A Framework to Better Understand Emotional Experiences with Portable Interactive Devices: Preliminary Trial

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Abstract: Two longitudinal experiments were conducted exploring emotional experiences with PIDs over six months including media and medial Portable Interactive Devices (PIDs). Results identifying the impact of negative social and personal interactions on the overall emotional experience as well as different task categories (Features, Functional, Mediation and Auxiliary) and their corresponding emotional responses have previously been reported [2,3,4,5]. This paper builds on these findings and presents the Designing for Evolving Emotional Experience (DE^3) framework promoting positive (and deals with negative) emotional experiences with PIDs including a set of principles to better understand emotional experiences. To validate the DE^3 framework a preliminary trial was conducted with five practicing industrial designers. The trial required them to consider initial design concepts using the DE^3 framework followed by a questionnaire asking about their use of the framework for concept development. The trial aimed to analyse the effectiveness, efficiency and usefulness of the framework in assisting in the development of initial concepts for PIDs taking into account emotional experiences. Common themes regarding the framework are outlined including the ease of use, the effectiveness in focusing on the personal and social contexts and positive ratings regarding its use. Overall the feedback from the preliminary trial was encouraging with responses suggesting that the framework was accessible, rated highly and most importantly permitted designers to consider emotional experiences during concept development. The paper concludes with a discussion regarding the future development of the DE^3 framework and the potential implications to design theory and the design discipline.

Key words: Design and Emotion, Emotional Experience Framework, Emotions with Portable Interactive Devices

1. Introduction

> Experience is prime, and the product only a means [6] (p.63).

At its core the field of Design is, and always will be, about creating a better life for people. As such, designed artifacts should facilitate and mediate emotionally meaningful experiences so as to positively impact people's lives. Portable interactive devices (PIDs) are unique because they are carried and interacted with in diverse contexts; alone or with other people, privately or publically. As such, people's relationship with PIDs and their emotional experiences, can be unique and distinctive in ways that other products cannot.

The authors have previously conducted a longitudinal study, founded on Activity Theory, exploring the emotional experience of two product categories including media / entertainment PIDs (MP3 players and PDAs with mobile telephone functionality) and medical / health PIDs (blood-glucose monitors, pedometers and heart-rate monitors). Findings from this experiment have previously been outlined including the impact of the social level on the overall emotional experience. It was identified that negative and positive social experiences have different impacts on the emotional experience with PIDs [2,3]. Further, the authors also presented four categories of activities with PIDs including Feature, Functional, Mediation and Auxiliary activities that constituted emotional experiences. It was found that for both PID types Feature related activities were identified as negative in nature. Functional activities were characterised as mainly positive for both PID types. Likewise Mediation activities were identified as overwhelmingly positive for both PIDs while Auxiliary activities were characterised as significantly negative in nature [4]. Additional findings have been presented regarding specific positive emotional experiences within the Functional and Mediation task categories. It was identified that activities related to the primary functions of the products led to positive experiences. For example for media PIDs listening to music, sending text and work-related functions were rated as positive while for medical PIDs timing exercise, tracking steps and taking blood sample were rated as positive. Experiences that mediated some broader user needs were also identified as overwhelmingly positive, for instance escape and relaxation for media PIDs and monitoring fitness, monitoring health and motivating fitness for medical PIDs [5].

This paper builds on these findings and presents the Design for Evolving Emotional Experience framework (DE^3). The DE^3 framework promotes positive (and deals with negative) emotional experiences with PIDs including a set of principles to better understand emotional experiences. To validate the DE^3 framework a preliminary trial was conducted with five practicing industrial designers. The trial required participants to consider initial concepts using the DE^3 framework as a basis followed by a questionnaire asking about their use of the framework for concept development. The trial aimed to analyse the effectiveness, efficiency and usefulness of the framework in assisting in the development of initial concepts for PIDs taking into account emotional experiences. Common themes regarding the framework are outlined including the ease of use of the framework, the effectiveness of the framework in focusing on the personal and social contexts and the positive rating of the framework. Overall the feedback from the preliminary trial was encouraging with responses suggesting that the framework was accessible, was rated highly and most importantly permitted designers to consider emotional experiences during concept development. The paper concludes with a discussion regarding the future development of the DE^3 framework and the potential implications to design theory and the design discipline. The findings presented here contribute and build on existing emotional experience frameworks / models and knowledge of the evolving emotional experience with products, especially with PIDs.

2. Activity Theory

Activity Theory is used as the theoretical basis for the study. A detailed outline of Activity Theory and how it relates to this study has previously been outlined [5] so the basic premise will be outlined here. The primary focus of Activity Theory is on human experience within everyday life and how artefacts mediate and possibly enhance this experience [9]. The critical aspect to highlight is that activities are composed of three levels with activities sitting at the highest level, which are composed of actions, which in turn are composed of operations at the lowest

level. Activities however, area always situated within some sort of context and so need to be conceptualised as such (Figure 1). One of the important features of the Activity Theory framework is that it can be used to separate and explore various levels of interactions. First, at the micro-level (local-level) operations and actions can be identified. These are the routines, basic components of experiences in everyday life, and often the physical parts of an experience. Observed by themselves, these actions, although important, can be misunderstood and their value lost without putting them into the broader context of people's lives as they only tell part of the story. Second, the macro-level (global-level) activities describe the more general and higher level components and experiences of people's actions over time in context.
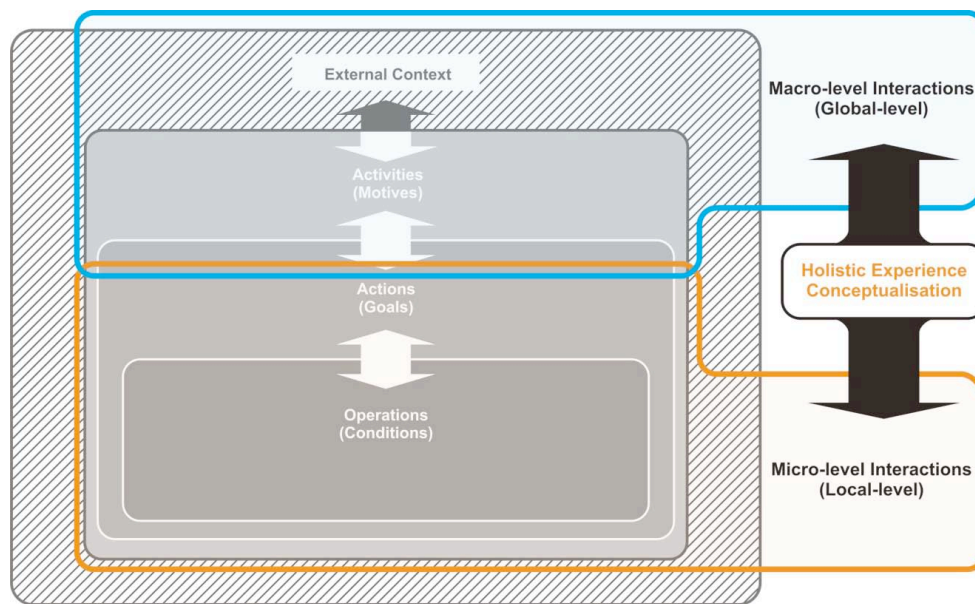

Figure 1. Activity Theory Framework including micro and macro level interactions

Activity Theory and the associated framework is a promising conceptual model for studies of human-computer interaction. This is a good starting point considering the focus of the research is on exploring and understanding broader issues including social and contextual aspects concerning the human-product interaction. This framework serves as an important conceptual model for the DE[3] framework presented here.

3. Emotional Experience Frameworks and Models

Research specifically studying the evolving interaction between user and product has been previously explored [10,11]. Nevertheless, the topic is still in its early stages and an established framework or model for emotional experiences has not yet emerged. There is a common understanding that over time a person's relationship with a product evolves and progresses [11]. This progression begins before the product is used through to the moment of interaction and continues evolving for weeks, months and even years. Context has a big impact on the user-product interaction, especially for PIDs. In this case context can refer to physical location and environment but also to the social and personal aspect of use. Context is critical for designers because without understanding context it is difficult to understand people's actions and behaviours; as Kuutti [in 9] argues, "actions are always situated into a context, and they are impossible to understand without that context" (p.26). It is clear that the

experiences of any interactions are influenced by the surrounding social context in which they occur and this has the power to enhance or detract from the emotional experience.

One of the earliest emotional experience framework / models within the field of design was developed by Desmet [1] and consisted of four parameters in the eliciting process of emotions: (i) appraisal, (ii), concern, (iii) product, and (iv) emotion (Figure 2).
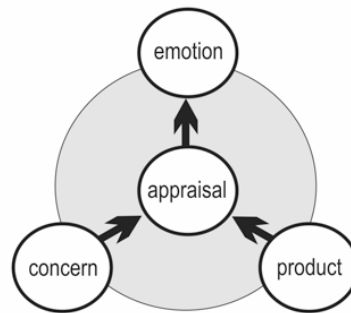

Figure2. Basic model of product emotion [1] (p.2)

This model is based on the proposition that all emotional reactions result from an appraisal process in which the individual appraises the product as damaging or favoring one or several concerns. Desmet identified 5 broad categories of emotions elicited by this appraisal process including (1) surprise, (2) instrumental, (3) aesthetic, (4) social, and (5) interest emotions. The model is a successful and useful attempt at providing a broad theoretical basis for understanding emotional responses but seems to lack the inclusion of context and its effect on the emotional experience perceived by the user during interaction.

A more recent framework / model is described by Karapanos, Zimmerman, Forlizzi and Martens [7]. Karapanos et al. identify three phases for adoption of products including (i) Orientation, (ii) Incorporation, and (iii) Identification (Figure 3).
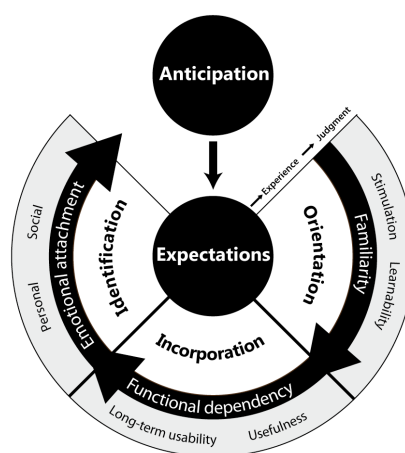

Figure 3. Temporality of experience [7] (p.732)

These phases reflect different qualities of the product from before product purchase through to several weeks after product interaction. This model takes into account the evolving aspect of experience including (i) increasing familiarity, (ii) functional dependency and (iii) emotional attachment as forces that transition users from one stage

to another. Although this model is useful in understanding certain aspects of emotional experience, including the social dimension, the specific aspect of context is not incorporated or described.

A useful framework is outlined by Khalid and Helander [8]. This framework is more descriptive and is intended to identify and evaluate aspects of emotional experiences (Figure 4). The framework is broken down into the conceptual spaces regarding Designer's Environment (left) and the Affective User Experience (right).
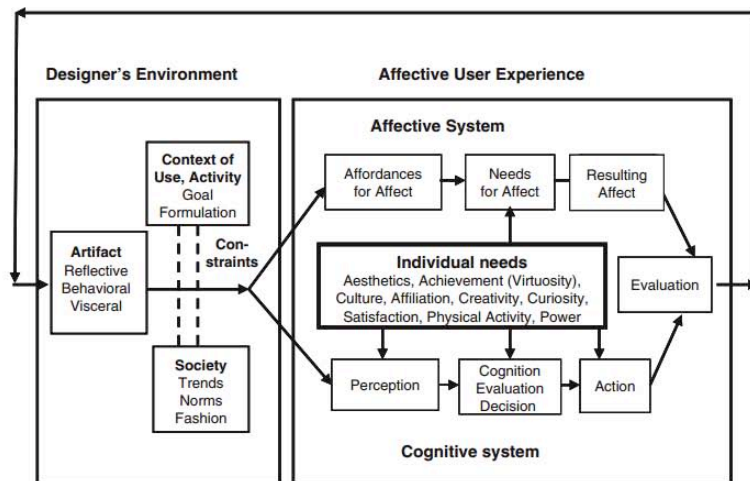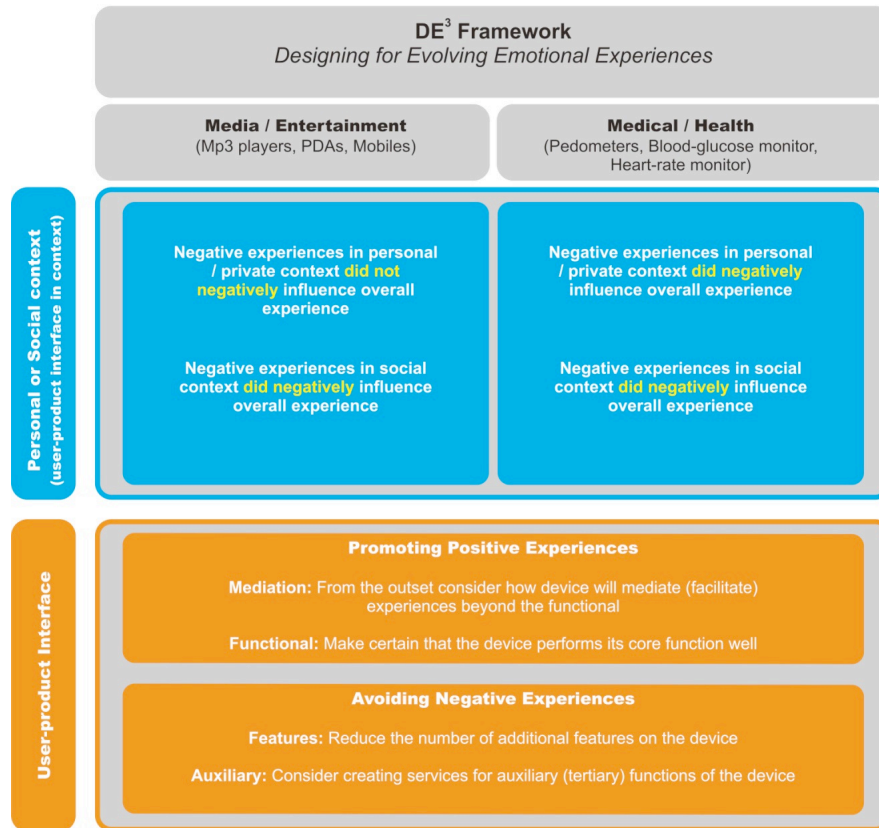

Figure 4. A framework for evaluationn of affective design [8] (p.200)

The detail in this model identifies several important aspects of emotional experiences. Within the designer's space there are the constraints including artifact design elements as well taking into account the context of use and social dimensions. For the user, individual user needs as well as the cognitive and affective systems will influence the emotional evaluation of the experience. Although more complicated than the previous models it describes some important aspects of user-product interaction in relation to emotional experiences. The framework in Figure 4 relates closely to the framework presented in this paper as it blends broad theoretical concepts with specific elements to assist designers to better conceptualise, understand and target aspects of emotional experiences.

4. A Framework of Emotional Experience for Portable Interactive Devices

This paper focuses on the Designing for Evolving Emotional Experience (DE^3) framework. The DE^3 framework was developed as a result of findings from two longitudinal studies on the evolving emotional experience of interacting with two different product categories including media (PDA's with mobile phone capabilities, MP3 players) and medical PIDs (Pedometer, Heart-rate monitors and Blood-glucose monitor). The purpose was to identify aspects that influenced the emotional experience over the course of interaction in a positive or negative manner.

The experiments will be briefly outlined here as the details have previously been reported elsewhere [2,3]. The experiment aimed to capture the emotional experience of interacting with PIDs before, during and at the end of six months through a triangulation approach consisting of interviews, diaries and co-discovery methods. Overall 651 experiences were recorded and analysed during the experiment. This included 426 experiences for media and 225 experiences for medical PID category.

DE³ Framework
Designing for Evolving Emotional Experiences

Media / Entertainment
(Mp3 players, PDAs, Mobiles)

Medical / Health
(Pedometers, Blood-glucose monitor, Heart-rate monitor)

Personal or Social context
(user-product interface in context)

Negative experiences in personal / private context **did not negatively** influence overall experience

Negative experiences in social context **did negatively** influence overall experience

Negative experiences in personal / private context **did negatively** influence overall experience

Negative experiences in social context **did negatively** influence overall experience

User-product Interface

Promoting Positive Experiences

Mediation: From the outset consider how device will mediate (facilitate) experiences beyond the functional

Functional: Make certain that the device performs its core function well

Avoiding Negative Experiences

Features: Reduce the number of additional features on the device

Auxiliary: Consider creating services for auxiliary (tertiary) functions of the device

Terminology

Features: Relating to added features of the device.

Functions: Relating to the core functions of the device. For example ability to play music (mp3 player), ability to allow seamless communication (mobile phone), ability to record timing (heart-rate monitor).

Mediation: Relating to broader experiences beyond the physical aspects/attributes of the device.

Auxiliary: Relating to peripheral (or tertiary) to core functions of the device. For example reading manual, changing the battery, product upgrade, etc.

Figure 5. Designing for Evolving Emotional Experience (DE³) Framework

Several findings were identified from the experiments. Findings revealed people interact with PIDs emotionally both at a personal and a social level, supporting previous studies in this area [12]. Further, the social level impacts significantly on the emotional experience attained. For media PIDs, Negative Social experiences adversely impacted the evolving emotional experience. For medical PIDs, both Negative Social and Negative Personal experiences adversely impacted the evolving emotional experience [2,3]. Additionally, different task categories, and their emotional responses, were identified including Features, Functional, Mediation and Auxiliary categories. Functional and Mediation Categories were characterised as overall positive while Features and Auxiliary Categories were characterised as overall negative. These findings have been used as a basis to develop the DE³ framework to better conceptualise and understand emotional experiences with PIDs (Figure 5).

TheDE³ framework provides some principles that should be taken into account when designing PIDs for emotional experiences. Starting at the top (Figure 5), the framework includes the title: DE³ Framework Designing for Evolving Emotional Experiences. The second row includes the two PID categories with media / entertainment on the left and medical / health on the right. The third column includes findings and recommendations regarding the macro-level with regard to the impact on the personal and social context. The fourth column includes the

findings and recommendations regarding the micro-level with regard to the impact of the four Categories including Mediation, Functional, Features and Auxiliary. Finally underneath the fourth column is a description of the terminology used for the four Categories.

To explain the framework in more detail, it is broken down into its main components. Figure 6 highlights the macro-level findings and recommendations of the DE^3 framework are contextualised within the Activity Theory model taking into account Operations, Actions, Activities and External Context (Figure 1). On the far left is the title Personal or Social context (user-product interface in context), which outlines that this relates to the macro-level. On the left hand side are the findings explained for the media / entertainment PID category. The first line reads: Negative experiences in personal / private context did not negatively influence overall experience. The second line reads: Negative experiences in social contexts did negatively influence overall experience. On the right side are the findings outlined for the medical PIDs. The first line reads: Negative experiences in personal and private contexts did negatively influence overall experience. The second line reads: Negative experience in social contexts did negatively influence overall experience. As explained previously, these were the findings relevant for the media and medical PIDs respectively at the macro-level.
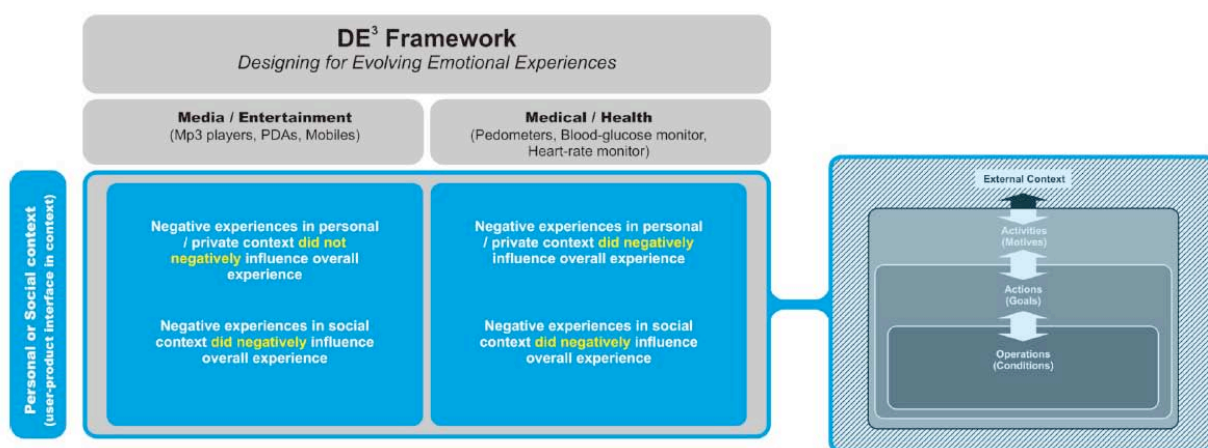

Figure 6. Macro-level within Activity Theory model: Findings relevant to media / entertainment (left) and medical / health (right) for personal and social contexts

The micro-level findings are contextualised within the Activity Theory model in relation to Operations and Actions (Figure 7). On the far left is the box explaining that these are findings relevant for the user-product interface, highlighting that this relates to the micro-level. It encapsulates the findings and implications regarding positive and negative emotional experiences of the four Categories. As depicted in Figure 7, the principles outlined for promoting positive experiences and avoiding negative experiences are provided as recommendations regarding designing for evolving emotional experiences. The top box states that to promote positive experiences the following aspects regarding Mediation and Functional activities need to be considered (i) Mediation; From the outset consider how device will mediate (or facilitate) experiences beyond the functional, (ii) Functional; Make certain that the device performs its core function well. The bottom box states that to avoid negative experiences the following aspects regarding Features and Auxiliary activities need to be considered, (i) Features; Reduce the number of additional features on the device, (ii) Auxiliary; Consider creating service for auxiliary (tertiary)

functions of the device. Under these descriptions are brief definitions of the terminology used for each Category so they can always be referred to.
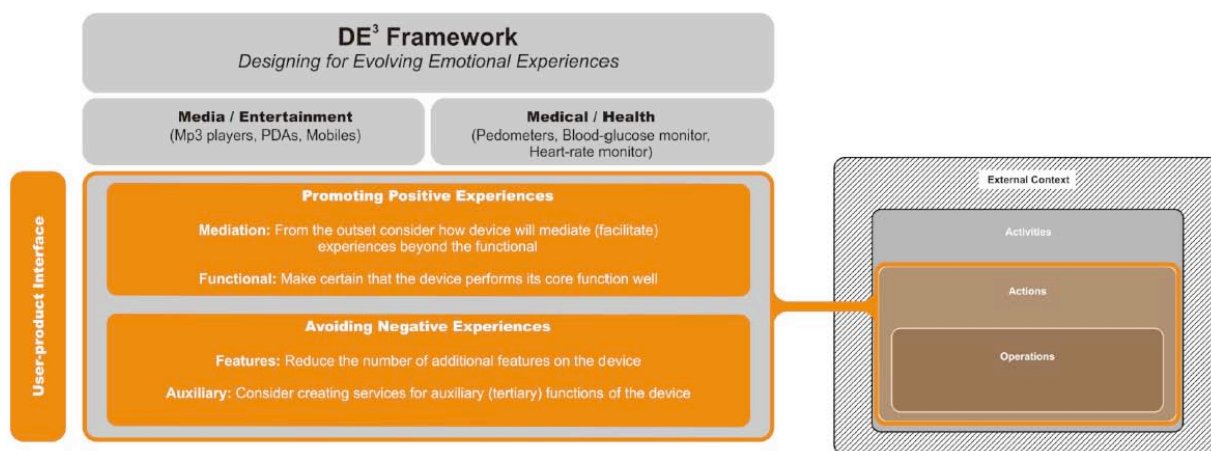

Figure 7. Micro-level within Activity Theory model: Findings relevant to Categories with Mediation and Functional (top) and Features and Auxiliary (bottom)

The final step in completing the framework is to integrate the two levels. Figure 5 completes the framework by combining the micro and macro-levels to form a holistic relationship between them and providing recommendations. These recommendations and principles are derived from the findings discussed in this section within the context of the Activity Theory model.

5. Preliminary Trial of DE^3 Framework

The aim was to trial the DE^3 framework with the objective of analysing its effectiveness, efficiency and usefulness in relation to assisting in the development of initial concepts taking into account emotional experiences. The outcomes of the trial included written responses on the questionnaire regarding the framework, as well as sketches of concepts based on the findings and recommendations outlined in the framework.

5.1 Participants

To validate the DE^3 framework a preliminary trial was conducted with five participants who were experienced practicing industrial designers. A convenience sample of colleagues from industry were recruited for the trial. Four participants were provided the trial via electronic mail while one was conducted at the People and Systems (PAS) Lab at the Queensland University of Technology.

5.2 Method

The trial involved providing the designers with a scenario in which they were to develop two initial concepts, one for media (Mp3 player, PDA or mobile phone) and medical (Blood-glucose monitor, Heart-rate monitor or Pedometer) using the DE^3 framework. First, the participants were provided with information and a brief explanation of the task. Participants were asked to read and review the recommendations on the DE^3 framework and apply them to their conceptualisation process. They were given 30 minutes to perform the trial. Once two initial concepts were considered the participants were asked to answer the questionnaire provided. The questions focused on gathering information to determine (i) the effectiveness of the framework, (ii) how easy the framework

was to use, (ii) how the framework facilitated the task, (iv) did the framework introduced new knowledge regarding emotional experiences, and (v) the overall rating of the framework in assisting with concept development.

5.3 Outcomes

Some common themes regarding the DE^3 framework were outlined in the responses from the questionnaire provided. These include; (i) ease of use of the framework, (ii) the effectiveness of the framework in focusing on the personal and social contexts and (iii) positive rating of the framework in assisting with concept development.

(i)   First, the questionnaire asked the participants to outline the framework's ease of use through a five point likert scale ranging from very easy to use, easy to use, moderate, difficult to use, very difficult to use. One participant identified the framework as moderate, three identified the framework as easy to use and one identified the framework as very easy to use. For a preliminary trial this is encouraging, especially given the participant's experience. Nevertheless, as this is a preliminary trial, the responses leave room for improvement.

(ii)   Second, one clear theme from the respondents was the positive response to the macro-level recommendations in providing a different way of thinking about developing concepts for emotional experiences. As one participant commented:

It allowed me to come [at] the problems from the perspective of personal vs social contexts, and how these contexts contribute to the overall experience.

With this response, the participant identified how the framework permitted him to consider personal and social contexts and how they influence the experience. It suggests that without the framework specifically identifying these two contexts, he would not have considered them both at this early stage of concept development. Likewise, another participant commented how the framework permitted him to consider these two contexts:

... looking at the framework got me thinking about how with media/entertainment products there's a certain amount of user pride/identity tied up in owning and using a product. As such users are willing to be a bit more forgiving of flaws in the product and a bit more willing to learn [to] work around these flaws provided they aren't displayed in public in a way that might embarrass. Given that the user's personal identity is tied up in the product a perceived flaw in the product might be seen to reflect a flaw in the user. With medical products it's more important that they just work. The user may see them more as tools than as extensions of identity.

In this instance the participant's response explored the idea of personal and social contexts deeper and what it means for product development. The response also outlines the difference between the two device categories and how that might influence the concept development of each PID type. These responses are encouraging for the use of the framework in facilitating designers in developing initial concepts based on emotional experiences, especially in relation to personal and social contexts.

(iii)   Third, the final outcome identified from the responses was the positive rating of the framework by all participants. The responses relate to the final question that asked how the framework is rated with regard to assisting designers to develop concepts targeting emotional experiences. One participant identified:

I rate it as an effective design tool to help consider the emotional implications of contextual and interaction experiences.

Here, the participant identifies the framework as useful in considering emotional experience at both levels, the contextual (macro) and interaction (micro) levels. Similarly another participant comments:

I think it's great and would rate it highly… It's very easy just to start by thinking of technology and functions rather than thinking about the people using it.

Here the participant not only outlines the positive rating but also suggests that the framework assists in considering people and their needs first and foremost rather than the technological or functional aspects of the device. And a third participant identified the following:

The framework is great as another way to think about how a product should be designed. When used it should result in better products, that consider emotional experiences… Thinking about the personal and social contexts ensure[s] that multiple scenarios of use are considered, and the most appropriate solution for both is reached.

Once again this response highlights the positive rating of the framework overall. It indicates that the identification of personal and social experiences (and the differences for each type) is helpful in the process of concept development. As all these responses show that participants felt that the DE³ framework was useful for thinking about concept development for both PID types. Further, the responses also suggest that the framework permitted them to consider other broader aspects that would otherwise go ignored during concept development.
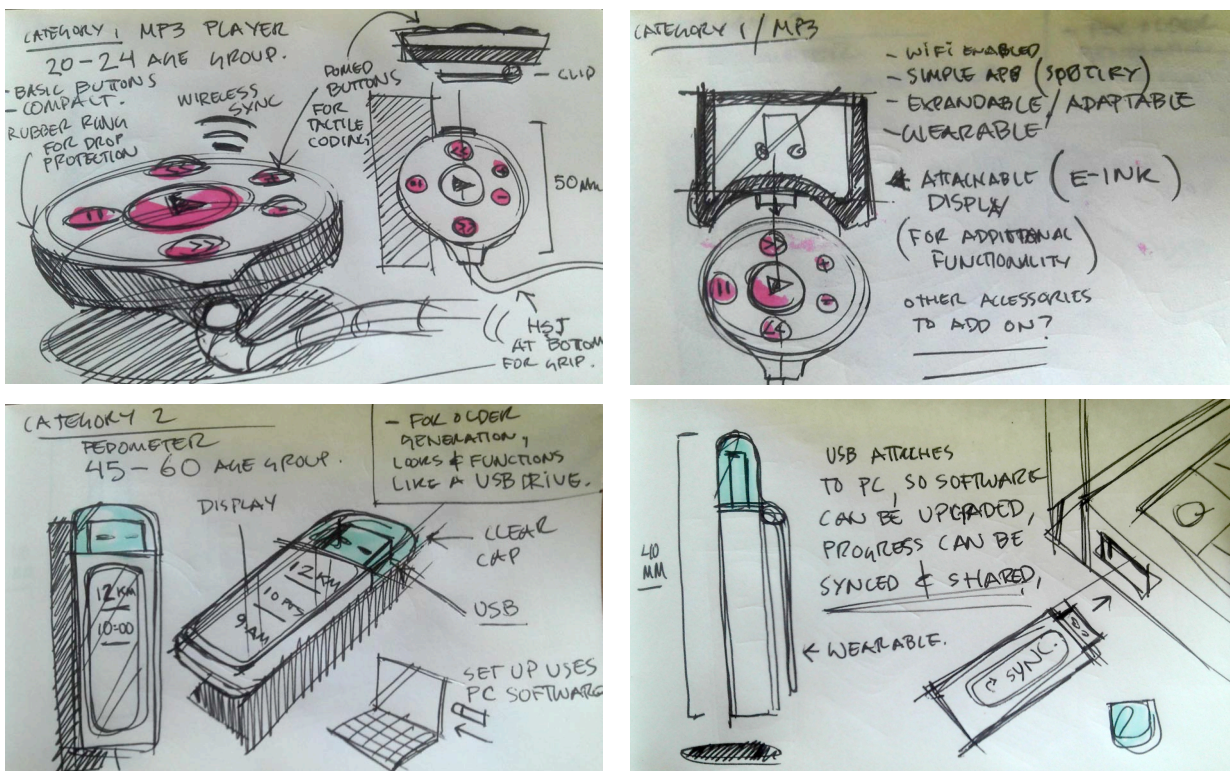

Figure 8. Images of concepts for MP3 player (top row) and pedometer (bottom row) based on DE³ Framework

To exemplify, the design concepts from a participant are included showing the results from the experiment based on the information and recommendations in the framework (Figure 8). The drawings show one concept for an Mp3 player designed for the 20-24 age group and one concept for a pedometer for the 45-60 age bracket. As the drawings demonstrate, the designer applied some of the recommendations in the framework to develop the concepts. These mainly include the micro-level recommendations. For instance on the Mp3 concept notes such as "basic buttons" and "simple apps" (applications) indicate a focus on the core function of the device, which falls under the recommendations regarding the Functional Category.

Comments and notes such as "rubber ring for drop protection" and "wireless sync" suggest consideration for tertiary interactions of the device including the product being damaged and updating the device software automatically, which fall under the recommendations for Auxiliary Category. Likewise for the pedometer drawings comments and notes including "USB attaches to PC, so software can be upgraded, progress can be synced and shared" is also a consideration for Auxiliary Category. These notes and comments on the concept drawings lend further support that the framework was useful for the designer to focus on certain aspects, especially regarding the micro-level interactions with the device.

Overall the feedback from the preliminary trial of the DE^3 framework was encouraging. The responses on the questionnaire and the concept drawings suggest that the framework was accessible, rated highly and most importantly permitted the participants, all experienced industrial designers, to consider and think about concept development of PIDs for emotional experiences.

6. Discussion and Future Directions

There are several important contributions to the field of design arising from the development and trial of the DE^3 framework. The Designing for Evolving Emotional Experiences (DE^3) framework provides a set of principles and guides regarding the design of evolving emotional experiences between user and device in real life contexts. This can be considered as advancement on the current frameworks and models available in literature [1,7,8] in respects to emotional experiences. Further, there appears to be no frameworks available specifically dealing with PIDs, which are unique in that they are specifically used in varying contexts and social as well as personal situations. As such the DE^3 framework is an addition to the existing range of frameworks and models available.

Additionally the framework has the capacity to be transferred to other PID types and other research domains regarding understanding evolving emotional experiences in context. The trial conducted suggests the framework is relatively easy to use for concept development although there is room for improvement. The trial also indicated that it was effective in focusing the designer on aspects relating to personal and social contexts of use, which are important in influencing the emotional experience of interaction. Finally responses from participants indicated that the trial was rated positively by professional designers and suggests that it would be useful for concept development in regards to emotional experience of PIDs.

Although some positive outcomes have been highlighted through the trial it is important to note there are opportunities for future development. Firstly, it needs to be tested on more participants to make a useful analysis of the effectiveness and usefulness of the framework. Secondly, the framework needs to be further developed and simplified and make it more accessible for practicing designers. This is a matter of further refinement and iterative

testing. Finally, it would be useful to attempt to test the framework to develop concepts for other PID types to see how transferable the recommendations are across different product types.

7. Conclusion

Two longitudinal experiments were conducted exploring emotional experiences with PIDs over six months including media and medial Portable Interactive Devices (PIDs). Results identifying the impact of negative social and personal interactions on the overall emotional experience as well as different task categories (Features, Functional, Mediation and Auxiliary) and their corresponding emotional responses have previously been reported [2,3,4,5]. This paper outlines the development and trial of the Designing for Evolving Emotional Experience (DE^3) framework that helps to promote positive (and deal with negative) emotional experiences with PIDs including describing set of principles to better understand emotional experiences. This model was developed based on findings from previous research conducted by the authors [2,3,4,5]. To validate the DE^3 framework a preliminary trial was conducted with five practicing industrial designers. The trial required them to consider initial concepts using the DE^3 framework as a basis followed by a questionnaire asking about their use of the framework for concept development. Common themes regarding the framework are outlined including (i) ease of use of the framework, (ii) the effectiveness of the framework in focusing on the personal and social contexts and (iii) positive rating of the framework. Overall the feedback from the preliminary trial was encouraging with responses suggesting that the framework was accessible, rated highly and most importantly permitted designers to consider emotional experiences during concept development. It is hoped that the framework represents a significant step forward in understanding emotional experiences in the field of design, specifically for PIDs; and a useful point of reference to assist designers in developing more appropriate design that take into account emotional experiences

8. References

[1] Desmet, P. (2002) *Designing emotions*, Doctoral Dissertation, Technical University of Delft, The Netherlands.

[2] Gomez, R., Popovic, V. & Blackler, A. (2009) *Emotional experience with portable interactive devices*, in IASDR 2009 Proceedings.

[3] Gomez, R., Popovic, V. & Blackler, A. (2010) *Emotional experience with portable health devices*, in Proceedings 7th Int'l Conf on Design and Emotion.

[4] Gomez, R., Popovic, V. & Blackler, A. (2011) *Categorising emotional experiences with portable interactive devices*, in IASDR2011 Proceedings.

[5] Gomez, R., Popovic, V. & Blackler, A. (2012) *Positive emotional experiences with portable interactive products*, im Proceedings 8th Int'l Conf on Design and Emotion.

[6] Hassenzahl, M. (2004). *The interplay of beauty, goodness and usability in interactive products*, Human Computer Interaction, vol. 19 no. 4, pp 319–349.

[7] Karapanos, E., Zimmerman, J., Forlizzi, J. & Martens, J-B. (2009) *User experience over time: an initial framework*, in CHI '09 Proceedings, ACM, pp 729–738.

[8] Khalid, H. & Helander, M. (2006) *Customer emotional needs in product design*, Concurrent Engineering-Research and Applications, vol. 14, no. 3, pp 197-206.

[9] Nardi, B. (1996a) *Activity Theory and Human-Computer Interaction*, Nardi, B. (Ed.), Context and Consciousness : Activity Theory and Human-Computer Interaction, MIT Press, USA, pp 7-16.

[10] Nardi, B. (1996b) *Context and Consciousness : Activity Theory and Human-Computer Interaction*, MIT Press, Cambridge.

[11] Petersen, M., Madsen, K. & Kjaer, A. (2002) *The Usability of Everyday Technology: Emerging and Fading Opportunities*. ACM Transactions of Computer-Human Interaction, vol. 9, no.2, pp 74-105.

[12] Stelmaszewska, H., Blandford, A. & Fields, B. (2005) *Emotion and technology: an empirical study*, Peter, C., Beale, R., Crane, E., Axelrod, L. & Blyth, G. (Eds), Emotion in HCI: Joint Proceedings of the 2005, 2006, and 2007 International Workshops, pp 48-53.