Emotional Experience with Portable Interactive Devices

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Abstract: This paper reports on a six month longitudinal study exploring people's personal and social emotional experience with Portable Interactive Devices (PIDs). The study is concerned with the experience design approach and based on the theoretical framework of Activity Theory. The focus is on emotional experiences and how artefacts mediate and potentially enhance this experience. The outcomes of the study identified interesting aspects of PID interaction. Findings revealed people interact with PIDs emotionally both at a personal and a social level, supporting previous studies. Further, the social level impacts significantly on the emotional experience attained. If negative social experiences exceeded negative personal experiences the emotional experience was constant over six months. If negative personal experiences surpassed negative social experiences the emotional experience was varied over six months. The findings are discussed in regards to their significance to the field of design, their implication for future PID design and future research directions.

Key words: Experience, interaction, design, emotion and longitudinal research

1. Introduction

Emotions are central to human experience. Whether consciously or not emotions filter people's thoughts, behaviours, attention, perception, memory and decision-making through our everyday activities. It is through these diverse interactions that humans experience moments of frustration, heartache, joy and delight.

Contemporary electronics are small enough to add unprecedented functionality and versatility to an array of portable devices. These include mobile telephones, portable music players, personal digital assistants, portable medical devices and many others. These portable interactive devices (PIDs) pose an interesting challenge as they are designed to be transported and utilised across a variety of locations and situations. They also present new means of interacting with the world; influencing the way people relate with entertainment, news, information and a whole subset of personal and business communications [6,16,19]. PIDs were promoted as opening up entire new worlds of excitement and life-changing opportunities; "…while the computer of yesterday was occupied with crunching numbers, today and tomorrow's technology will be occupied with maintaining our social contacts with one another" [36]. Has this vision come to pass? A possible answer to this question can be found in statistics dating from the early years of mobile telephone research. As Jones and Marsden [19] report, the use of very advanced technology such as WAP (wireless application protocol), video calling and mobile payment schemes failed while the use of very basic applications such as voice calling and text-based messaging thrived. Why would these very advanced, supposedly appropriate and useful applications fail while the basic ones

succeed? The answer; the latter "meet basic human desires in simple, direct ways" [19]. From this perspective it is critical to understand how artefacts, especially PIDs, are to be designed to fulfill and meet these needs. This is not only relevant for design but also for branding and marketing, business, engineering and IT fields, which play a crucial role in the future success or failure of PIDs. To achieve this, a study on how these products fit within the broader social and emotional context of everyday is necessary. When considering these aspects of interactions the starting point should not be *"how can this device make the life of the person more enjoyable?"* but rather *"what type of experiences make people happy in everyday life?"* followed by *"how can the device/s facilitate or enhance these experiences through everyday use?"*. This shifts the focus away from the product and draws attention to the people and the activities they wish to undertake. Picard and Wexelblat [30] support this view by outlining "systems that ignore the emotional components of human life are inevitably incomplete and inferior" [30]. The fundamental step in making new technology usable, practical and ultimately enjoyable involves investigating and understanding people and their experiences with artefacts in everyday situations; and designing the artefacts based on that critical understanding [24].

2. Background

Despite the advent and proliferation of PIDs within society research focusing on emotions combined with contextual and longitudinal factors with PIDs appears to be limited with the exception of the mobile telephone [1,18,19,23, 28,31]. Stelmaszewska, Blanford and Fields [35] studied peoples' experiences and emotions when using technology; including PDAs, mobile telephones and MP3 players. Although interesting aspects in relation to the social dimension of interaction were reported, the research did not appear to have methodologically recorded or documented the longitudinal aspect of interaction. Another study conducted by Geisler and Golden [13] reported on results from structured interviews conducted with PDA users. In this case neither the emotional reaction nor the longitudinal aspects of use were specifically observed. This study aims to bridge the gap found in the available literature in respect to PIDs including portable music players (MP3 players) and personal digital assistants (PDAs). The approach reflects experience design [5,27,34] and the work conducted by Dourish [9] whereby the concern is not purely the physical interface of the products or its usability aspects but rather the ways in which they are experienced in everyday contexts. As such, the research centers on exploring emotional interactions with PIDs in real life contexts over time. The research objectives include: (i) focusing mainly on the **emotional** aspects of interaction; (ii) situating experiences within **real life contexts** and situations and (iii) observing these evolving emotional experiences **over time.** The aim is to enable designers to better understand how to support and enhance the evolving emotional experience between people and PIDs.

3. Theoretical Framework

Researchers in design and human-computer interaction fields have suggested that studies relating to the human – artefact relationship have previously been based on cognitive psychology [2,17,25]. This approach has been criticised for reducing the user-artefact interaction to minuscule levels, forgetting about the broader aspects of interactions [4] leading to research that overlooked critical and relevant aspects of interaction including context, emotions and interactions over time [12].

To appreciate interactions between people and artefacts in context Activity Theory has been considered as a theoretical framework. Activity Theory stands on the premise that artefacts are mediators for human experience [25]. It attempts to deal with engagement in a real world context, rather than abstract ideas about interactions. Activity Theory argues that interactions must be situated within a framework that takes varying interrelationships into account. As such, understanding how people perceive and act in these real life contexts is crucial and forms the basis for understanding how they interact with their world, including artefacts [22]. Artefacts become the means to an end, not the end itself and as such are appropriately viewed simply as mediators for human experience. There are several issues from activity theory that are taken into account: (i) the need to focus on activity through time; (ii) activities occur within a context and (iii) people are not merely agents in a system, they have motives/intentions/emotions. Conceptually, Activity Theory talks about activities being composed of three levels with activities sitting at the highest level, composed of actions, in turn composed of operations [22]. This model explains a complex interaction dynamic in a simple format. For instance to make a call with a mobile telephone a number is dialed (*operations*), a conversation ensues (*actions*) and a message is communicated (*activity*). The model also takes the dynamic nature of activities into account. For instance if in the attempt to make the call the mobile telephone does not function then the *activity* changes to finding out what the problem is, while the *action* may involve looking for error messages or checking if the device is on, and *operations* include pressing buttons and so on. This highlights the fact that activities are neither static nor one-dimensional. Activities exist on multiple levels simultaneously consisting of a global (or macro) level and a local (or micro) level [14]. In relation to this study the global-level is composed of the overall emotional experience over the course of six months, while the local-level is composed of the multitude of experiences recorded throughout that time. This perspective has certain implications for this study, which will be discussed in more detail in section 5.

4. Portable Devices in Everyday Contexts: A longitudinal study

An investigation was conducted exploring the emotional experience of interacting with portable devices in everyday use. One of the primary aims of this research is to observe what types of factors influence the emotional interaction with portable devices. The objectives of the investigation include: (i) seeing whether there are different relationships with PIDs over the course of time (six months); (ii) determining the critical factors influencing the overall emotional experience of utilizing PIDs and (iii) Outlining how these factors influence the overall emotional experience in a positive/negative way. This paper reports on an experiment that studied participants who utilised MP3 players and PDAs over the course of six months. Results from the investigation provide data to better understand how to appropriately design future portable devices to support positive (and avoid negative) emotional experiences in everyday situations.

4.1. Data Collection and Methods

The investigation centered on recording experiences with PIDs in everyday life over the course of the initial six months of use. The intent was to capture initial stages of interaction and observe how much the experience and relationship evolved over time. Nine participants were involved in the study; six used MP3s while three used PDAs. There is literature to support using anywhere between 5-10 participants to collect enough data for the validity of studies relating to portable computing [26,29]. Only users with no more than two months experience with the portable device were recruited; thus attempting to capture the initial stages of interaction and how it

evolved over the initial six months of use. Data collection methods consisted of diaries, interviews and co-discovery. The triangulation approach helps to make the research and results more reliable and valid [7,32] and increases the theoretical generalisations emerging from the study [11]. The investigation was divided into the following four stages: initial interview, participant diaries, intermittent consultations and co-discovery. All data were recorded, transcribed and analysed using Atlas.ti software.

4.1.1. Initial interview

The initial interview (15-20 minutes) was the first step of the investigational procedure. This entailed meeting the participants and explaining their involvement in the study. This interview centered on: (i) gaining knowledge about the participant's expectations of the product; (ii) emotions felt towards the product; (iii) the expectation of the benefits it might provide; and (iv) the expectations of possible challenges the device might present.

4.1.2. Participant diaries

The diaries were used by participants to record relevant interactions with the products as they experienced them over six months. They were asked to fill out the diary once a week. The structure of the diary provided for up to three experiences per week. Participants were asked to reflect primarily on the emotional experiences with the product during interactions by answering the following questions: (i) context of interaction (location/time/date); (ii) activity performed (purpose of use); (iii) who was present during interactions (alone/other people/crowd) and (iv) summary of their perception of the emotional experience (perceived emotional reaction to experience). The participants recorded the main details of their interactions with the product and rated the overall emotional experience using the Emotional Chart [15]. The Emotional Chart is based on Russel's [33] model of Core Affect and has been used effectively as a self-reporting tool in other studies investigating design and emotions [8,10,14].

4.1.3. Intermittent consultations

Between 5 and 8 intermittent consultations (semi-structured interviews) were conducted with participants over the six month period. The interviews took 15-20 minutes on average, and were recorded through audio and note-taking. Between two and three consultations were performed in the first month followed by one a month for the remaining five months. The purpose was twofold; regularly check any problems with the diary and record more detailed information about the experiences. Participants were asked: (i) on average how often have you used the product? (ii) how would you characterise your feelings towards the product? (iii) what have been some of the positive aspects? (iv) what have been some of the negative aspects of using the product? and (v) did the surrounding context (environmental or social) affect the use of the product in a positive or negative way?

4.1.4. Co-discovery

The final part of the study involved a co-discovery session between two and three participants. This part of the investigation focused on how their expectations in the beginning changed as their experiences with the products evolved over the six month period.

5. Coding Scheme

The data analysed were the diary responses obtained throughout the six month period involving up to 194 individual experiences for the nine participants. This was analysed using content analysis technique [3, 20]. To assist in contextualising the findings the data sets were split into two categories. Firstly, data relating to specific activities within the overall six month timeframe are referred to as local-level interactions (Section 3). For instance, a participant using the MP3 player to listen to a song on a train would be an example of a local-level experience and could be analysed independently. Alternatively, during the interviews a participant may be asked how he/she felt about the product over the previous month and their response would be characterised as a global-level experience. As such, these global-level experiences were composed of many local-level interactions throughout. Table 1 shows the relationship between data gathering techniques and how data was categorised.

Table 1. Global-level and local-level experiences

Data collection and Methods	Global-level experiences	Local-level experiences
Initial interviews	✓	
Diaries		✓
Intermittent interviews	✓	
Co-discovery	✓	

5.1 Global-level Experiences

The first aspect analysed was the overall emotional experience reported by the participants across time (global-level interactions). This was performed by analysing the interviews conducted over six months. During the interview participants were asked to characterise their emotion toward the product. Figure 1 is an example from Participant 7b showing the global-level experience captured over the six month period. The X axis represents the participant's emotional response during the interview ranging from intense negative through neutral all the way to intense positive mirroring the quadrants represented on the emotional chart [15]. The Y axis is denotes time in months. Each point represents the participant's emotional description during the interview. For example, during the sixth interview (month 4) the participant was asked how she felt about the product at that stage and her response was: "*I would say it's a nice object, it works well, I like it but I don't feel anything*". This comment reflects a characteristic example that was coded as positive in valence one step up from neutral. As such, it was "neutral positive" on the graph. Figure 1 represents Participant 7b and the emotional experience over time. The flatness of the line reveals that the participant has recorded the experience as overall constant across six months.
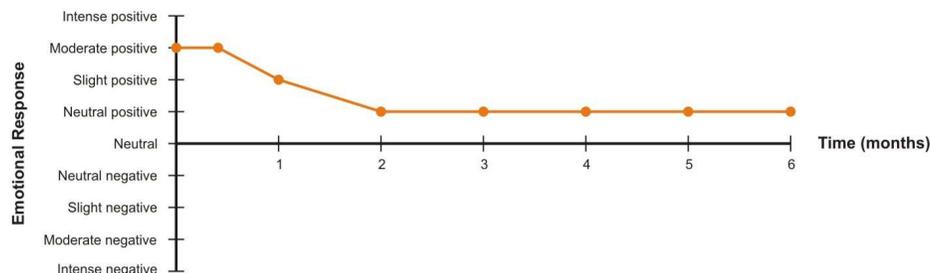

Figure. 1 Global-level: overall experiences plotted across time

5.2 Local-level Experiences

The local-level experiences were identified using the diary responses (Section 5). The diaries permitted up to three experiences a week over the six month period to be recorded. Participants were asked questions about their experiences such as; *who else was there and did their presence affect your use?* and *how did you feel about this experience?* The responses for the question; *who else was there and did their presence affect your use?* were coded and separated into personal and social interactions. "Personal" interactions referred to activities performed in private or where other people nearby did not influence their experience. "Social" interactions referred to activities in which the presence of other people was perceived as affecting the experience. For instance, on one occasion Participant 7b responded: *"My spouse* [was present]*, and he affected my thoughts about my use…"* This particular response was coded as "social" since another person was present and affected the experience. In another example Participant 7b reported: *"no-one else was present"*. This was coded as "personal" as no-one else was present during the interaction. These responses represent prototypical examples of these two questions from the diary responses.

6. Personal and Social Interactions

Once the diaries and interviews were performed the findings were examined to determine the relationships between the local-level and global-level interactions. Preliminary analysis of the local-level data strengthens the idea that PIDs are used both at a personal level and at a social level. To date 194 experiences have been analysed. Out of these, 65% (126 experiences) were noted as being personal while 35% (68 experiences) were noted as being social (Figure 2). Figure 2 indicates that overall participants identified just over a third of their experiences as social over the course of six months. Although personal interactions outweighed social interactions the influence of social interactions was found to be central in influencing the overall emotional experience.
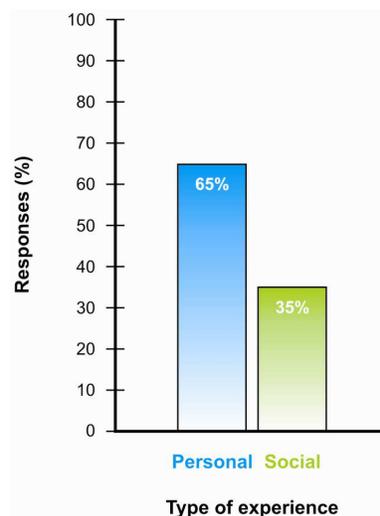

Figure. 2 Total percentage of personal and social interaction reported by all respondents

6.1 Effect of Social Interactions

Analysis has revealed an interesting aspect regarding the significance of social experiences and their relationships to the overall emotional experience at a global-level. When the personal and social experiences

were divided into positive and negative emotional valence a relationship was discovered between the overall emotional experience perceived by the participant and negative experiences. For example, if a participant reported more negative social experiences than negative personal experiences the overall experience as plotted along a timeline became flat and constant over time. On the other hand, if a participant reported less negative social experiences compared to negative personal experiences the line plotted along the graph became more varied and irregular. This relationship was consistent across all nine participants.

This relationship suggests that negative social experiences over the course of time have a distinct influence on the overall emotional experience, while negative personal experiences do not appear to have the same effect. Figures 3 and 4 illustrate this particular phenomenon and are typical of all responses. The nature of the participant's experience over the course of time is plotted on a graph alongside the corresponding reported personal and social negative experiences. Figure 3 compares the global-level experiences of participant 4a and 5b and illustrates how the experience is particularly different over time. Figure 4 highlights the difference between the negative emotional responses for the participant 4a and 5b in regards to personal and social interactions.
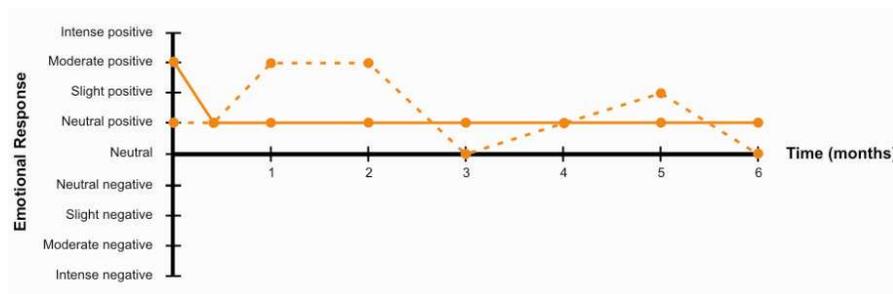

Figure. 3 Global-level experiences: Participant 4a (full line) and 5b (dotted line) overall experience
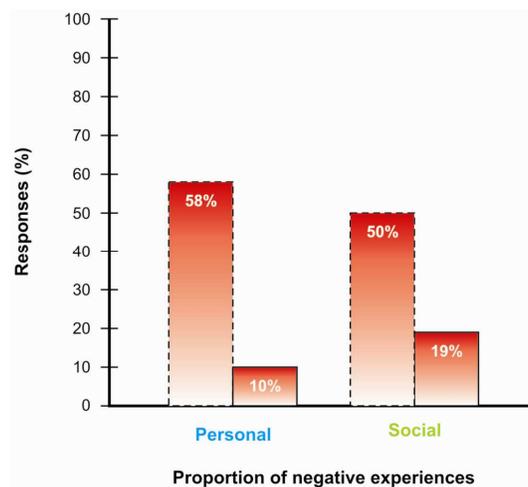

Figure. 4 Local-level experiences: Participant 4a (full line) and 5b (dotted line) negative experience at a personal and social level

Figures 3 and 4 demonstrate that if participants experiencing relatively more negative social experiences (Participant 4a – dotted line) than negative personal experiences the overall experience appears to become flat over time. In other words, as time goes on there is little change in regards to the emotional experience perceived

by the participant. The same relationship is not observed when negative personal experiences outweigh negative social experiences (Participant 5b – full line). In these cases, the emotional experience over time becomes varied and inconsistent.

7. Implications for Design

Merholz et.al. [24] address the importance of the overall experience of interaction over time for the success of businesses to connect with their customers on an emotional level. They identified the critical ingredient in creating meaningful experiences between people and artefacts is to create "wow" moments over time; "…create moments of "WOW!" over and over again, it bonds with customers at a level far beyond the realm of gold-colored plastic cards" [24]. They refer to experience and focusing on the overall experience to create these moments of interest again and again. They argue that interactions that are consistent become boring and limited, whereas an experience that is varied over time can help create an interesting and engaging connection with the user at an emotional level.

In relation to this paper two findings from the study are reported. Figure 2 demonstrates that PIDs are used for personal as well as social interactions further supporting other studies conducted in this area using similar types of devices [35]. Figure 3 and 4 support the importance of social interactions on the overall emotional experience. It was noted that if more negative social experiences were reported compared to negative personal experiences then the overall experience over time became flat. This did not change regardless of how many actual experiences were recorded. The same did not apply if the negative personal experiences outweighed the social. In these cases the emotional experience varied over time. The design of PIDs needs to take this into account, as any negative social interaction experienced by users appears to distinctly impact unfavourably on the overall experience [24]. The social theory of emotion offers an explanation for this phenomenon [21]. This theory suggests the idea of self is nothing if not for social interactions. Emotions occurring at the social level are of primary importance for the development of how people perceive themselves and how they interrelate with the surrounding world. As such, emotions experienced in social settings are crucial to people's perception of everyday interactions over time. PIDs are indeed personal but more importantly there exists the social dimension which impacts considerably on the emotional experience perceived by the user. These findings combined with the perspective outlined by Merholz et.al. [24] offer an interesting direction for designers; if the rationale is to mediate positive emotional experiences over time, the intention is to create a varied experience and moments of "wow" over time. When considering PIDs negative social experiences need to be avoided as they tend to influence the overall emotional experience in a contrary fashion.

8. Conclusions and Further Work

Emotions are central to everyday experiences including interactions with surrounding products and devices. An interesting and challenging area for investigation is people's emotional interaction with portable interactive devices (PIDs). This paper reported on a study that explored people's emotional experience with portable interactive devices (Portable music players and Personal digital assistants) over the first six months of use. The users and their emotional experiences with products in everyday settings was the fundamental starting point. The investigation conducted revealed the social dimension of interaction with PIDs is critical in determining the

overall emotional experience over time. When considering the overall experience the intent is to create moments of "wow" over time [24]. Findings suggested that if negative social experiences outweighed negative personal experiences then the overall experience was perceived as invariable over time. Consequently it is important to consider how the design of PIDs will influence the social dimension of interaction as any negative experiences on a social level will be counter-productive to the overall experience perceived by the user. This particular finding is a significant contribution to the area of design and emotion and for the design of future PIDs, especially in regards to how people interact with these devices over time in real life contexts.

Further analysis can now be performed on the data to identify additional relationships at all levels of interaction. This includes looking at the local-level of interactions to determine what extent elements like context, setting, time of day and type of interaction impact on the overall emotional experience. To complement the reported study, a similar investigation is currently being conducted with participants using portable medical/health devices including pedometers and heart-rate monitors. The intent is to compare and analyse the two sets of findings between these groups to determine what relationships occur between the two different product types. It is predicted that some interesting trends about peoples use with portable devices will be revealed.

9. Acknowledgement

10. References

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