

Affective experiences in the Home: measuring emotion

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Abstract

Examples of home applications related to leisure activities and playful consumptions are interactive television programmes, recreational shopping or home music services. Such applications produce emotional experiences enjoyed for their own sake. A number of studies have shown the limitations of traditional evaluation methods like usability for affective applications. As few studies related to emotion assessment could be found in human-computer interaction we turn to the field of consumer behaviour to find appropriate methods. We review and discuss these methods within the framework of affective home applications. The field of consumer behaviour has also highlighted another important aspect related to emotion and affective applications: emotional characteristics of users. Individuals differ in their way of apprehending and reacting to emotions. As, it has some consequences for the evaluation of affective applications and user preferences, individual measures of emotion such as affect intensity are discussed.

The purpose of this paper is to facilitate the development of affective applications, by describing theories and studies relevant to the evaluation of these applications. We address here, one specific issue the assessment of emotions. In this way it is hoped that methods related to the evaluation of emotions will prove useful to researchers and practitioners interested in the development of affective applications.

1 Introduction

In this section, we present examples of *affective* home applications, in relation to three areas play, social interaction and domestic life. We highlight the relation of these applications to emotions, and discuss methodological issues related to evaluating emotions.

1.1 Affective Home applications

Home applications have been undergoing a rapid expansion and diversification. They have first benefited from better Internet connection, then from the development of integrated home networks and emerging technology such as ubiquitous computing. At home, people can work or play. A large part of home applications are thus dedicated to leisure activities and playful consumptions, producing experiences enjoyed for their own sake for sensory pleasure, stimulation or emotional playoffs.

We focus here on this aspect, affective experiences, and thus present examples of home applications connected to three main areas: augmenting play, enhancing social interaction and making domestic life more pleasurable.

Interpersonal communication has been found to dominate the residential use of the Internet (Kraut and co., 1998). Humans are social creatures finding human presence and communications essential for the enjoyment of life. Familyware provides specific support for small and intimate communities. It supports feelings of connection with simple signals (i.e. via an ubiquitous jewellery). These applications are focusing on the maintenance of emotional relationships with extended family members (Go and co., 2000). Another related example is the multimedia family tree embedded in an interactive photo frame. The interactive frame is connected to a home network and enables the display of family pictures. Besides, it can act as a reminder for special occasions like birthdays (Lambourne and co, 1997). Other examples of social computing applications are interactive toys and virtual pets. They enable the simulation of social activities and provide emotional comfort to their owners.

There are numerous examples of home applications related to play, especially for computer and network games. Computer entertainment can provide humans with enjoyment by allowing virtual fantasy and imaginative play activity to be carried out. A review of these applications is beyond the scope of this paper, however new developments for novel game spaces are based on the inclusion of real world elements within the virtual games (Cheek and co., 2002). Another form of a popular entertainment is television and its extension interactive television (ITV). Examples of successful applications are interactive television gameshows ranging from sports to cooking (Dormann, 2000). By allowing viewers to participate in a game and playing along a television candidate, an interactive application increases users' involvement and excitement as well as augmenting viewers' fidelity. Interactive teleshopping is a modern form of teleshopping based on vicarious shopping, a form of recreational activity carried out to relieve boredom, and to procure excitement. It often has a social aim (e.g. shopping and comparing products with friends). ITV as television is about emotion, pleasure, and being really compelling.

Computers are embedded in our environment. A well-know example is the interactive fridge that can order milk. Nevertheless, these new types of products are dedicated to increase the well-being of consumers. Such are an intelligent alarm clock sensing your mood (Wensveen and co., 2000), or the emotional container. The emotional container is a gift object, which contains a special electronic message, reminding both giver and receiver of shared memories (Lambourne and co, 1997).

These home applications can generate social emotions (e.g. familyware); they can be an expression of emotional self-awareness (e.g. emotion container), or an object of emotions (e.g. interactive dolls). Moreover they can help to manage emotions by handling and regulating feelings (e.g. ITV or interactive photo frame). We can characterise these applications as affective home applications or artefacts, as emotion is a fundamental element of all these applications. Affective home applications play an important role in people's lives by answering a range of human emotional needs and desires.

1.2 The affective perspective

An important aspect of activities carried in a home environment as we have shown is based on emotions. Humans are affective beings, motivated to action by a complex system of emotions, drives, needs and emotional conditioning in addition to cognitive factors. The role of emotions has been recognised in a number of domains including consumer behaviour, and psychology. However, much of the human-computer interaction (HCI) community has been limited for years to measuring and responding to aspects of human behaviour such as efficiency, or capacity, in this reflecting HCI's major concern with productivity (Picard, 2002). Several authors have recently pointed to the limitations of traditional methods to account and evaluate for emotions. Established usability engineering methodologies have been deemed as ill-suited to emerging applications, like affective home applications (Thomas and Macredie, 2002). To examine this area, understand and measure users' reactions, affective applications require further methodological developments, the operationalisation of several new variables and an extended conceptual framework that can be used to account for all aspects of emotional experiences.

We address in this paper a specific issue, measuring emotions, in order to advance knowledge in this domain,. Measuring emotions refer two topics: methods for evaluating users emotional reaction and methods for measuring individual emotional characteristics. Despite, emerging emotional research in HCI in particular connected with emotional usability or within the field of affective computing, we found few methods or practical studies related to emotion evaluation. Thus, we turn mainly to the field of Consumer Behaviour to find examples of studies related to emotion assessment and to investigate methods for emotion evaluation. HCI can benefit from knowledge gathered in this area, as one of these well-tested methods has indeed proven successful for interactive applications (Dormann, 2001).

In order to understand the importance and impact of emotions generated by the usage of home affective applications, we also need to take in consideration individual emotional differences. The way in which individual apprehend emotions impact their response to emotional stimulus (Moore and Harris, 1994). This has some implications for the evaluation of affective applications, by moderating or enhancing user emotional reactions. Moreover, individual differences could also help to predict user preferences, in determining what type of affective applications or interfaces they might enjoy. The purpose here is not proved the validity of an hypothesis but to discuss, methods for measuring emotional characteristics and show their relevance to affective applications. We hope in this way to initiate further investigation in this area.

In the second section of this paper, we discuss the evaluation of emotions by first reviewing usability and highlighting its limitations for the evaluation of emotions. We briefly define emotions and then review existing methods for assessing emotions by drawing on studies from consumer behaviour. We present three major types of methods: pictorial tools, questionnaires and physiological methods. We further illustrate the application of these methods by referring to a case study related to web design.

In the next section we discuss measures related to emotional characteristics of users. In particular we discuss one measure, the affect intensity measure stating the consequences of emotional variations for affective applications. These measures highlight the role of emotion.

The numbers of works and concerns related to emotion warrant the establishment of an affective framework. Thus to conclude we discuss issues related to such a framework. It is hoped that an affective framework will be of critical interest to practitioners interested in affective applications.

2 Usability and affective applications

The use of computer technology has reached far beyond the office toward the home and community. These technologies have demanded a transformation of methodologies used. In some way, HCI is following the same evolution as consumer behaviour. Consumer behaviour was initially based on information processing theory then extended to hedonistic and experiential consumption, in which the role of affect was fully recognised. Similarly, HCI starts to account for affective experiences. In this section, we briefly review notions of usability discussing the limitations of usability with regard to emotions. Then we present emotional usability and question the adequacy of usability for affective applications.

2.1 Traditional usability and emotion.

We take the concept of usefulness as a starting point for the discussion on usability and emotion. Usefulness includes usability and utility. Utility is the question of whether the functionality of the system in principle can do what is needed and usability is the question of how well user can use that functionality. Usability has multiple components and is traditionally associated with five attributes: learnability, efficiency, memorability, error and satisfaction. Measurement of subjective satisfaction are usually formulated in terms of work and productivity “achieve high productivity” and user experience in term of “pleasant versus unpleasant”.

In recent years, a number of authors have pointed to the limitations of traditional usability for new applications. Jordan (2000) stated that usability is a concept that does not seem to include feelings such as delight, or excitement in its attitudinal component. Contradictory to usability is the principle to foster curiosity by designing a system that is novel or surprising. The emotion of trustworthiness has been emphasised as one of the most important factors in electronic commerce, (Shelat and Egger, 2002). In fact, an interface may elicit a variety of emotions ranging from joy or fear, to trustworthiness or sophistication. Usability does not cover the range of emotions that can be linked to human experience. Within usability, emotion evaluation concerned mostly the unpleasant-pleasant dimension, which is a very limited view of emotion as we will see (3.1).

The context and perspective in which usability was developed can explain this limitation. Applications related to work and organisations are not assumed to produce strong positive emotions. It is assumed that users evaluate the application at the cognitive level (e.g. in term of success with a task, and low rate of errors made while using the application) then users experience satisfaction at the affective level based on the cognitive evaluation of the application qualities. However when something happens to delight users, users will experience strong emotions which then form a significant part or perhaps the only part of their satisfaction. In that case satisfaction is experienced at the affective level, and does not relate to the usefulness or qualities of an application (Krishnan and Olshavskly, 1995). We can presume that a large part of affective home applications (e.g. games) fall in the second category. For the others, emotions form an important part of an application qualities and thus should be evaluated fully.

2.3 Emotional usability, consumer experience and emotion evaluation.

To cover its limitations, usability has been extended to emotional usability. Emotional usability was defined as the degree to which a product is desirable or serves a need beyond traditional functional objectives.

Hassenzahl and co (2000) showed that good usability could be cancelled out by a lack of hedonique qualities. They develop a model for appealing software systems, extending the notion of usability to encompass two groups of quality dimension: ergonomic related to usability and hedonique forming the judgement of appeal and resulting in an emotional outcome.

Similarly, we can extend system acceptability to cover for other emotional aspects. We can extend utility to emotional utility. An entertainment product has high utility if it is fun to use. We can define different types of utility for affective home applications (as seen in paragraph 1.). We can also refer to emotional acceptability to cater for affective applications.

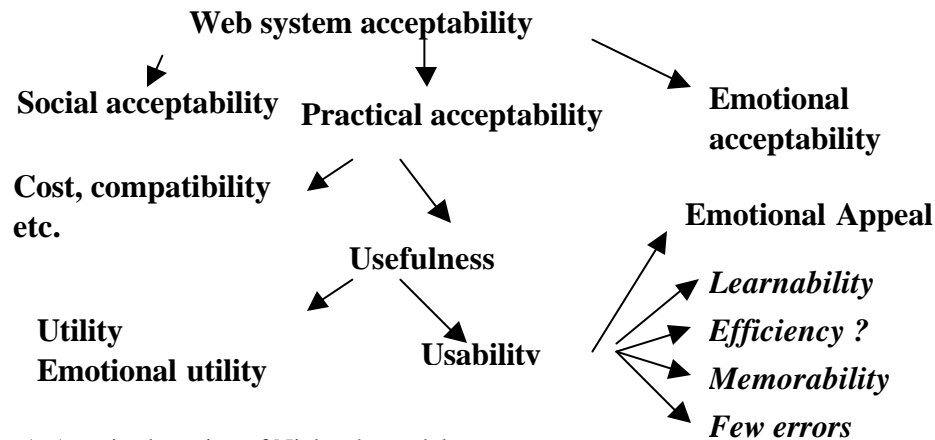


Figure 1: A revised version of Nielsen's model.

As Tractincnsky (1997) showed, earlier HCI positions advocated that the contribution of aesthetics or emotions to HCI should be measured in terms of facilitating information not in terms of engaging the user in pleasing experience. Existing methods thus might not prove suitable for affective application. Usability was motivated by management's desire to improve productivity and it might be that this aim is too grounded in this framework to be fruitful for affective home applications.

We have discussed emotional usability and the addition of other emotional aspects for evaluating affective applications. However further reservations and limitations have been shown with the extended usability framework. Even if we can say people are using an application because they have the goal of reaching a pleasurable state, this has proven awkward and not terribly useful as a guiding approach to design of affective home applications (Karat, 2002). It seems indeed rather strange to define "fun or having fun" in relation to usefulness and utility. Moreover we still need to modify extensively existing methodologies to suit affective applications. Examples concern the data-gathering activities, the way they are set up and what kinds of information are sought. Researchers who have studied the use of home technology have remarked that establishing contacts with home users is more difficult and that different methodologies were needed to gather information (Kjaer and co., 2000).

There are aspects of personal choices and values that cannot be easily subjected to usability engineering approaches of task systems. Besides, we still need to redesign questionnaires as "tell me if you like the experience is quite different from carry out this task" or "does a user feel is working well is quite different from does a user feel elated, active or excited". We still have to find methods that are appropriate for evaluating emotions, an issue which is addressed in the next section.

3 Measuring emotions, emotion evaluation

Emotions are at the core of affective home applications, thus evaluating emotions is an essential element of these applications. We first review definitions of emotions to highlight the complexity of emotions. Then, to find appropriate methods for evaluation as well as relevant studies, we turn to the field of consumer behaviour. Following the analysis of the literature, we have categorised these methods in three groups: physiological, questionnaires and adjective checklists, and pictorial tools.

3.1 Defining emotions

Attempts to define the concept emotion (feeling, aesthetics, or passion) originated in the domains of religion and philosophy. Taxonomies given historically by philosophers such as Aristotle, Descartes and Kanto were all in the forms of discrete emotions and they emphasize the variety of human emotions.

Emotions have been defined as states of emotional feelings or as feeling states involving positive or negative affective valence (Fridja, 1988). Emotions represent motivational phenomena with characteristic neurophysiological, expressive, and experiential components (Hirschman and Hollbrock, 1982). Emotions are complex, organised states consisting of cognitive appraisals, action impulses and patterned somatic reactions. Mood is often seen as long term emotion.

Tomkins (1962) suggested that there are eight basic emotions: fear, anger, anguish, joy, disgust, surpass, interest and shame. Other emotions are derived from mixing these basic emotions, for example fear mixed with surprise yields awe. Some authors have been less concerned with the existence of basic emotions and instead refer to continuous dimensions of emotions. The two most common dimensions of emotions are arousal (calm/excite) and valence (negative/positive). The circumplex model (Figure 2), consists in a circular structure around which names for categories blend into another in a continuous form without beginning or end (Russell, 1980). Terms closer to being synonyms (happy delighted) are closer together on the circle, antonyms (happy and sad) are at opposite end. Unlike a list of emotions, a circumplex model specifies the degree to which categories are interrelated, the horizontal dimension represents the pleasure-displeasure dimension. Mehrabian and Russell (1977) define a framework stressing three analogous dimensions of emotion: pleasure, arousal and dominance constituting the PAD paradigm. All emotions can be derived from their rating on these three dimensions.

Beside, showing the spectrum of the emotional space, it is important to understand emotional representations as some methods for measuring emotions are based on specific models.

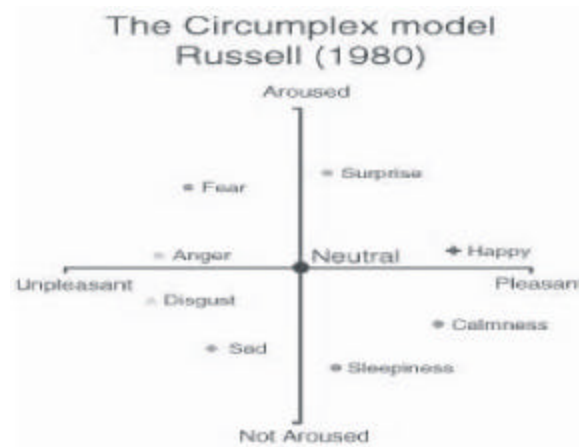


Figure 2: the circumplex model

3.2 Physiologic measures

There are many signals relevant to emotional responses that are physically measurable, especially by cameras, microphones, and sensors. Physiologic measures are derived from the physiologic theories and include the use of measures such as galvanic skin responses (response sweat glands), pupil responses and cardiovascular parameters such as electroencephalograms, etc (Picard, 1998). Another possibility is the use video to record facial expressions. Some of the limitations of these methods are their lack of precision. Moreover it is not always possible to know precisely which emotions are evaluated.

3.3 Questionnaires

Few affective evaluations have been carried out in human computer interaction, however related works include Kim and Moon (1998) and Hassenzahl (2000). By contrast, numerous studies related to emotion evaluation can be found in the consumer behaviour literature. These studies address different aspects of emotion, such as mood (Rustin and Larsen, 1995), affective cognition (Chaudhuri and Buck, 1995), etc. The most common methods used are questionnaires and adjective checklists. Beside, these studies used different types of emotional scale: semantic differential scale, unipolar scale or free labelling.

We are going to present briefly a few examples of these evaluations, which are relevant for home applications. Kim and Moon (1998) interested in measuring trustworthiness presented an emotional evaluation of cyberbanking systems. They develop of taxonomy of 40 semantic scales ranging from awkward to witty. Hassenzahl (2000) develop a model for appealing software systems with 22 scales including cognitive emotional factors derived from usability, such as comprehensible – incomprehensible, familiar-strange, supporting-obstructing and hedonique factors such as aesthetic-unaesthetic, inviting-rejecting, or attractive-unattractive. Hollbrock and O'Shaughnessy (1984) scheme developed to measure emotions in advertisement assess seven dimensions of emotional responses: entertainment, confusion, relevance, favourability, empathy, familiarity, and alienation. We can see some relations between these criteria, Hassenzahl and usability evaluation (confusion, relevance, favourability or familiarity) and although neither empathy nor alienation is generally included in usability.

An adjective checklist was developed also in relation to advertising by Mano (1996). Mano's evaluation was regrouped around seven key notions containing both positive and negative emotions. The check list address a more aesthetic-sensory aspect of emotional experiences and relate to the pleasure (e.g. pleasantness) and arousal dimension (e.g. arousal) of emotion.

Arousal: Astonished, surprised, aroused.

Elation: elated, active excited

Quietness: quiet, still, quiescent

Boredom: Sleepy, sluggish, Drowsy.

Pleasantness: pleased, satisfied happy.

Calmness: calm, at rest, relaxed.

Unhappiness: Unhappy, sad, blue,

Distress: anxious, fearful, nervous.

As we can see these questionnaires vary considerably in the scope and range of emotion assessed. They highlight to two different aspects of emotions cognitive versus emotional reactions (or aesthetic-sensory). It is thought that Mano's checklist might be more suited to the evaluation of applications like ITV programmes or games. While Hassenzahl or Hollbrock and O'Shaughnessy's questionnaires might be more appropriate for more complex and less playful applications such as a home network. Further research is needed to analyse and compare these schemes and determine which can be used in the context of affective home applications.

3.3 Pictorial tools

Another set of techniques used for evaluating emotions is pictorial tools. Most of these tools have been originally developed in Advertising, since they have been utilised in other domains such product design (Desmet, 2002), web site evaluations (Dormann, 2001) and cross-cultural studies (Morris, 1995). These methods are very easy to use especially with children, and are supposed to be culture free (i.e. as they do not rely on verbal adjectives).

3.3.1 SAM

Pictorial tools are based on pictures of faces representing emotions to measure consumer responses. The most basic of these tools, like visual image profile or picture sort methodology consist in asking consumers to pick the face that best represent their feelings (Rossiter and Larry, 1991). A more advanced tool has been created by Desmet (2002) to assess emotions elicited by product appearance. It is a self-report instrument based on 18 animations of characters representing 9 positive and 9 negative emotions. The truly interesting feature of this tool is the inclusion of gestures making each emotion represented more comprehensible.

Another interesting method is the Self-Assessment Manikin (SAM) based on the PAD model and developed by Lang (1985). SAM depicts each dimension with a graphic character arrayed along a

continuous nine-point scale. For pleasure, SAM ranges from a smiling happy figure, to an unhappy and frowning figure. For arousal SAM ranges from to an excited figure to a sleepy figure. Last, the dominance scale goes from a very small figure to a very big forceful half figurehead (see Figure 3).

From rating obtained using SAM, there are different ways of interpreting and representing the data. The most simple is to establish an emotional chart including compared applications (e.g. teleshopping services or web sites). Another possibility is to situate results in the emotion space, by correlating SAM values with Mehrabian and Russell (1977) emotion adjective lists. They established standard values for different emotions on the PAD scales.

Usually SAM is taken for a specific web page or print advertisement. The remaining question is to see how SAM can be used with a website or an ITV programme evaluation. We can use SAM after a user interaction. However we then would miss the emotional sequence that is incorporated in a site or ITV programme. An alternative might be to ask users to rate their emotions at key points during their visits or during the programme sequence.

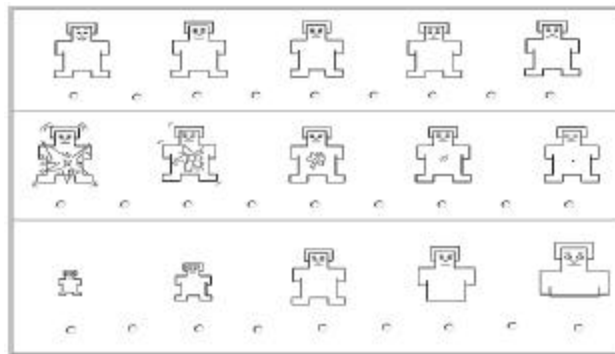


Figure 3: SAM scale

3.3.2 A case study with home pages

We are going to present an evaluation based on home pages of electronic commerce sites, carried out with SAM. The purpose here is not to present an empirical study in site design but to give an illustration of results obtained with SAM.

A hypothetical scenario for such study is as followed: “you are at home with a friend and organising a Mexican dinner party, however you have run out of exotic hot sauces then, for coffee you also want some special chocolates”. From which site, a specific user group would buy is an important question for designers. It will depend on the emotional profile of users, the situation (i.e. a relax home atmosphere) and the product (i.e. low information product). For this kind of products, consumers will see more favourably sites with higher ratings on positive emotions such as pleasant and arousing.

The results discussed here are part of a larger investigation on the role of affect in web design, which was conducted with students (18) rather home users (for convenience), (Dormann, 2001). All students rated home pages on the three SAM dimensions. Results were coded as such, 1 to 9, 1 for the most arousing and pleasurable to 9 for the least and in reverse order for dominance (1 quiet and 9 very dominant). All selected sites sell one kind of product, hot sauces or chocolates (see figure 6). The most important differences between these sites concern their designs, simple and blend design (e.g. Hotsaucetogo includes a display of small bottles of hot sauces) versus humorous design (Hotheadz includes a character breathing and spiting fire). The chocolates sites, Sweet Seductions and Chocolic, are both quite appealing, differences between these two sites include colour e.g. dark versus light colour, and the size of the graphics. Using SAM, each homepage was characterised by distinct emotional values (see Table 1 for values).

P	3,11	4,21	3,32	4,26
A	4,32	6,16	4,89	5,26
D	5,68	5,00	5,11	5,42

	hotheadz	hotsauce	chocolic	Sweets
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Table 1: Means

Graphs and a table show means obtained for: pleasure (P), arousal (A), and dominance (D). As we can see, there are marked differences between pages. Interesting differences were found between quieter versus emotional designs, the more humorous sites has could be expected generated stronger pleasant and arousing emotions (see Figure 4). Ratings for the chocolates sites are very close for arousal and dominance, but offer variations for pleasure (see Figure 5). SAM can indeed be used for the evaluation of electronic commerce and to evaluate emotional difference between designs.

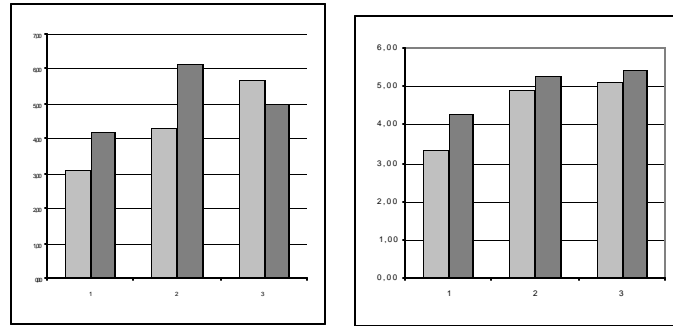


Figure 4: PAD ratings (hotheadz, hotsaucetogo). Figure 5: PAD ratings (Chocolic, Sweet seduction).

3.4 Evaluating emotion

We have presented a number of methods to evaluate emotion, which technique should we choose depends on the context, the user group, the type of applications and evidently the goal of the evaluation. We can combine more than one of these methods if a more thorough investigation is needed. These techniques are used to measure users' emotional reactions. They can also be utilised to compare different designs for an application, to find out which interface is the most arousing. This has interesting potentials for the development cycle. We can also compare related electronic commerce sites as we have seen. We can perform the evaluation in relation with specific user groups to find if an application is as seductive for men and women, or for Dutch and Americans. We have discussed some of the main methods for evaluating emotions however we should further investigate this field of of consumer behaviour to find methods suitable for emotional qualitative study.



Figure 6: Hot sauces (Hotheadz, Hotsaucetogo), Chocolates (Sweet seductions, Chocolic)

4 Measuring emotions, the emotional user profile

Traditionally human–computer interaction consider user characteristics such as age, gender, their socio-economic background and computer expertise. Some personality traits have also been studied such as locus of control in connection to usability (Linda, 2002). Recent studies have shown the role of cultural factors within electronic commerce. Cultural factors have been reported to shape people's trust attitudes and behaviour (Simon, 2000). Reviewing studies from the field of consumer behaviour have highlighted an important aspect of emotion, emotional characteristics of users. In the same way that we take in consideration computer usage or age, for affective applications we should. we should take these characteristics in consideration.

An emotional profile would help us to understand users' reactions, or predict usage of applications. The emotional characteristics of a user influences his/her emotional reactions thus the evaluation of an application. Moreover it can have some bearing on the sorts of applications that he/ she might enjoy. In this section, we first review different constructs related to user emotional characteristics, then discuss the relevance and implications of emotional differences for affective applications.

4.1 Emotions profile measure

There are a number of measures considering emotional characteristics of users. Examples are the affect intensity measure (Moore and Harris, 1994), the need for emotion scale (Raman and co, 1995), affective orientation (Booth-Butterfield, 1990), and sensation seeking scale (Russell, 1990).

The affect intensity measure can be described as individual differences in the intensity of emotional responses to a given level of affect stimulus. The need for emotion scale is defined as the tendency or propensity for individuals to seek out emotional situations and stimuli, and exhibit a preference to use emotion in interacting with the world. It is close to the affect intensity measure. Affective orientation is defined as the degree to which individuals are conscious of affective cues and use these cues to guide decision-making process. Sensation seeking refers to behaviours which involve risk and seeking exciting and thrilling activities during leisure time. It differs from affect intensity concerned with daily events. We are going to look at affect intensity as an example of these measures and show its relevance to affective home applications.

4.2 Affect intensity.

The most well know construct related to emotion and an individual characteristic used in consumer behaviour is the affect intensity measure (Moore and Harris, 1994). Affect intensity (AI) has been conceptualised as a stable and consistency for some individuals to react more strongly than others to emotion. A 40 items, affect intensity measure (AIM) was developed by Larsen (1987) and is designed to cover a broad range of emotions of both positive and negative tones such as bad, troubled, nervous or happy, joy, and peaceful. Examples of questions are: "I feel pretty bad when I tell a lie" and "when I feel happiness, it is a quiet type of contentment".

4.2.1 *Affect intensity and advertising*

Advertising studies illustrate the consequences of individual differences in affect intensity in the field of communication and entertainment consumption. We can establish a parallel between these studies and affective applications.

Advertising studies highlight variations in the way participants described their affective reactions: high intensity subjects described more intense reactions and reacted more emotionally to events than low intensity subjects. This has a significant influence on individual affective and attitudinal responses. Moore and Harris (1994) found that high AI subjects manifest stronger affective response when exposed to emotional advertising appeals, but show no differences with low AI subjects when exposed to non-emotional ads. Furthermore, it appears that high AI individuals experience more affect related cognitive responses as well as stronger emotional reactions when exposed to emotional stimuli. High AI was also highly correlated with measure of sociability. Last, high affect intensity has a strong impact on activities enjoy by individuals, high AI consumers prefer arousing activities such as TV dramas (Harris and Moore, 1990).

Similarly to findings in advertising, we can presume that differences in AI also have major implications for affective applications in two areas: in the choice of affective applications and for the evaluations of these applications. Moreover it could also have some implications for more traditional applications and usability evaluation.

4.2.2 Relevance of affect intensity for affective applications

We first discuss affect intensity within the context of evaluation and then refer to affective applications. If we assume that work related applications do not normally generate strong emotions then AI should not have much influence on the design and evaluation of these applications. However when users experience severe problems and become highly frustrated such might not be the case, AI could then have some significant for usability evaluation. It could be interesting to explore the relation of AI to usability.

When moving toward affective applications it becomes primordial to study the influence and effects of affect intensity on these applications. Fundamentally, AIM can be used in evaluation to determine whether a given sample of respondents is unevenly skewed in the tendency to be high or low in emotional reactivity. Using results biased sample might have reaching implications. On one hand we can question the validity of an evaluation study which would have an unbalance sample. On the other hand, for highly arousing applications, such as interactive games we might choose to evaluate only with high AI users who are the natural target for such applications. Thus AIM can help us in the sampling procedure.

Other implications of AI concerned user preferences. High and low AI users might prefer different applications features, interfaces and designs. When doing teleshopping, low and high AI individual might want to shop from different types of interactive services, high AI users might prefer more emotional sites. This could also have serious implications for website designs. It might be that information abundant sites that generate very few emotions during a user visit, does not cater for the need of high AI individuals. Another issue is the relation of affect intensity to various emotional appeals, for example what is the relation of trustworthiness to AI, do different AI individuals value different attributes of trustworthiness.

If we take as another example, an integrated home network, we can assume that low and high AI might enjoy different features and attributes of the home network. Considering the home music network, different types of users might prefer different search engines. A low AI user might prefer to choose music from a traditional search engine by selecting a band name. A high AI user might prefer a more hedonique approach and use a mood engine. A mood engine would be based on sound sampling, moving in a music space with two axes music genre, and affect. Other features of the home network such as ambience (lighting) could also depend on the level of AI, with high AI individuals preferring more stimulating and creative settings than low AI individuals. AI also has implications for personalisation, as we could propose different services and interfaces to different AI consumers.

We have highlighted the relevance of affect intensity to affective applications. We have discussed simple examples to illustrate the relation of AI to affective applications. A number of empirically studies should validate the relation of AI to emotional evaluation. We have suggested that we should study the relation of AI with the design of affective applications, it could be worthwhile to study the relation of AI to hedonique interfaces. Last, we could test and compare different measures of emotion..

5 Conclusion, toward a framework for affective home applications

Emotions are fundamental aspects of affective home applications. We have argued that existing human-computer interaction methodologies are not always adapted to the design and evaluation of these applications. As an example we have discussed usability, highlighting the problematic. Usability might not be the most fruitful approach for the evaluation of affective home applications.

In the second section of this paper, we have presented three types of methods for evaluating emotions: physiologic measures, questionnaires, and utilisation of pictorial tools. We have further illustrated one of these methods, the Self-Assessment Manikin by a small example based on web design. These techniques can be used to measure the emotional reactions of users to affective application but also to compare affective artefacts.

In the third part of this paper we have reviewed methods for assessing user emotional characteristics, showing that, evaluating user reactions is but one aspect of measuring emotion. In particular we have

argued that a measure like affect intensity is relevant and should be investigated further in the context of affective home applications. Emotional characteristics are an important part of the human profile. As we have seen differences in the intensity level in which individual experience emotion have a significant influence on user's responses and emotional reactions.

5.1 Future research

In this paper we have suggested a number of issues for future studies. In the section on emotion evaluation, we have proposed to test SAM in relation with a website or an ITV programme. We have proposed to establish emotional profile for users and to study the relation of affect intensity to user preferences and emotion evaluation. To illustrate the extend of work needed in this area, we are going to present other issues. These issues concern a taxonomy of affective applications, the evaluation of affective experiences, and user profiles.

It is fundamental to establish a taxonomy of affective applications. We have to recognise that different types of applications will demand the utilisation of different approaches. For example, agent applications need to communicate appropriate emotional responses to users, thus we need to study gesture, body language and character representation in relation to emotion. By contrast, in web design we could investigate the relation of multi-sensory criteria to emotional appeals.

We have focused in this paper on a primordial but limited aspect emotions. However as we have discussed in relation to usability, a broader perspective might be needed for affective experiences. Traditional human computer interaction has largely ignored multi-sensory aspects of user responses, while measuring mostly functional rather than emotive and imaginary reactions to products and applications. Multi-sensory impulses, information occurring in other multi-modalities such as olfactory or tactile have been ignored when evaluating the user experiences (Hirschman and Hollbrock, 1982). This information could however form an important element of users' reactions and should be taken in consideration in affective applications, demanding a more rounded approach to evaluation and the development of new evaluation criteria and questionnaires.

We have discussed affect intensity as personal characteristics of users. A question arises in connection to emotion, which other characteristics influence emotional responses or what other phenomena can mediate emotional reactions. Demographic variables such as age have been found to have some significance in relation to pleasure scale and gender with arousal scale. Besides personality traits such as neurotism can also mediate emotional reactions i.e. neurotism correlates with negative affect (Zelenski and Larsen, 2002). Other variables are cultural. The relation between culture and emotion has been shown by Basabe and co. (2002), who argue that culture and emotion are inextricably linked: cultural experiences shape one's emotional experiences. Thus it can be expected that culture play an important role in the expression of emotions and individual reactions. We should thus explore the relation between users, emotions and context.

5.2 Toward a framework for affective home applications

In this paper, by defining methods for measuring emotions, we have taken steps to establish necessary methodologies for the development of affective applications. We should then develop an extended conceptual framework that can be used to describe all aspects of affective experiences. We need to understand more fully what are the roles of emotions, and which processes are affected by emotions. Emotions influence decision-making, perception, learning priorities, and creativity (Picard, 1998). Within a specific context, we need to choose tools, methods and design techniques, which are the best for a given situation. There are a number of existing techniques such as the Kansai engineering method that can contribute to the development of affective applications, other concerned requirements (e.g. culture probe), or design (e.g. mood board). We need to collect further data on emotion from related fields to provide insights in the design of affective applications. Domains such as literature and film have a large body of works related to emotions, for example studies in film characters and emotions could be useful for the design of agent applications. Besides, we also need to carry empirical studies to evaluate the relevance of findings for affective home applications.

References:

- Basabe N., Paez D. and J. Valencia (2002) Cultural dimensions, socio-economic development, climate and emotional hedonic level. *Cognition and emotion* 16, 1, 103-125.
- Booth-Butterfield M. and S. Booth-Butterfield (1990) Conceptualisation affect as information in communication production. *Human communication research* 16,4, 663-668.
- Chaudhuri, A. and R. Buck (1995) Affect, Reason, and Persuasion. *Human communications research* 21, 3, 422- 440.
- Cheok D., X. Yang, Z. Ying, M. Billinghamurst and H. Kato (2002) Touch-space: Mixed reality game space based on ubiquitous, tangible, and social computing. *Personal ubiquitous computing* 6, 430-442.
- Desmet P. Hekkert P. and J. Jacobs (2000) When a car makes you smile. *Advances in consumer research*, 27, 111-117.
- Dormann C (2000) Enhanced television and interactive services. *Home Informatics and telematics*, (Eds) Sloane A. and Van Rijn F., *Kluwer Academic publishers*: London, 21-43.
- Dormann C. (2001) Seducing consumers, evaluating emotions. People and Computers XV, Joint *Proceedings of IHM-HCI 2001*, Lille September 2001, 2,10 -14.
- Frijda (1988) *The emotions*. The Cambridge press: Cambridge.
- Go K., Caroll J. and A. Imamiya (2000) Familyware. *Home Informatics and telematics*, (Eds) Sloane A. and Van Rijn F., *Kluwer Academic publishers*: London, 125-141.
- Harris and Moore (1990) Affect intensity as an individual difference variable in consumer response to advertising appeals. *Advances in consumer research* 17, 792-797.
- Hassenzahl, M. Platz A., Burmester M. and K. Lehmer (2000) Hedonic and Ergonomic quality aspects determine a software appeal. *Proceedings of conference on human factors in computing system CHI'200*, DenHag 2, 201-208.
- Hirschman E.C. and Hollbrock M.B. (1982) Hedonic consumption: emerging concepts, methods and propositions. *Journal of Marketing*, 46, 92-101.
- Hollbrock and O'Shaughnessy (1984) *The role of emotion and advertising*. Psychology and marketing, 1, 2, 45-64.
- Jordan P. (2000) Future trends and product design. *Proceedings of the IEA 2000/HFES 2000 congress*, 61-64.
- Karat J. (2002) Beyond task completion: evaluation of affective components of use. *Hanbook of human-computer interaction*. Springer 59, 1152-1164.
- Kim J. and JY. Moon (1998) Designing towards emotional usability in customer interfaces-trustworthiness of cyber-banking system interfaces. *Interacting with computers* No. 10,1-29.
- Kjaer A., Halskov Madsen K. and G. Petersen (2000) Methodological challenges in the study of technology use at home. *Home Informatics and telematics*, (Eds) Sloane A. and Van Rijn F., *Kluwer Academic publishers*: London, 45-61.
- Kraut R., Mukhopadhyay T., J. Szczypula J. Kiesler S. and W. Scherlis (1998) Communication and Information: alternative Uses of the internet in households. *Proceeding of CHI'98*, Los Angeles, 368-375.
- Krishnan S., and Olshavsky R. (1995) The dual role of emotions in consumer satisfaction/ dissatisfaction. *Advances in Consumer Research*, 22, 454-460
- Lambourne R., Feiz K. and B. Rigot (1997) Social trends and Product opportunities. *Proceedings of CHI'97*, 404-502.
- Lang P (1985) *The cognitive Psychophysiology of emotion: anxiety and the anxiety disorders*. Hillsdale NJ: Lawrence Erlbaum.
- Larsen R. and E. Diener (1987) Affect intensity as an individual difference characteristic: a review. *Journal of research in personality*, 21, 1-39.
- Linda B. (2002) Can personality be used to predict how we use the internet. Usability News (www.usabilitynews.com)

- Mano H. (1996) Assessing emotional reactions to TV ads: a replication and extension with a brief adjective checklist. *Advances in consumer research*, 23, 63-69.
- Mehrabian A. and J. Russel (1977) Evidence for a Three-Factor Theory of emotions. *Journal of Research in Personality* 11, 273-294.
- Moore D. and W.Harris (1994) Exploring the role of individual differences in affect intensity on the consumer's response to advertising appeals. *Advances in consumer research* 24 181-187.
- Morris J. (1995) Observations: SAM: the Self –assessment Manikin, an efficient cross-cultural measurement of emotional response. *Journal of advertising research*, November / December, 1-5.
- Picard R. (1998) Affective computing. The MIT press: Cambridge.
- Picard R. and J. Klein (2002) Computer that recognises and responds to user emotion: theoretical and practical implications. *Interacting with computers* 14, 141-169.
- Raman N. , Chattopadhyay P. and W. Hoyer (1995) Do consumers seek emotional situations: the need for emotion scale. *Advances in consumer research* 22, 537-542.
- Rossiter J. and P. Larry (1991) Emotions and motivationa in advertising. *Advances in consumer research* 18, 100-110.
- Russel J. (1980) A circumplex model of emotions. *Journal of Personality and Social Psychology*, 39, 1161-1178
- Russell G. Wahlers, 1990 A structural examination of two optimal stimulation level measurement models. *Advances in Consumer Research* 17, 415-425.
- Rusting C. and Larsen R. (1995) Moods as sources of stimulation: relationships between personality and desired mood states. *Personal individual differences* 18, 3, 321-329.
- Shelat D. and Egger F. (2002) What makes people trust online gambling sites? Conference on Human Factors and Computing Systems *Proceedings of CHI 2002*, 852 – 853.
- Simon S. (2001) The impact of culture and gender on web sites: an empirical study. *The database for advances in information systems*, 32, 1, 18-37.
- Thomas P. and R. Macredie (2002) Introduction to the New Usability. *ACM Transactions on Computer-Human Interaction* 9, 2, 69-73.
- Tomkins S. (1962) Affect, imaginery, consciousness: the positive affects. Springer: New York.
- Tractinski N. (1997) Aesthetic and apparent usability: empirically assessing cultural and methodological issues. *Proceedings of CHI'97*, 1-8.
- Wensveen S. , K. Overbeeke and T. Djajadiningrat (2000) Touch me, Hit me and I know how you feel. A design approach to emotionally rich interaction. *Proceeding of DIS'00*, New York, 48-52.
- Zelenski J. and R. Larsen (2002) Predicting the future: how affect-related personality traits influence likelihood judgements of future events. *Journal of Personality*, 10, 1000-1010.