person. Raising their awareness and vigilance or overwhelming them physically, mentally and emotionally.<sup>1</sup>

The connotations and contexts in which stress emanates from, called a "stressor", is normally linked to whether or not the stress is negative/harmful or positive/helpful. This is either referred to Eustress experienced from "positive" stressors and Distress from "negative" stressors<sup>2</sup>

Negative stress can primarily be categorized into three forms, Acute, Episodic Acute and Chronic stress, with each category often stemming from varying and/or different stressors while also producing varying side-effects and consequences for the person.<sup>3</sup>

### Types of stress and their stressors<sup>2</sup>

#### Acute Stress

Acute stress can typically come about for two reasons, demands and pressures of a recent occurrence and anticipating them for the upcoming future. Stress in its most common and short-lived form, which in this sense means it is also the most highly amenable and manageable. Due to its short life it's symptoms typically do not develop in the same fashion and do not have lasting effects that are linked to episodic acute and chronic stress.

#### Episodic Acute Stress

Episodic acute stress primarily manifests when a person frequently and consistently encounters stressors in their life and therefore experiences acute stress in the same frequency. This can be often linked to lifestyle, personality, habits which are hard to change. This can lead to a routine that is deeply embedded with stressors and symptoms, this can deeply change the perspective about the world and him or herself.

<sup>1</sup> American Psychological Association. n.d. "Fact Sheet: Health Disparities and Stress." American Psychological Association. Accessed March 23, 2019.

<sup>2</sup> The American Institute of Stress. 2018. What is Stress? September 20. Accessed March 20, 2019. <https://www.stress.org/daily-life>.

<sup>3</sup> n.d. Stress: The different kinds of stress. Accessed March 15, 2019. <https://www.apa.org/helpcenter/stress-kinds>.

### Chronic Stress

Chronic stress, is a persistent form of stress that constantly erodes a person's mental, physical and emotional wellbeing over typically a long stretch of time. This stems from stressors that are deeply rooted in the life of the person, so much so that they do not see a way out of it and see it as something that is simply there rather than a problem that can be fixed. Stressors can be internal, external or an internalization that is caused by an external situation.

### Stressors

Stressors are the internal and/or external conditions and situations that cause the experienced stress that a person experience. Typically, there are more than one stressor at any given time and are mostly unique to a person's particular circumstances.<sup>4</sup> Some examples, are<sup>1</sup>:

- Acute Stress are situations and/or conditions that have gone astray, such as;
  - Losing a certain contact
  - An impending deadline or hearing about your child
  - His/her unfavorable situation at school.
- Acute Episodic Stress and the deeply rooted nature of its stressors normally stem from habits, personality, routine and perspective, such as;
  - A cycle of always being in a rush but always being late
  - Continuously predicting the outcome of an upcoming situations to be unfavorable to them.
- Chronic Stress and its stressors are demands and pressures that seem to have no end, that can manifest internally and externally, such as;
  - An early traumatic childhood experience that causes an internalized painful memory
  - An unhappy marriage
  - Being in a job that you hate.

Although stressors are normally unique to a person, they can more or less be categorized or relative, examples are; daily situations, family, acculturative, environmental and socioeconomic.

<sup>4</sup> Robotham, David. 2008. "Stress among Higher Education Students: Towards a Research Agenda." *Higher Education: The International Journal of Higher Education and Educational Planning* 735-746.

### Physicality of Stress

Although stress is highly subjective, it is highly agreed upon that there are external and internal factors at play. A model that defines this is the Biopsychosocial model of stress, this includes biochemical and physiological internal components and social external components. The model bases stress on the interaction between all three components.<sup>5</sup>

As previously stated, stress is a response to a stressor or stimuli, the experience of stress typically can have an accompanying physical reaction, commonly this occurs through hormonal signals that result in transient-over arousal which may include; elevate heart-rate, breathing rate and blood pressure.<sup>6</sup>

Some examples of more noticeable, physical reactions are; emotional distress (anger, anxiety, depression), muscular problems (headaches, back/jaw pain, muscular tensions), gastrointestinal problems (heartburn, diarrhea, constipation, etc.).<sup>7</sup>

#### Biosensors and Biophysical Data

As a result of findings regarding stress research and its relationship to the body, attempts have been made to detect and/or identify stress in a more scientific way. This is more in line with physicality and the body rather than psychological and/or social components of stress.

Biosensors are the most common way of detecting stress physically and/or physiologically, this involves a device that detects Biomarkers emitted by the body as a result of a stressful experience which is then converted electrically by a biosensor into a readable form that can range from being numeric to graphic.<sup>8</sup>

Particularly for stress, this involves detecting a biomarker such as pulse and/or heart rate during and before a stressful situation, which gives an indication of stress levels.<sup>9</sup>

<sup>5</sup> The American Institute of Stress. 2018. *What is Stress?* September 20. Accessed March 20, 2019. <https://www.stress.org/daily-life>.

<sup>6</sup> *Ibid*;

American Psychological Association. n.d. "Fact Sheet: Health Disparities and Stress." *American Psychological Association*. Accessed March 23, 2019.

The American Institute of Stress. 2018. *How stress affects your health*. September 20. Accessed April 1, 2019. <https://www.apa.org/helpcenter/stress>.

<sup>7</sup> *Ibid*;

<sup>8</sup> Bhalla, Nikhil, Pawan Jolly, Nello Formisano, and Pedro Estela. 2016. "Introduction to biosensors." *Essays in Biochemistry* 1-8; Strimbu, Kyle, and Jorge Tavel. 2010. "What are biomarkers?" *Current Opinion in HIV and AIDS*. 463-466.

<sup>9</sup> Singh, Simran A., Praveen Kumar Gupta, M. Rajeshwari, and Tabitha Janumala. 2018. "Detection of Stress Using Biosensors." *Materials Today: Proceedings* 5 (Materials Today) 21003-21010.

### Stress amongst university students

Mental health and consequently stress have particularly become increasingly prevalent and common amongst university students, continues to do so. This has not gone unnoticed, as universities and the public have had growing concern.<sup>10</sup>

While stress is experienced by everyone as part of human biology, it is widely acknowledged in particular as a typical association with university and is inevitable as part of being a university student.<sup>11</sup> Of which has also been argued that university students experience more stress on average than those who aren't students.<sup>12</sup>

Similarly, to stress amongst general populations, many qualitative studies show that stress amongst university students comes from a very wide array of stressors that can occur at the same time and are based on each students' individual situation as well as their subjective perception of it,<sup>13</sup> however based on the literature and statistical research there are stressors that are mostly unique to only university students.<sup>14</sup> Academic stressors in particular seem to be the most commonly experienced as well as the most dominant amongst university students.<sup>15</sup>

In addition, it has been particularly noted that first year university students experience the highest levels of perceived stress in comparison to later years. This has been attributed to a drastic transition that most students endure, related to new social, physical and academic environmental demands.<sup>16</sup>

According to Penn State's 2018 Collegiate Mental Health Report stress is reasonably high in self-reported concern as well as priority amongst university students in the US, with anxiety being the

<sup>10</sup> Brown, June S. L. 2018. "Student mental health: some answers and more questions." *Journal of Mental Health*. 193-196.

<sup>11</sup> Pitt, Adele, Florin Opreacu, Geraldine Tapia, and Marion Gray. 2018. "An exploratory study of students' weekly stress levels and sources of stress during the semester." *Active Learning in Higher Education*.

<sup>12</sup> Furman, Mariama, Nataria Joseph, and L. Cindy Miller-Perrin. 2018. "Associations Between Coping Strategies, Perceived Stress, and Health Indicators." *Psi Chi Journal of Psychological Research* 61-71.

<sup>13</sup> Y, Ganesan, Talwar P., Norsiah Fauzan, and Oon Y.B. 2018. "A Study on Stress Level and Coping Strategies among Undergraduate Students." *Cognitive Sciences and Human Development* 37-47; *Ibid*; Robotham, David. 2008. "Stress among Higher Education Students: Towards a Research Agenda." *Higher Education: The International Journal of Higher Education and Educational Planning* 735-746; Brown, June S. L. 2018. "Student mental health: some answers and more questions." *Journal of Mental Health* 193-196; Pitt, Adele, Florin Opreacu, Geraldine Tapia, and Marion Gray. 2018. "An exploratory study of students' weekly stress levels and sources of stress during the semester." *Active Learning in Higher Education*.

<sup>14</sup> Pitt, Adele, Florin Opreacu, Geraldine Tapia, and Marion Gray. 2018. "An exploratory study of students' weekly stress levels and sources of stress during the semester." *Active Learning in Higher Education*; Penn State Counseling and Psychological Services. 2018. *Center for Collegiate Mental Health 2018 annual report*. Annual Report, State College: Center for Collegiate Mental Health.

<sup>15</sup> *Ibid*; Robotham, David. 2008. "Stress among Higher Education Students: Towards a Research Agenda." *Higher Education: The International Journal of Higher Education and Educational Planning* 735-746.

<sup>16</sup> *Ibid*;

highest by reasonably large margin (among a total of 54 concerns). This can be further broken down into: general, social, panic, other, **test taking (academic)** and phobia anxiety.<sup>17</sup>

It is important to note that anxiety itself is as an emotion that comes as a result of experiencing stress. Anxiety is described as a feeling of worry or worrying thoughts about the looming future or upcoming event.<sup>18</sup>

However, these are simply additional stressors that make being a university student unique from an experiential view and that these are often layered on top of more common stressors of adults who are 18 to 25 years old.<sup>19</sup>

### Stress Coping

As a result of the conclusions and findings that stress is an inevitable/normal part of university as well as the reported wide-array of individually unique stressors for each student, the literature review has shifted focus onto stress coping (as opposed to mitigation).

#### Lazarus and Folkman's Transactional Coping Theory for psychological stress.

Lazarus and Folkman's transactional theory published in 1984, remains to be the cornerstone of coping research across many fields. There have been subsequent alternative suggestions and proposed theories but none have been widely acknowledged to the same degree, as a result Lazarus and Folkman's theory will be used as a primary research underpinning (at this point in the research).

The original theory is based on the foundation on the fact that whether an event is stressful depends intrinsically on the person who experiences it, covering three key features; cognitive appraisal, coping and cognitive reappraisal.

- Cognitive appraisal is process in which a person intrinsically determines whether something is stressful to them or not, this is determined by two factors **their personal values, goals, beliefs** and environmental factors (like demands and/or resources). This can be further broken into two parts;

<sup>17</sup> Penn State Counseling and Psychological Services. 2016. *Center for Collegiate Mental Health 2016 annual report. Annual Report*, State College: Center for Collegiate Mental Health.

<sup>18</sup> American Psychological Association. n.d. *Anxiety*. Accessed May 20, 2019. <https://www.apa.org/topics/anxiety/>; American Psychological Association. n.d. *Stress: The different kinds of stress*. Accessed March 15, 2019. <https://www.apa.org/helpcenter/stress-kinds>.

<sup>19</sup> *Ibid*;

Robotham, David. 2008. "Stress among Higher Education Students: Towards a Research Agenda." *Higher Education: The International Journal of Higher Education and Educational Planning* 735-746.

- Primary appraisal (the transaction between the individual and an event, resulting in the individual determining the importance of the event to his/her well-being).
- Secondary appraisal occurs when the individual determines that the event is potentially a stressor, they begin to evaluate their coping resources, situational variables and coping styles
  - Coping is the aftermath of appraisal when the individual determines that the event is stressful and needs their effort to be managed. Coping is described as process oriented and needs conscious actions from the individual. Coping strategies aim to directly deal with the stressor (problem-focused coping, directed towards controllable stressors) or change the individual emotions/perceptions attached to the stressor (emotion-focused coping, directed towards uncontrollable stressors).
  - Cognitive Reappraisal follows after an action has been done in attempt to cope, which triggers appraisal of whether or not it was particularly successful (also meaning whether or not the stressor is still a stressor).

The theory suggests that the three key features described are constantly interacting with each other or that stress coping is a constant transaction process.<sup>20</sup>

### Stress Coping Amongst University Students

#### Personalized Coping

In line with the transactional theory of stress described above, stress amongst university students cannot be generalized as an event seen by a student as stressful may not be by another, moreover the stress experienced may not even be negative and it would be good to question how good university students are, at recognizing that they are stressed.

Consequently, this means that each student would deal with the same stressor differently from another<sup>21</sup> and assumingly the inverse is also true.

While universities have recognized stress as a problem amongst students in the past, it has used generalized stress programs, however this has been historically underutilized due to a seemingly preference to self-manage as well as the perception of students that stress is a normal part of being of university.<sup>22</sup> Although the amount of students who are reported to have actively sought counselling has dramatically

<sup>20</sup> Biggs, Amanda, Paula Brough, and Suzie Drummond. 2017. "Lazarus and Folkman's Psychological Stress and Coping Theory." In *The Handbook of Stress and Health: A Guide to Research and Practice*, by Cary Cooper, James Campbell Quick and eds., 349-364. Wiley-Blackwell; Furman, Mariama, Nataria Joseph, and L Cindy Miller-Perrin. 2018. "Associations Between Coping Strategies, Perceived Stress, and Health Indicators." *Psi Chi Journal of Psychological Research* 61-71.

<sup>21</sup> Saleh, Daliah, Nathalie Camart, and Lucia Romo. 2017. "Predictors of Stress in College Students." *Frontiers in Psychology*.

<sup>22</sup> Brown, June S. L. 2018. "Student mental health: some answers and more questions." *Journal of Mental Health* 193-196.

increased over the last 5 years (at least in the US), according to Penn State's 2018 Collegiate Mental Health Report.<sup>23</sup>

In addition, stress interventions, based on research, has been shown to be more effective on an individual level, particularly constructed to address a specific stressor as opposed to broad stress intervention programs.<sup>24</sup> This is somewhat in line with the known success of psychotherapies, as they focus on the individual and their unique situations.

A seemingly prevalent concept amongst university students is avoidance coping, which is typically seen as unhealthy and more or less delays the stressor instead of actually dealing with it. Examples are: drinking, smoking and illegal drug use. Consequently, studies based on this have resulted in the highest perceived stress amongst university students, in comparison to perceived stress using typical coping strategies in the same study.<sup>25</sup>

It has been noted that with the prevalence of academic related stress, that time management is the problem, however, it has been suggested that, in-line with Lazarus and Folkman's stress theory described above, that the source of stress is the student's perception of control over time rather than the management of time itself.<sup>26</sup>

In addition, previous literature has suggested that counsellors, university programs and stress management interventions in general need to work towards students' individual and intrinsic management which will consequently alleviate their stress. Some examples are; counsellors allowing students to examine and define stressors in their own way<sup>27</sup> and counsellors as well as educational health strategies needing to engage students to understanding their stress by reflecting on stressful situations in the past, it's sources and how to manage it before it becomes unmanageable. This includes understanding of coping strategies by the student, with how and why it is working for them.<sup>28</sup>

<sup>23</sup> Penn State Counseling and Psychological Services. 2018. *Center for Collegiate Mental Health 2018 annual report*. Annual Report, State College: Center for Collegiate Mental Health.;

<sup>24</sup> Robotham, David. 2008. "Stress among Higher Education Students: Towards a Research Agenda." *Higher Education: The International Journal of Higher Education and Educational Planning* 735-746.

<sup>25</sup> Furman, Marisela, Natalia Joseph, and L. Cindy Miller-Perrin. 2018. "Associations Between Coping Strategies, Perceived Stress, and Health Indicators." *Psi Chi Journal of Psychological Research* 61-71.;

<sup>26</sup> Robotham, David. 2008. "Stress among Higher Education Students: Towards a Research Agenda." *Higher Education: The International Journal of Higher Education and Educational Planning* 735-746.

<sup>27</sup> Frazier, Patricia A., and Laura J. Schauben. 1994. "Stressful life events and psychological adjustment among female college students." *Measurement and Evaluation in Counseling and Development* 280-292.

<sup>28</sup> Cummings, Anne L., and Andrea L. Dwyer. 2001. "Stress, self-efficacy, social support, and coping strategies in university students." *Canadian Journal of Counselling* 208-220.

### Coping through social support

Social support as defined by Shumaker and Hill, can be identified through two concepts; functional social support (types of resources provided) and structural social support (refers to the existence and types of connections within a social network).<sup>29</sup> Of which, functional support has been associated with lower chances of depression, anxiety, self-injury, suicidality, and symptoms of eating disorders.<sup>30</sup>

Social support seemingly is lacking amongst university students, which could be attributed to the transition they make into a new environment socially and geographically. This is particularly important because the common ages of university students are also the ages that have been shown to be crucial to identity development (ages 18 - 25).<sup>31</sup> In particular, students who are more socially isolated, feel lonely and/or have little contact with friends have shown higher levels of psychological distress.<sup>32</sup>

In addition to individualized coping strategies, social support has been shown to have an impact in the ability of university students to cope with, buffer and experience stress (specifically, better psychological well-being) or at the very least a moderator.<sup>33</sup> Research suggests that coping behavior alongside social support has been shown to do well in combination in reducing the effects of stress amongst university students.<sup>34</sup>

<sup>29</sup> Shumaker, Sally A., and D. Robin Hill. 1991. "Gender differences in social support and physical health." *Health Psychology* 102-111.

<sup>30</sup> Hefner, Jennifer, and Daniel Eisenberg. 2009. "Social support and mental health among college students." *American Journal of Orthopsychiatry* 491-499.

<sup>31</sup> Pitt, Adele, Florin Oprescu, Geraldine Tapia, and Marion Gray. 2018. "An exploratory study of students' weekly stress levels and sources of stress during the semester." *Active Learning in Higher Education*; Hefner, Jennifer, and Daniel Eisenberg. 2009. "Social support and mental health among college students." *American Journal of Orthopsychiatry* 491-499.

<sup>32</sup> Hefner, Jennifer, and Daniel Eisenberg. 2009. "Social support and mental health among college students." *American Journal of Orthopsychiatry* 491-499.

<sup>33</sup> Ibid; Yue, Wu, and Liu Fangli. 2018. "Study on the Correlation of Mental Health, Resilience and Stress Events of College Students." *International Conference on Information and Education Technology*, Osaka, Japan: ACM. 165-169.

<sup>34</sup> Brown, June S. L. 2018. "Student mental health: some answers and more questions." *Journal of Mental Health* 193-196.;

Robotham, David. 2008. "Stress among Higher Education Students: Towards a Research Agenda." *Higher Education: The International Journal of Higher Education and Educational Planning* 735-746.; Y. Ganesan, Talwar P., Norsiah Fauzan, and Con Y.E. 2018. "A Study on Stress Level and Coping Strategies among Undergraduate Students." *Cognitive Sciences and Human Development* 37-47.

Hypothesis building document

### Contextual Research - Hypothesis & Assumptions

Contextual research focused on the nature of stress and coping in general and amongst university students, of which a set of assumptions were made regarding strategies and methods that maybe most effective in allowing university students to cope with stress. The following is an outline of contexts and their key conclusions;

#### Individual Nature of Stress & Stressors

To create a foundation, I first looked at stress and stressors in general and focused on understanding the topic and space.

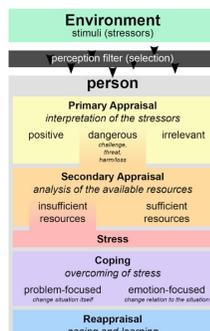
- Stress is an experience that is normal to everyone, which can be broken into negative (distress) or positive (eustress) experiences.
- Stress is normally brought about by external and internal conditions and variables that are unique to each person, these conditions and variables are typically called stressors.
- What can be seen as a stressor is completely subjective to each individual and as such, a condition and/or variable that is seen as a stressor by one person could be seen as otherwise by another.

#### Stress Coping Theory

After initial research on stress and stressors, focus moved into stress coping and what is believed to be the underlying theory behind coping with stress.

The most prominent theory and still the cornerstone of stress coping research is Lazarus and Folkman's Transactional Theory, of which three important keys to this literature review moving forward;

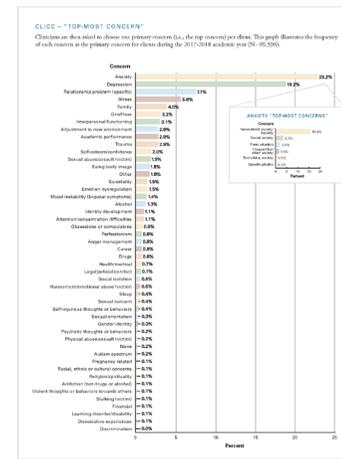
- The importance of subjective interpretation of whether something is a stressor or not, a concept called Appraisal
- The use of either Emotional or Problem-focused strategies to cope.
- Coping is not automatic it is learned and normally uses emotional and behavioural resources.



### Stress Amongst University Students

Conclusions drawn from the two previous contexts underpin the rest of the research regarding stress. Contextual research continued, applying those contexts to university students, of which the following conclusions were drawn;

- It is widely acknowledged that mental health problems have over the years become increasingly prevalent amongst university students, in particular stress levels a very big concern.
- There are a wide amount of individual stressors that are experienced by university students.
- University students lack knowledge on stressor recognition and stress in general.
- Lack of and/or poor social support, peer support networks and social interaction (loneliness) is key stressor and contributor to psychological distress.
- University students normally leave behind their existing social support systems.



- Students' inability to cope and manage stress can lead to physical problems, particularly lack of sleep and energy.
- Final Year and 1st year students have an overall higher level of stress.
- Avoidance and/or Escapism coping is prevalent amongst university students.

### Stress Synthesis and Assumptions

A thematic analysis was conducted through an affinity diagram to identify the most prominent themes regarding stress amongst university students and implications towards stress management interventions.



Using the affinity diagram, assumptions based on each theme were made regarding implications to stress management/coping interventions;

- Students need to guidance on Identification, Self-reflection and subjective perception of stressors in their lives and their own stressful experiences.
- Timing of study, experience and specific-time frames during the semester have important implications on stress levels, in particular, 1st year and final year students experience more stress.
- Students become more effective at handling stress as they progress through university, as well as their perception of stress and their overall priorities in university.
- Behavioural/Physical/Action-oriented strategies are effective.
- Social Support, interaction and networks are extremely important emotional coping resources for university students. Bad social support often leaves to high levels of psychological distress.
- Due to the individualised nature of stressors amongst university students, personalisation should be a key part of interventions.
- After understanding their stress and defining it in their own terms, students may need to use their understanding to create a repertoire of coping strategies that are specifically catered.
- Stress experiences and stressors are constantly changing, this means ongoing reflection and integration maybe needed to cope and manage stress.
- Both physical and emotional coping strategies are effective amongst university students.

- Organisation, Time Management and Balance are extremely crucial to well-being in university
- Digital / Technological use is mainly in the form of avoidance coping (Netflix, Youtube, etc) outside of actual academic use.
- Stress is simply a by-product that is experienced and dealt with in the context of higher overarching university student goals.

### Competitive Audit - Hypothesis & Assumptions

Parallel to contextual research, a competitive audit was conducted on existing commercialised stress related and/or management interventions to survey the landscape of prominent features, mediums and effectiveness of interventions.

This resulted in several dominant categories of interventions;

- Mobile Applications.
- Commercialised Wearable Technology
- Stress Focused Wearables
- Personalised Interventions
- Other Technology Based Interventions
- Psychotherapies / Programs
- Virtual Reality Applications

A competitive auditing report was created which examined in detail the nature of each category.

### Intervention Mapping

The assumptions formulated from contextual research were used to create parameters for 2x2 mapping in order to compare and understand interventions from the competitive audit (left image). Ideas were then grouped into conclusions, of which assumptions were made (right image).

