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PICK-A-MOOD
DEVELOPMENT AND APPLICATION OF A PICTORIAL MOOD-REPORTING INSTRUMENT

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ABSTRACT

This paper presents 'Pick-A-Mood' (PAM), a cartoon-based pictorial instrument for reporting and expressing moods. The use of cartoon characters enables people to unambiguously and visually express or report their mood in a rich and easy-to-use way. PAM consists of three characters that each express eight different mood states, representing four main mood categories: energized-pleasant (excited and cheerful), energized-unpleasant (irritated and tense), calm-pleasant (relaxed and calm), and calm-unpleasant (bored and sad). The added value of PAM compared to existing instruments, is that it requires little time and effort of the respondents, which makes it suitable for design research applications, which are often used in situations in which people have little time or motivation to report their moods. Mood is defined, a brief review of existing instruments is provided, and the development and validation of PAM is reported. Various design (research) applications are presented, illustrating that PAM can be used both as a tool for measurement (i.e. to enable researchers to measure the moods of their respondents) and as a tool for communication (i.e. to enable people to communicate their mood in social interactions).

Keywords: mood measurement, well-being, remote social interaction.

INTRODUCTION

Sometimes we are cheerful, and sometimes we are grumpy. Or we are calm, nervous, relaxed, excited, gloomy, or irritated: it may not continuously be within our awareness, but we are always in some mood (Russell, 2003). These moods are pervasive; they form the core of one's affective being. At the same time, moods are transient because while they can last hours, days, and sometimes even weeks, they are always passing, unceasingly converging into other moods. Mood has been shown to strongly influence a host of behaviours and attitudes. For example, compared to people who are in a negative mood, those who are in a positive mood are more kind both to themselves and to others, more willing to help other people, more generous, more satisfied with the products that they own, and have higher expectations about future pleasurable activities (for reviews, see Gardner, 1985; Faber & Christenson, 1996). It is therefore not surprising that individuals often try to anticipate the moods of other people prior to interacting with them, and to read these people's moods during interaction. As Gardner (1985, p. 281) points out, mood information is acquired and used informally to facilitate both social and professional interactions: "[…], knowledge of the boss's mood on a particular day may help an employee anticipate the boss's reaction to a request for a raise."

Moods are typically elusive because they are not evoked by a single stimulus or event (as opposed to emotions) but rather by constellations of a variety of stimuli – and therefore people are often not able to explain why they are in a particular mood. Moods are however easily influenced by little things (Isden, et al., 1982). Small changes in physical surroundings may strongly influence one's mood, such as the smile of a friend, the colour of a room, or the fragrance of a perfume.

We believe that, as a phenomenon, mood is highly relevant to the design profession because of the combination of the above stated three qualities: (1) they have substantial impact on human behaviour and

attitude, (2) they are an important factor in social interactions, and (3) can be influenced by design. Moreover, moods and emotions influence each other. For instance, a person in an irritable mood becomes angry more readily than usual (Ekman, 1994). In the same way, a person's emotional response to products may vary depending on their mood. Conversely, emotions also influence our moods. A person who is repeatedly disappointed by a malfunctioning computer may very well end up in a bad mood (Desmet, 2002). It is therefore surprising that mood has received little attention in the 'design & emotion' research domain. One reason can be that moods cannot readily be considered to be product or user experiences. Desmet and Hekkert (2007) defined the three main components of product experience as 'emotions' (e.g. admiration, pride), 'experiences of meaning' (e.g. elegant, natural), and 'aesthetic experiences' (e.g. beautiful, attractive). Mood is not considered one of them because they form the affective backdrop of these experiences rather than being a stimulus-response-based experience themselves. In other words, design cannot evoke moods like it can evoke emotions. However, it can (and does) influence moods. Therefore, understanding mood and understanding the effect of design on mood can help designers in their experience-driven designs in a variety of applications, such as public spaces, interactive technology, service design, and medical environments.

To facilitate mood research in the design domain, this paper introduces a non-verbal self-report tool to measure mood: Pick-A-Mood (PAM). PAM can be used both as a tool for measurement (i.e. to enable researchers to measure the moods of their respondents) and as a tool for communication (i.e. to enable people to communicate their mood in social interactions). In this paper, we first define the phenomenon mood, discuss how it can be distinguished from emotions, and review existing measurement instruments. Then, the development and validation of the mood tool is reported. Some initial examples of applications are presented and future developments are discussed.

MOOD

The words mood and emotion are regularly used interchangeably, both in research and in everyday language. Some words are used to express both moods and emotions (like sad and happy). They do, however, refer to specific and different experiential phenomena. Even though both phenomena can be categorised as affective states, they differ in terms of eliciting conditions and experiential and behavioural manifestations. In design and emotion research, we should therefore distinguish between them.

MOOD VERSUS EMOTIONS

The key dimension that differs between moods and emotions is whether or not the state involves a relation between the person and a particular cause or object (i.e. intentional versus non-intentional): states that involve a relationship between the person and a particular object are intentional, whereas those that do not involve such a relationship are non-intentional.

Emotions

Emotions are intentional because they imply and involve a relation between the person experiencing them and a particular object: one is afraid of something, proud of something, in love with something and so on (Frijda, 1994). In addition, people are usually able to identify the object of their emotion (Ekman & Davidson, 1994). We know who we love, and we know with whom we are angry. Besides being object-related, emotions are acute, and exist only for a relatively short period of time. Usually, the duration of an emotion is limited to seconds, or minutes at most (Ekman, 1994). The cause that elicits an emotion (the stimulus) can be an event in the environment (e.g. someone calling our name, catching sight of an object), or some change within us, such as thoughts or memories (Ekman, 1994).

Moods

Moods tend to have a relatively long-term character. One can be sad or cheerful for several hours or even for several days (Beedie, Terry & Lane, 2005). Even so, moods, like emotions, are acute states that are limited in time. The main difference between moods and emotions is that moods are essentially non-intentional (e.g. one is not sad or cheerful at something). Moods are not directed at a particular object but rather at the surroundings in general or, in the words of Frijda (1994, p. 60), at "the world as a whole." Whereas emotions are usually elicited by an

explicit cause (e.g. some event), moods have combined causes (e.g. “It is raining,” “I didn’t sleep well,” “Someone has finished the coffee!”). Consequently, we are generally unable to specify the cause of a particular mood (Ekman, 1994).

In line with the discussion above and adhering to the definitions of Forgas (1992) and Tellegen (1985), we define moods as follows: *moods are low-intensity, diffuse feeling states that usually do not have clear antecedents, are not directed at a particular object, and can last for hours or days but are limited in time.*

Mood structures

Watson and Tellegen (1985) proposed a basic two-factor model of mood, which represents the two dominant dimensions that consistently emerge in studies of the affective structure of moods, and have been used extensively in the self-report mood literature (Watson, Clark & Tellegen, 1988): Valence (pleasure - displeasure) and arousal (high energy – low energy). Together these dimensions represent four basic mood categories, see Figure 1.

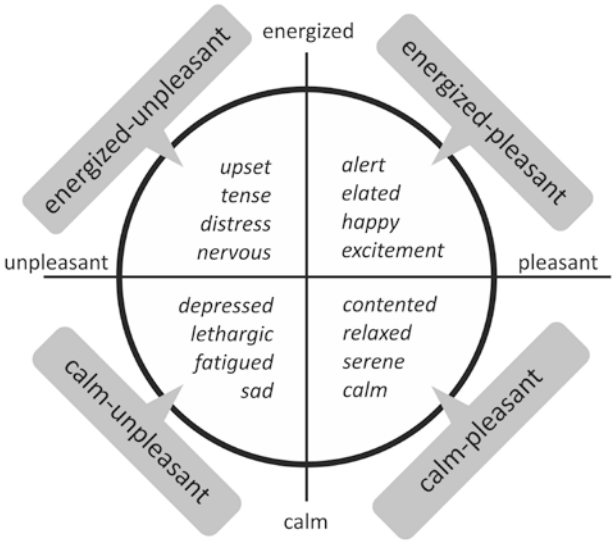

Figure 1. Four basic mood categories; based on the PANAS model by Watson and Tellegen (1985), with examples of moods (in the circle) from Russell (1980) and Barrett & Russell (1999).

The energized-pleasant mood state represents the extent to which a person feels enthusiastic, active, and alert. This is a state of excitement and pleasurable engagement, whereas the opposite mood state (calm-unpleasant) is a state of sadness and lethargy. The energized-unpleasant mood state represents the extent to which a person feels tense, nervous, and upset. This is a state of distress and unpleasurable engagement, whereas the opposite mood state (calm-pleasant) is a state of serenity and peacefulness. Together, the four mood states account for roughly one-half to three-quarters of the common variance in mood terms (Watson, 1988; Watson & Tellegen, 1985), and they have emerged consistently across diverse descriptor sets, time frames, response formats, languages, and cultures (for an overview of literature, see Watson & Clark, 1994).

Another approach to mood description rather than to identify broad, higher order, factors or dimensions, is to identify specific mood states. Watson and Tellegen (1985) proposed that the four basic mood categories (see Figure 1) are each composed of several correlated, yet ultimately distinguishable moods. This means that each category includes several individual moods with distinctive qualities. For example, being nervous and being irritated both fall in the ‘high energy unpleasant’ mood category. Various mood theorists have reported sets of mood states; Table 1 gives an overview of some prevailing mood lists. For ease of comparison, we have categorised them in the four basic mood categories.

Note that, in general, mood theorists do not provide a rationale for the particular selection of mood states they include in their analysis. Moreover, it is debatable if all states are clear examples of moods (e.g. shyness, which seems to more a personality trait than a mood state, and anger which seems to be more an emotion than a mood state). Nonetheless, Table 1 illustrates that each mood category represents a variety of mood states. For example, energized-unpleasant represents fear / tension / anxiety, but also anger / hostility / annoyed. Calm-unpleasant represents sadness / depressed / gloomy, but also fatigue / inertia / boredom.

	ENERGIZED-PLEASANT	CALM-PLEASANT	ENERGIZED-UNPLEASANT	CALM-UNPLEASANT
Watson & Clarck (1994)	Joviality; Attentiveness; Surprise.	Serenity; Self-assurance.	Fear; Hostility; Guilt.	Sadness; Shyness; Fatigue.
Lorr & McNair (1988)	Vigour-Activity.		Tension-Anxiety; Anger-Hostility; Confusion-Bewilderment.	Fatigue-Inertia; Depression-Dejection.
Lorr, McNair & Fisher (1982)	Elated; Energetic; Clearheaded.	Composed; Agreeable; Confident.	Anxious; Hostile; Unsure; Confused.	Depressed; Tired.
Russell (1980)	Aroused; Astonished; Excited; Happy; Delighted.	Pleased; Glad; Serene; Content; At ease; Satisfied; Relaxed; Calm; Sleepy.	Alarmed; Tense; Angry; Afraid; Annoyed; Distressed; Frustrated.	Miserable; Sad; Gloomy; Depressed; Bored; Droopy; Tired.

Table 1. Typologies of mood states.

MEASURING MOOD

Mood can now only be measured through self-report: by asking people what mood they are in. Traditionally mood is measured with questionnaires that include lists of verbal items. Respondents rate each item on a scale ranging from “not at all” to “extremely” to represent how well the item describes the respondent’s mood. Factor analysis is used to reduce the data to key dimensions (like the pleasantness and arousal dimensions described above) or to other subcomponents of the mood construct. The two most prominent instruments are the ‘Positive and Negative Affect schedule’ (PANAS; Watson et al., 1988), and the ‘Profile of Mood States’ (POMS; McNair et al., 1971).

The PANAS scale measures Positive Affect and Negative Affect with 20 items (10 for both factors). Watson and Clarck (1994) developed an extended version (60-items; the PANAS-X) that measures 11 mood states: fear, sadness, guilt, hostility, shyness, fatigue, surprise, joviality, self-assurance, attentiveness, and serenity. The POMS measures six distinct mood states with a set of 65 items: anger, confusion, depression, fatigue, tension, and vigour. A main limitation of POMS is that it mostly measures unpleasant moods (i.e. one of six mood states is pleasant). To overcome this limitation, an updated version was developed that measures six bipolar mood states (72 items; POMS-BI; Lorr & McNair, 1988). One pole represents the positive, whereas the other pole represents the negative aspect of the dimension: composed-anxious; agreeable-hostile; elated-depressed; confident-unsure; energetic-tired; clearheaded-confused. Both POMS and PANAS have been criticised for being demanding for the respondent and taking too long to complete (Curren et al., 1995). This point is particularly relevant when mood is assessed in an ecologically valid setting, such as before or after a human-product or social interactions. In those situations, brevity is paramount (see Terry et al., 1999). It has also been noted that some POM items, such as “bushed” and “blue”, can be sensitive to different interpretations across cultures (Grove & Prapavessis, 1992). These limitations are overcome by the Self-Assessment Manikin (SAM; Lang, 1980), a non-verbal pictorial assessment technique that measures the pleasure, arousal, and dominance associated with a person’s affective reaction. The main advantage is that it uses a single visual scale for each dimension (as opposed to a set of verbal items), which allows for an undemanding self-report, both in terms of time and effort. Similar advantages have been found for other non-verbal pictorial emotion scales, such as the ‘Gaston Lagaffe’ scale, which is based on a popular French comic-strip character (Johnstone et al., 2005), the Layered Emotion Measurement tool (LEM; Huisman & Van Hout, 2010), and two scales that use dynamic cartoon animations: the Product Emotion Measurement instrument (PrEmo, Desmet, 2003) for the measurement of product emotions, and the Mood Assessment via Animated Characters instrument (MAAC; Manassis et al., 2009) for the measurement of emotions of young children with anxiety disorders.

These available pictorial scales are not suitable for measuring mood states because they measure basic dimensions of affect (SAM; pleasantness, arousal, dominance), or because they measure emotional responses and/or are developed for particular types of stimuli (LEM; PrEmo), or for respondents with anxiety disorders (MAAC). Nonetheless, these instruments have been shown to enable respondents to report their affective state fast, intuitive, and accurately. An additional advantage of pictorial scales is that, when carefully developed, they can be used reliably across cultures because they do not suffer from translation complications (Desmet, 2003). As such, pictorial instruments are well suited for situations in which respondents have limited time or motivation to express their affective state. For this reason, we decided to develop PAM to measure specific mood states in an quick and intuitive way, which can be used in both qualitative and quantitative research settings (e.g. basic mood assessment before a concept test, or mood expression in a context-mapping study), and as a means for self-expressing mood in technology-enabled communication.

DEVELOPMENT OF PICK-A-MOOD (PAM)

The development of the instrument involved three main challenges. The first challenge was to select which moods to measure, the second was to develop characters that express these moods, and the third to validate these characters. The first challenge required us to decide on the desired level of granularity. On the one hand, the instrument should enable people to express moods as diverse and rich as they occur, and on the other hand, the set of characters should be small to allow for convenient and intuitive self-report. To balance between these requirements, we decided to include eight distinct mood types; two for each of the four mood categories, see Table 2. In this way, we capture the four main mood categories, and add nuance by distinguishing between two types within these categories. These types were selected to represent the main mood differentiations found in the mood typologies in Table 1. Note that the differentiation in the negative moods is bigger than in the pleasant moods. We still decided to include an equal number of positive and negative moods to allow for a balanced instrument (for a discussion on balance in affect scales, see Desmet, 2002).

	Pleasant	**Unpleasant**
Energized	(1) Excited - Lively (2) Cheerful - Happy	(3) Tense - Nervous (4) Irritated - Annoyed
Calm	(7) Calm - Serene (8) Relaxed - Carefree	(5) Sad - Gloomy (6) Bored – Weary

Table 2. Eight mood types in four mood categories measured by PAM.

PICK-A-MOOD CHARACTER, INITIAL VERSION

A professional cartoonist developed three different characters to allow for some freedom in application possibilities. After several design iterations, a neutral-aged male character, a neutral-aged female character, and a non-human character (a teapot) were selected (Figure 2).

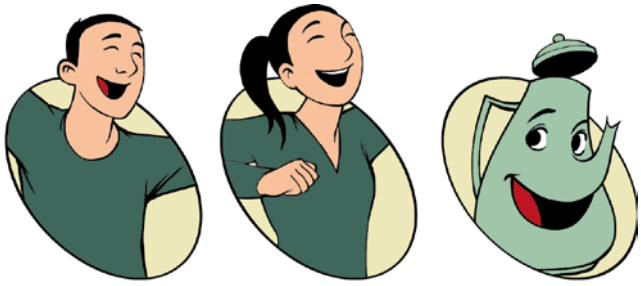

Figure 2. Three initial PAM characters (for the Excited mood type).

The cartoonist created nine expressions for each character: one for each mood type and an additional expression that represents a ‘neutral’ mood. The design and validation of these initial expressions was reported in a previous publication (Vastenburg et al., 2011). Although the results of the validation study indicated that most expressions were recognized unambiguously, indicating that people are capable of recognizing and distinguishing between these mood expressions, we also found five possibilities for improvements. First, the teapot expressions were found to be relatively difficult to recognize. Second, the interpretations of Tense and Irritated partly overlapped. The same applied to Neutral, Calm and Relaxed. Third, because interpretations were influenced by minor differences in expressions between the characters, comparisons of mood-reports between the three characters was hindered. Fourth, the green colour of the characters’ clothing was experienced as non-neutral (i.e. green can be associated with positive). Fifth, the expressions’ passe-partout hid the arms or hands in some

expressions (see Figure 2), which reduced the communicative quality of these expressions.

PICK-A-MOOD CHARACTER, FINAL VERSION

New drawings were created to improve on the above stated five shortcomings. After some design explorations, it was decided to replace the teapot by a robot character because a robot better resembles the human anatomy. The green colour was changed to blue, the expressions between characters were made consistent, some expressions were made more explicit to be more discriminative, and for no expression the passe-partout hid part of the arms or hands, see Figure 3 and Figure 4.

Figure 3. Three final PAM characters (for the Excited mood type).

EVALUATION STUDY

An evaluation study was designed to test if the eight expressions (plus a neutral expression) portray differentiated mood states, representing all four general mood categories, and if people correctly recognize the intended mood states. In total, 191 people participated, recruited through informal social networks, with 31 different nationalities (of which 52% Dutch), including people from various countries in Europe, Asia, Australia, South-America, Canada, and the Middle-East. Age ranged between 13 and 76 (mean = 34,9; SD = 13,0), and 53% was male.

PROCEDURE

Participants filled out a web-based questionnaire (in Dutch or English; 100 respondents filled out the Dutch version). Each participant was randomly assigned to respond to one of the three characters, which could be the same gender version or the robot version. The order of expressions was randomized. The procedure consisted of three stages: In stage 1, participants generated a text-label for each of the nine expressions. This was an open question, without providing pre-ordained labels. In stage 2, participants were asked to select (for each expression) a label from a set of nine predefined labels: excited, cheerful, relaxed, calm, bored, sad, irritated, tense, and neutral. In stage 3, participants rated each expression on the basic affect dimensions valence and arousal (with 5-point scales; unpleasant-pleasant and calm-energized).

Figure 4. PAM expressions of eight mood types (and neutral).

RESULTS

Table 3 summarizes the findings for the labelling task. The second column shows the four most often provided labels, with the percentage of respondents who provided this label. The table combines labels that were formulated in Dutch with the labels that were formulated in English. Dutch labels were translated with the Van Dale dictionary software (Van Dale, 2009) and subsequently added to the English labels. A complete overview of reported labels can be found in Appendix 1. The third column of Table 3 shows the labels that respondents selected (in the second stage of the questionnaire) from a fixed set of labels. Labels with percentage of lower than 10 are not included in the table.

Expressions	**Open labelling** (respondent provided label)	**Forced labelling** (respondent selected between predefined labels)
EXCITED	Joyful (17%) Happy (17%) Excited (15%) Exuberant (14%)	Excited (78%) Cheerful (20%)
CHEERFUL	Happy (30%) Joyful (29%) Cheerful (13%) Relieved (8%)	Cheerful (82%) Excited (14%)
RELAXED	Relaxed (81%) Satisfied (8%) Content (6%) Enjoying (2%)	Relaxed (95%)
CALM	Neutral (59%) Dreamy (11%) Satisfied (5%) Calm (4%)	Calm (40%) Neutral (39%) Relaxed (13%)
BORED	Bored (64%) Disinterested (5%) Pensive (5%) Tired (5%)	Bored (77%) Sad (10%)
SAD	Sad (50%) Depressed (10%) Gloomy (9%) Disappointed (8%)	Sad (96%)
IRRITATED	Angry (55%) irritated (12%) suspicious (6%) grumpy (4%)	Irritated (89%) Tense (11%)
TENSE	Nervous (12%) Pensive (11%) Worried (9%) Thoughtful (9%)	Tense (76%)
NEUTRAL	Neutral (42%) Astonished (15%) Surprised (8%) Serious (5%)	Neutral (59 %) Tense (18%) Calm (11%)

Table 3. Percentages of selected labels for all mood expressions; only percentages of 10 or higher are included in the table.

The forced-labelling percentages indicate that 75% up to 96% of the participants selected the correct label for seven expressions: Excited , Cheerful, Relaxed, Bored, Sad, Irritated, and Tense. Calm and Neutral were interpreted as being similar: Calm is misinterpreted by 39% of the respondents as being neutral, and Neutral is misinterpreted by 10% as calm. Moreover, Neutral is also misinterpreted (by 18%) as tense. Table 4 shows the valence and arousal ratings.

Expressions	**Valence** (Unpleasant = 1; Pleasant = 5)		**Arousal** (Calm = 1; Energized = 5)	
	Mean	SD	Mean	SD
EXCITED	4.92	.30	4.68	.79
CHEERFUL	4.55	.57	3.80	.87
RELAXED	4.47	.70	1.36	.80
CALM	3.38	.72	2.09	.92
BORED	2.42	.81	1.90	.83
SAD	1.61	.70	1.87	.99
IRRITATED	1.62	.61	4.03	.78
TENSE	2.54	.72	3.26	.96
NEUTRAL	2.88	.61	2.59	.96

Table 4.Valence and arousal ratings of PAM expressions.

To test if all four basic mood categories are represented, a t-test was done for each expression, with the scale mid-point as the test value. The test found significant ($p < .001$) differences for all emotions on both pleasantness and arousal: Excited and Cheerful are high valence and high arousal (energized-pleasant); Relaxed and Calm are high valence and low arousal (calm-pleasant); Bored and Sad are low valence and low arousal (calm-unpleasant); Irritated and Tense are low valence and high arousal (energized-unpleasant). To test if the two expressions within each category differentiate in terms of valence and arousal, Multivariate ANOVA's were performed with valence and arousal as the dependent variables, and the expression as the fixed factor, see Table 5.

mood expression A	**mood expression B**	**VALENCE Mean Diff. (A- B)**	**AROUSAL Mean Diff. (A - B)**
Excited	Cheerful	.37*	.87*
Relaxed	Calm	1.09*	-.73*
Sad	Bored	-.81*	-.03

Table 5. Differences between mood expressions with basic mood categories.

Table 5 indicates that Excited and Cheerful differ significantly in both valence and arousal: Excited was perceived as more pleasant and more energetic. The same applies to Relaxed and Calm (Relaxed is more pleasant and less energetic than Calm) and Annoyed and Tense (Annoyed is less pleasant and more energetic than Tense). Bored was perceived as more unpleasant than Sad, but no significant arousal difference was found.

CONCLUSIONS AND DISCUSSION

The validation results indicate that the eight mood expressions portray a diverse pallet of moods, representing all four basic mood categories. Moreover, the two mood-expressions within each basic category represent mood states that differ in terms of type, valence and arousal, adding nuance to the set. When provided with labels, respondents were able to select the correct label for the various expressions.

The labelling did indicate some overlap between expressions within the basic mood categories, but that is in line what is found in other affect studies (e.g. Russell, 1980). For example, the labelling for Excited and Cheerful showed some overlap, and the same applies to the labelling for Irritated and Tense. However, the valence and arousal data indicated significant differences between the mood expressions within categories: Excited is perceived as more energetic and more pleasant than Cheerful, and Irritated is perceived as less energetic and more unpleasant than Tense, indicating that these expressions enrich the level of nuance of the PAM character set. Note that positive affect is often found to differentiate less than negative affect (e.g. Russell, 1980), which is also visible in the current study. One could argue that using either Excited or Cheerful would be sufficient for a differentiated measurement, but we advocate for using both because of the advantages of having a balanced set. Affect measurement instruments (both emotion and mood) tend to be biased towards the negative (i.e. including more negative than positive items), which may be appropriate for the typical clinical applications, but is unwanted for application in design research (see Desmet, 2003). The results indicate that Neutral is the only problematic expression. In the forced labelling, almost 20 percent labelled this expression as tense, and in the open labelling, 15 percent used the word ‘astonishment.’ Note that this may have been an effect of the questionnaire: because respondents were instructed to describe the mood, it might not have been apparent that they could also select ‘neutral’. Moreover, a neutral mood may not even be part of our affective repertoire. The circumplex model of affect (Russell, 1980), for example, does not include neutral: one always experiences some affective state. We originally included a neutral expression in the PAM set because we envisioned it may be useful in measurement situations. Based on the validation results and the discussion above, we concluded to omit Neutral from the PAM set.

APPLICATION EXAMPLES

The PAM set has been used in various applications. The most straightforward application is for mood state self-reporting. Hilbolling and her colleagues (2012) used PAM in an interview study to assess mood variations of delayed international travellers at Amsterdam airport (Figure 5). Respondents were handed a printed version of PAM, and asked to point out which expression best represented their mood during a series of moments in their airport experience.

Figure 5; PAM mood measurement of international passengers at Amsterdam airport (from Hilbolling et al., 2012).

The set can also be used as a reference when aiming to interpret affective states of people. In another study, Hilbolling and her colleagues (2011), for example, used the PAM set in a study of user mood

during the use of GPS car navigation devices (Figure 6). Participants were given a destination (which was unknown to them) and used the navigation device to reach that destination. Respondents were filmed during the procedure, and the PAM set was used as a reference for interpreting the affective states of the participants.

Figure 6. PAM used as reference in interpreting mood of filmed respondents (adapted from Hilbolling et al., 2011).

Besides for mood measurement and interpretation, the set can also be used as a means for mood communication. Vastenburg & Romero (2011) reported an application in which the PAM set was used for experience tagging in a social awareness communication device (Figure 7). The system was used to improve communication between seniors in need of care and their family caregivers. Presence in the kitchen, living room, and bedroom doorway was detected using passive infrared sensors. Users were asked to enrich the sensor data by adding subjective annotation messages to the sensor data using text and PAM. In a user test, the authors found that the system contributed to the peace-of-mind of users, since they were better aware of the remote situation.

Figure 7. PAM used as means for communicating mood in a social awareness communication device (adapted from Vastenburg & Romero, 2011)

Jimenez, Romero & Keyson (2011) used PAM in a context-aware system that monitors patients' recovery experiences after being discharged from the hospital, to reduce the general lack of information regarding their feelings during recovery (Figure 8). The system uses PAM for mood expression in order to enable it to support day-to-day the recovery process of elderly patients, including physical and emotional support (Figure 8). A preliminary analysis indicated that reported mood changes somehow foreshadowed changes in physical reports. Currently these authors are developing a new version of the application that connects the monitoring data to the mood self-reports.

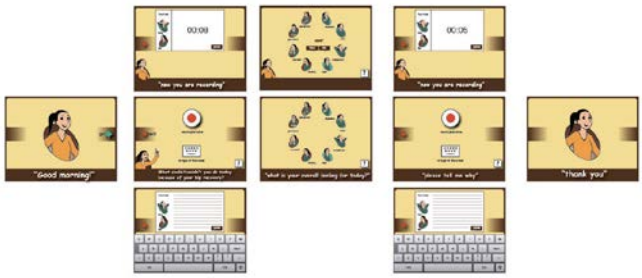

Figure 8. PAM used as means for monitoring mood of elderly patients recovering at home after a total hip replacement procedure (from Jimenez et al., 2011).

GENERAL DISCUSSION

This paper presents PAM, a cartoon-based pictorial instrument for reporting and expressing moods. The use of cartoon characters enables people to unambiguously and visually express or report their mood in a rich and easy-to-use way. PAM consists of three characters that each express eight different mood states, representing four main mood categories: energized-pleasant (excited and cheerful), energized-unpleasant (irritated and tense), calm-pleasant (relaxed and calm), and calm-unpleasant (bored and sad). An evaluation study indicated that the two characters within each category add nuance because they differ in terms of perceived nature, pleasantness and/or arousal.

The ability to read and to express moods is crucial for successful social interactions. Because this ability is often impeded when using technology-supported remote social interactions, PAM could be integrated in a communication tool to enable social communities to share experiences. For example, a group of friends that use social networks to share locations could use PAM to express their mood at

these locations. Similarly, PAM could be part of an engaging communication tool in senior-care systems. The mood-character can be used to invite seniors to provide richer information about their well-being. PAM could further be integrated in context-aware experience sampling tools. In their Mobile Heart Health Project, Morris and Guilak (2009) tested how ESG sensor data linked to mood self-reports can be used as input for the suggestion of 'mobile therapies' to control stress. PAM can be used to simplify the mood-self report procedures in such systems. A similar system could be used when evaluating a prototype in the field: participants can be asked to annotate their user-product interactions with moods. Another application possibility is to support self-tracking that facilitate self-awareness and self-reflection of one's mood for longer periods of time, to answer questions such as, how does my mood generally changes working hours, or how is my mood influenced by sports?

PAM is available in both paper and electronic versions under the 'Creative Commons community license'[1], free-of-charge for non-commercial use. In this way, the instrument will be available for collecting rich data, sampling experiences, creating remote awareness, and enabling self-expression in a wide range of design-related applications.

For understanding the long-term adoption of innovative immersive technology, it is crucial to understand how this technology affects the mood of users. Eventually, this could contribute to the abilities of designers to create technology, products, and services that are responsive to the users' subjective well-being. The subjective well-being of users is of interest for designers who aim to design products and systems that contribute to human welfare (either by diminishing welfare threats, or by stimulating welfare opportunities; see, Desmet & Hassenzahl, 2012, and Desmet, 2011). Given the fact that moods are by nature a more stable information source than emotions for monitoring people's well-being (Csikszentmihalyi & Hunter, 2003), mood measurement can play a relevant role in these kinds of efforts for a variety of design domains. For example, designers can use information on how design choices affect moods to improve their designs of waiting rooms (e.g. airports, hospitals, public transport, etcetera) or other functional rooms (e.g. lecture halls, prisons, schools, office spaces, etcetera). Given the current developments in ambient technology, one can also think of intelligent atmosphere control systems that automatically adapt their behaviour in respect to the mood of the user. Future development of PAM will focus on the further validation of the character set, and developing interfaces that support varies online and offline applications.

ACKNOWLEDGMENTS

This research was supported by the Innovation-Oriented Research Program 'Integral Product Creation and Realization (IOP IPCR)' of the Netherlands Ministry of Economic Affairs, and the MAGW VIDI grant number 452-10-011 of The Netherlands Organization for Scientific Research (N.W.O.) awarded to P.M.A. Desmet. Lois van Baarle (initial version) and Peter Wassink (final version) have created the PAM characters and expressions. We express our thanks to Gael Laurans and Lars Rengersen for their suggestions on pictorial measurement instruments, and acknowledge Juan Jimenez and Susan Hilbolling for sharing their PAM case studies and providing us with application images.

APPENDIX 1; FREE LABELLING DATA

Below, results of the free labelling task are summarized (N = 191; see results section of the evaluation study described in this manuscript). The number between brackets represents the number of respondents that reported that word; only words with frequency of two or higher are included in the overview.

EXCITED
Joyful (28); Happy (27); Excited (25); Exuberant (23); Cheerful (17); Joyous (8); Enthusiastic (5); Jolly (5); Laughing (5); Very happy (5); Overjoyed (4); Ecstatic (3); Elated (3); Cheering (2); Super happy (2).

CHEERFUL
Happy (43); Joyful (42); Cheerful (19); Relieved (11); Welcoming (5); Open (5); Satisfied (4); Surprised (3);

[1] http://creativecommons.org

Proud (3); Glad (2); Exuberant (2); Explaining (2); Excited (2).

RELAXED
Relaxed (136); Satisfied (13); Content (10); Enjoying (3); Dreamy (2); Comfortable (2); Calm (2).

CALM
Neutral (75); Dreamy (14); Satisfied (6); Calm (5); Content (4); Bored (3); Awaiting (3); Indolent (2); Thoughtless (2); Sleepy (2); Relaxed (2); Quiet (2); Normal (2); Indifferent (2); Daydreaming (2); Confident (2).

SAD
Sad (78); Depressed (15); Gloomy (13); Disappointed (12); Tired (8); Dispirited (7); Glum (6); Upset (4); Disheartened (4); Sorrowful (3); Defeated (3); Listless (2); Frustrated (2).

BORED
Bored (83); Disinterested (7); Pensive (6); Dreamy (6); Sad (5); Disappointed (5); Tired (4); Thoughtful (3); Melancholic (3); Displeased (2); Discouraged (2); Waiting (2); Worried (2).

IRRITATED
Angry (82); Irritated (17); Suspicious (9); Grumpy (6); Frustrated (4); Annoyed (4); Dissatisfied (3); Disgusted (3); Upset (2); Thinking (2); Sceptical (2); Pissed off (2); Doubtful (2); Distrustful (2); Disappointed (2); Critical (2); Aggressive (2).

TENSE
Preoccupied (19); Pensive (18); Thoughtful (15); Worried (14); Hesitant (12); Doubtful (11); Nervous (9); Confused (7); Suspicious (6); Uncertain (5); Cautious (5); Anxious (5); Despair (4); Curious (4); Afraid (4); Scared (3); Pondering (3); Insecure (3); Tense (2); Questioning (2); Puzzled (2); Hesitant (2); Contemplative (2); Amazed (2).

NEUTRAL
Neutral (44); Astonished (16); Surprised (8); Serious (5); Attentive (5); Amazed (4); Thoughtful (3); Shocked (3); Pensive (3); Hypnotized (3); Concentrated (3); Alert (3); Questioning (2); Insecure (2); Clueless (2).

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