# Utilities and Capabilities: A Psychological Account of the Two Concepts and Their Relations to the Idea of a Good Life

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Abstract
The utilitarian approach to a good life asks people about their preferences and how satisfied they are. However, scholars such as Amartya Sen and Martha Nussbaum argue that utility is inadequate to capture essential aspects of human well-being. Rather, by referring to what people are able to do and to be, the concept of capabilities provides a more productive approach. In the current study, an integrated perspective is proposed, building on recent developments in emotion research. We present a model in which experienced utility and life satisfaction is considered to be the emotional responses to need fulfillment and goal achievement. Quite different emotions such as engagement, interest and curiosity are generated as an expectation of goal achievement, and not as a consequence of goal achievement. In this framework, life satisfaction is consistent with the utility approach and engagement is consistent with the capability approach. In support of the above distinctions, data from two Norwegian surveys are provided. The data show how the attitudes of satisfied individuals are biased toward pleasure and goal fulfillment. The attitudes of engaged and curios individuals, are biased toward exploring the environment and seeking out new action. Results are discussed with reference to the functional aspects of basic emotions.

(203 words)

# Utilities and Capabilities: A Psychological Account of the Two Concepts and Their Relations to the Idea of a Good Life

One of those rare occasions in science when a remarkable experiment starts a new field, happened with the serendipitous discovery of self stimulating areas in the brain. Looking for learning structures in the central nervous system, James Olds and his graduate student Peter Milner erroneously administered electrical shock to the wrong part of a rat's brain, and thus stumbled upon one of the most fascinating phenomenon ever discovered in biopsychology. What Olds and Milner (1954) found was that if rats, when wired to a self administered device that gave electrical stimulation to particular areas of their brains, were given the choice to stimulate themselves, they would do so almost all the time. Rather than eating, drinking or having sex, the rats preferred intracranial self stimulation (ICSS), by pressing the lever that gave the electrical signals thousands of times in a row.

Although Olds and Milner named these brain regions "reinforcing structures" (1954, p. 425), they are commonly referred to as "pleasure centers". However, either term is misleading. What seems to have escaped the attention of most observers of ICSS, is that the behavior displayed by the rats and other animals in these states does not at all resemble anything akin to pleasure behavior. Rather than the rewarding and consuming activities accompanying pleasant feeling states, self stimulating animals look excessively exited, even crazed, when they work for this kind of stimulation. Thus, Jaak Panksepp (1998) suggests that terms such as intense interest and engaged curiosity better reflect the feeling systems involved in the ICSS behavior.

We believe that the mix up of pleasure and interest is common, but unfortunate. Historically, pleasure has been a generic term for all emotions with an attractive valence, and even today this confusing use of the term is widespread. For example, in a recent issue of the Time Magazine, positive psychologist Martin Seligman says, "As a professor I don't like it (… ), but the cerebral virtues –curiosity, love of learning – are less strongly tied to happiness than interpersonal virtues like kindness, gratitude and capacity for love." (The new science, 2005). We suggest that the weak correlation normally observed between curiosity and happiness simply occurs because the feelings associated with curiosity have a different cause then those associated with happiness. In the current paper we shall try to show why an explicit distinction between curiosity and pleasure is pertinent to theories of human well-being.

## *Theories of human well-being*

The observation that engagement, interest and curiosity do not correlate strongly with happiness, has repeatedly been made at least since the days of Wilhelm Wundt. Contrary to Seligman's position we do not believe it reflects an unfortunate situation. Rather it constitutes a brilliant motivational and emotional arrangement, quite necessary for adaptive human performance. We believe that the difference between engagement and satisfaction is highly functional, and that this distinction has relevance for a debate on happiness and capabilities. We do, of course, readily recognize that the concept of capabilities is not basically related to distinctions in emotional qualities, but will nevertheless suggest that a better grasp of human emotions may contribute useful knowledge to this workshop. Towards this end, a primary task of our paper will be to move beyond the notion of pleasure as a homogenous subjective experience.

Our argument rests on two assumptions. First, the extensive use of self-reported measures of happiness is confronted with a non-trivial validity problem, referred to in psychometric literature as conceptual underrepresentation (e.g., Messick, 1995). This problem is only partly acknowledged in the field. From a theoretical point of view, happiness is often understood quite broadly, and may for example include engagement, meaning, interest and curiosity. However, empirical research have repeatedly revealed that self-reported happiness correlates quite modestly with engagement, meaning, interest, and curiosity. Consequently, when Seligman (and several other well-being researchers) speaks of self-reported happiness, the term does not cover happiness in the broad sense of the word, but rather a state of, or a preference for, need fulfillment and goal achievement

Second, whereas happiness and satisfaction are linked to pleasure and follows from either *having or getting* what one wants, engagement and curiosity are linked to the process of *doing and being* what one wants. From this point of view, the present paper attempts to apply the knowledge of happiness and satisfaction to the utility approach to human well-being. Emotions such as engagement, interest and curiosity, on the other hand, connect with the capability approach.

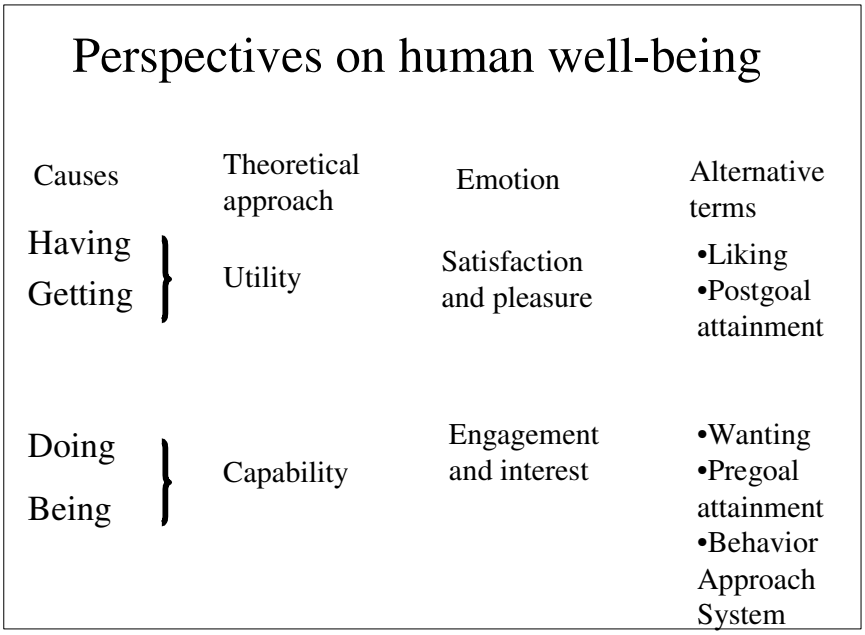



*Figure 1.* Two perspectives on human well-being.

A homogenous conceptualization of pleasure is imperative to utilitarian theory. For instance, Kahneman (1999) argues that happiness can successfully be reduced to a single dimension of evaluation, which he refers to as the Good-Bad Dimension. Every moment of our conscious life will have a positive, neutral or negative value (hedonic comment) on the Good-Bad Dimension, and summing up these hedonic comments intraindividually will give the level of happiness for each individual. Summing up the hedonic comments across individuals in a nation will give the national level of happiness (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004). Kahneman has even suggested a procedure for transforming the hedonic comments into an objective measure of happiness, by converting them into a temporal integral at the ratio level of measurement.

A series of objections have been raised against the basic assumptions of the utilitarian approach to happiness. Of major relevance for this workshop are some of the comments from the capability approach. For instance, the evaluative standards that constitutes the backbone of the utility judgment, is highly sensitive to a series of elements irrelevant to the good life itself. One such mechanism is what Nussbaum (2000) refers to as adaptive preference formation. Preferences are vulnerable to social norms and historical traditions, which imply that a person may consider his or her life as satisfying, even if there is a number of "objective" reasons why this person should not be satisfied. Moreover, the effects of adaptation to unfortunate (and fortunate) situations are well known and well documented (e.g., Kahneman, Diener, & Schwarz, 1999).

Against this backdrop, the idea of a capability approach has been proposed as a better basis for thinking about happiness and the good life. As presented by scholars such as Sen (e.g., 1993) and Nussbaum (e.g., 2003), the capability approach is basically a philosophical account of human well-being, and we would be utterly off target if we try to hay jack the concept by psychological methods and theory. However, the capability approach might be advanced by input developed from different academic perspectives. Toward this aim, our contribution is the concept of basic emotions.

*Basic emotions*

Recent advances in neuroscience have begun to identify the brain circuits underlying a system of basic emotions, the promise of which is to understand how emotional processes play a crucial role in the regulation of behavior. In the following we will submit to this tenet and in particular draw on three perspectives. First, we agree with psychobiologist Jaak Panksepp (e.g., Panksepp, 1998) when he argues that although a simple bipolar good-bad dimension running from pleasure (approach) to pain (avoidance) may be defensible for non-mammalian species, such a simplification is no longer tenable for of human emotions. More differentiated concepts are needed, and there is good biological evidence for the existence of at least seven innate emotional systems. These are referred to as basic emotions and include fear, anger, sorrow, anticipatory eagerness, play, sexual lust and maternal nurturance. In addition, there exist some more poorly understood feeling states related to regulatory principles of bodily systems, described overall as homeostatic mechanisms. These feeling states are, according to Panksepp, what we experience and describe as pleasure and pain.

In this paper we take Panksepp's ideas one step further, and suggest that the system of homeostasis regulated pleasure and pain, including related mechanisms of self-regulation, such as goal systems operated by negative feedback loops (e.g., Carver & Scheier, 2001), may account for the having and getting part of human well-being. The basic emotion of engagement/interest/curiosity, on the other hand, corresponds to the doing and being part of a good life.

The complexity of these two systems will be rather superficially described in the pages to follow, suffices it to say that the engagement system, or SEEKING system as Panksepp has baptized it, generates an intense interest in exploring the world around us, and lead us to become exited when we are about to get what we desire. Panksepp speculates that this may be one of the brain systems that generate and sustain curiosity in humans, even for intellectual pursuits. The feeling experienced during this emotional state is not pleasure as such, but the *expectation* that pleasure will be experienced. The important neurochemical ingredient in the

SEEKING system is dopamine, and drugs that typically would stimulate the system are psychostimulants such as amphetamines and cocaine.

The pleasure system plays a quite different role in the government of behavior. It sustains the regulation of bodily processes, including feeding, drinking and temperature regulation. Stimuli that promote a return to the homeostatic set-point are routinely experienced as pleasurable, while those that impair homeostasis are unpleasant. So, rather than feeling exited and curious, as was the case in the SEEKING system, the pleasure state is one dominated by satisfaction. The important neurochemical ingredient in the pleasure system is endogenous opioids, and drugs that typically would stimulate the system are narcotics such as morphine and heroine.

In Panksepp's theory, emotions are neurologically defined and described. His take is founded in a view that considers emotions as a coherent operating brain system with specific properties. This perspective provides a framework that differentiates pleasure from engagement. We need such a framework, but feel more comfortable when dealing in psychological concepts.

From a psychological point of view, a suitable perspective of basic emotions is offered by Keith Oatley, who together with Phillip Johnson-Laird have developed the Communicative theory of emotions (Oatley & Johnson-Laird, 1987; Oatley, 1992). Although the theory states that basic emotions have a biological structure, they are also phenomenological primitives, and cannot be fully understood by semantics or neurology. Just as one cannot understand what the color red means unless one has had the experience of seeing red, one cannot understand what fear or happiness is unless one has felt those experiences. Moreover, emotions have, according to Oatley, a meaning structure. Goals and plans are what links emotions to the principal aspect of their meaning, implying that what is being communicated by emotions, is information about goals states. Happiness, for example, communicates to our mental system that a goal or a subgoal is being achieved. Different messages are similarly broadcasted by the other basic emotions, according to the principles presented in Table 1. Note that the goal must be emotionally meaningful to produce their phenomenological effects. It will be beyond the scope of this paper to sketch out the principles of emotional meanings, suffice it to say that to enable a goal state to set off an emotional reaction, the goal must be activated and relevant to a self-system. The interested reader is referred to Oatley's own writing for further details (e.g., Oatley, 1992, 2004).

Table 1.
*Goal Status for the Four Basic Emotions in the Communicative Theory of Emotions*

| Emotion | Goal status | Basic communication | Primary function |
|---|---|---|---|
| Happiness | Goal / subgoal being achieved | Continue with plan, modify if necessary | Commitment to plans and goals |
| Anger | Active plan frustrated | Try harder, and / or aggress | Adjust social relations |
| Fear | Self-preservation goal. Threatened or goal conflict | Stop current plan, attend vigilantly to environment | Protect from danger |
| Sadness | Failure of major plan or loss of active goal | Do nothing / search for new plan | Disengage from important goals |

*Note*. Adapted from Oatley & Johnson-Laird, 1987; and Oatley & Johnson-Laird, 1996

Finally, a third perspective on emotions is needed before this section can be concluded. Contrasting both biological and cognitive theories of emotions, a series of socially oriented approaches have concerned themselves with the correlational structure of self-reported emotions. According to this approach, emotions are arranged in a circle around the intersections of two basic factors of emotions. For example, Russell and Barrett (1999)developed a model, often referred to as a circumplex, which posits that emotions can be mapped according to their degree of pleasantness (valence) and their level of arousal. There has been some debate about defining the most suitable factors of an emotion circumplex. Watson, Clark, and Tellegen (1988) have for instance suggested to rotate the axis 45 degrees compared with the Russell/Barrett model. These factors are Positive Affect and Negative Affect (recently relabeled into Positive Activation and Negative Activation, (see Watson, Suls, & Haig, 2002), located halfway between pleasure and activation and halfway between activation and pain, respectively. The distinction between the two models has no principal relevance for the argument being made in the present paper, and will not be further elaborated upon.

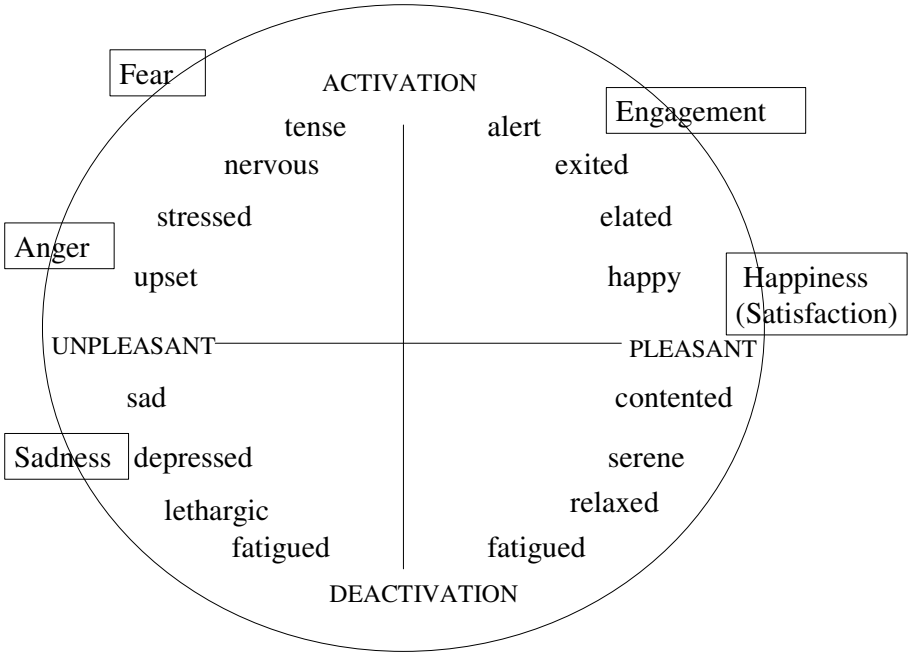



*Figure 2.* The emotion circumplex: Basic emotions in framed squares.

An obvious strength of the emotion circumplex is its ability to provide a useful taxonomy for emotional states. Differences and similarity between distinct feeling states are easily illustrated by their location along the circumference of the circle. Once the basic principles of the configuration is understood, a reader will quickly get an idea about how different emotions are related to one another. The basic principle of circular plots is that items located close together on the circle tend to be roughly similar in their meanings. When the arc distance between two items is $90^0$ the correlation between them is zero. This is due to the fact that, if the variables are presented as vectors in a Cartesian space, the correlation between two variables is equivalent to the cosine of the angles between the two vectors. For example, it can be seen in Figure 2 than pleasantness represent the opposite of unpleasantness, since the two emotions are located 180 degrees apart (the cosine of $180^0$ is –1.00). Pleasantness

and happiness are quite similar in their phenomenological qualities, which can be seen from the sharp angle between them. If the angle between two variables reaches 90 degrees, the variables are uncorrelated (the cosine of $90^0$ is 0).

The weak spot of a circumplex model of emotions is its lack of explaining power. The old idea that emotions can be reduced to a mixture of arousal and valence appears inferior indeed to modern theories of emotional processes, such as those presented by Panksepp and Oatley. However, we believe that the problem of explanation can be solved if the model is interpreted as a combination of Oatley's Communicative theory of emotions and the concept of a simplex structure.

*The simplex*

The idea of a simplex structure was developed by Guttman (1954) as one of several examples of the shortcomings of the common factor model. There are some data structures, Guttman argued, for which a factor analysis consequently will fall short of discovering its true generative mechanism. The simplex is such a structure. Basically, when a correlation matrix is generated by a simplex procedure, and these data are factor analyzed, the result will be a two-factor model. Since there is only one factor operating on the data, the correct number of factors should of course have been one. A detailed elaboration of this phenomenon is provided in the Appendix A. For now, suffice it to say that if the factor structure presented in Figure 2 really is generated by a single factor, a case can be made that the configuration may be accounted for by the concept of goal status as presented by the Communicative theory of emotions. Because of its superior explanatory power, Oatley's theory should be preferred to less powerful theories, such as those proposed by Russell/Barrett or Watson/Clark/Tellegen.

As indicated in Table 1, the dimension of goal status has four distinct positions. A goal can be achieved, obstructed, threatened or lost, and will, if emotionally meaningful, produce the feelings of happiness, anger, fear and sadness respectively. Drawing on Panksepp's theory, we suggest to add a fifth position to the goal status dimension. If one expects a (emotionally meaningful) goal to be achieved, a feeling of engagement and interest will be produced[1].

*Aim of the paper*

The major argument of this paper is that a single hedonic dimension is unable to account for the variability of emotional experience which must be considered in a theory of human well-being. We propose that well-being research replace the overall pleasure and pain approach (also referred to as a good-bad dimension or an approach-avoidance system) with a basic emotion approach. Note that this proposal is not about splitting the hedonic dimension into a positive part and a negative part. Sometimes, such a distinction is useful. However, in the debate on utilities and capabilities we believe a division between two qualitatively different aspects of the so-called positive emotions will be more appropriate. Rather than limiting the debate on emotions to a talk about positive and negative emotions, we suggest that a distinction must be made between two of the positive emotions as well, namely pleasantness and engagement.

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[1] As clarified by Panksepp (1998), a PLAY system may be separated from the SEEKING system, implying that the feeling of involved interest may have multiple causes. We too believe that several different mechanisms are able to create feelings of interest and engagement. However, the details of these processes are poorly understood, and reviewing them will be beyond the scope of this paper. Suffice it to say that we do not consider the fulfilment of needs and goals to be among the causes of engagement and interest.

Empirical support for our claim may be gained by confirmation of the following hypothesis:

(1) A circular representation of emotions may be accounted for by a single dimension. The best candidate to fill this role is the concept of goal status as proposed in Oatley's theory of basic emotions.

(2) We assume that measures of life satisfaction partly reflect stable individual dispositions. Such dispositions will be reflected in the pleasure system, and not in the engagement system. In other words, high scores of life satisfaction are hypothesized to be located in the pleasant area of a circular representation of emotions.

(3) Following the reasoning of personal dispositions from the second hypothesis, curious individuals are hypothesized to be located in the engagement area of a circular representation of emotions.

(4) Pleasure will follow from goal achievement and engagement will follow from the anticipation of goal achievement. The difference will appear as distinct locations on a circular representation of emotions.

We have tested our hypotheses against data from two different surveys. The first comprises data from an approximately representative sample of the Norwegian population (N = 466). This study addresses the first three of our hypotheses. The second study presents data from a Norwegian convenience sample (N = 131). This study addresses all four hypotheses.

## Study 1

### *Methods*

*Participants*

Data are from a questionnaire, distributed by ordinary mail to a representative sample of 1420 Norwegians. A total of 466 usable responses were returned, yielding a response rate of 33%. There are 257 females (57%) in the sample, which has a mean age of 48 years, ranging from 19 to 71, with a standard deviation of 13 years.

*Materials*

*Satisfaction with life* was measured with the Satisfaction With Life Scale (SWLS – Pavot & Diener, 1993), a five item inventory with items such as "I am satisfied with my life". Responses are given on a numerical rating scale running from 1 (strongly disagree) to 7 (strongly agree). Cronbach's alpha ($\alpha$) for the SWLS was .92. The participants were further divided into a high SWLS group (n = 241) and a low SWLS group (n = 223), based on the median split of the SWLS sumscore variable.

*Curiosity* was measured with the five item curiosity subscale from the Work Preference Inventory (WPI - Amabile et al., 1994). An example item is: "I enjoy trying to solve complex problems". Responses are given on a numeric rating scale running from 1 (strongly disagree) to 5 (strongly agree). Cronbach's alpha for the Curiosity scale was .83. Participants were separated into a high curiosity group ( n= 242) and a low curiosity group (n = 223), based on the median split of the Curiosity sumscore variable.

*Basic emotions* was measured with the Basic Emotion Trait Test (BETT) which is an instrument developed by the first author. The BETT contains a total of 15 items, three for each of the five basic emotions (pleasure, explore, anger, fear and sadness). An exploratory factor analysis with five factors (Maximum Likelihood, with Promax rotation) revealed that all items loaded on their expected factors (Table 2).

Table 2
*Pattern Matrix and Factor Correlations from a Maximum Likelihood Factor Analysis with Promax Rotation for the Basic Emotions Trait Test (N = 453).*

| | Factor | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Afraid | .919 | | | | |
| Scared | .840 | | | | |
| Nervous | .710 | | | | |
| Engaged | | .842 | | | |
| Inspired | | .797 | | | |
| Interested | | .757 | | | |
| Happy | | | .868 | | |
| Joyful | | | .840 | | |
| Satisfied | | | .732 | | |
| Fainthearted | | | | .992 | |
| Blue | | | | .858 | |
| Sad | | | | .665 | |
| Annoyed | | | | | .914 |
| Angry | | | | | .721 |
| Frustrated | | | | | .612 |
| Factor correlations | | | | | |
| Factor 1 | 1.00 | | | | |
| Factor 2 | -.24 | 1.00 | | | |
| Factor 3 | -.39 | .58 | 1.00 | | |
| Factor 4 | .63 | -.42 | -.64 | 1.00 | |
| Factor 5 | .46 | -.10 | -.39 | .46 | 1.00 |

*Note*. Only loadings > .50 are shown.

The five factors explained 79% of the variance, and had $\chi^2$ (49, n = 433) = 54.8, $p$ = .059. A confirmatory factor model fitted the data reasonably well, with $\chi^2$ (80, n = 433) = 260.8, $p$ < .001, CFI = .95, RMSEA = .070 (CI of RMSEA = .060 - .080). The model had five first-order factors, and one second-order positive emotion factor and one second-order negative emotion factor. The two second-order factors were negatively correlated ($r$ = -.59, $p$ < .001). The 15 items were collapsed into five sumscore variables, each represented by 3 variables: pleasure ($\alpha$ = .86), engagement ($\alpha$ = .86), anger ($\alpha$ = .86), fear, ($\alpha$ = .79) and sadness ($\alpha$ = .91).

*Results*

The five basic emotions sumscore variables were entered into a principal component analysis (PCA), revealing two components with Eigenvalues above 1.00, and explaining 72.7% of the total item variance. The five emotions spread across the circumference of a half circle as predicted by the notion of an emotion simplex. The correlation pattern adheres to the criterion for a simplex (cf. Appendix B), and the observed association among the five basic emotions may thus be consistent with the assumption that a single dimension accounts for the variation among them. Hypothesis 1 was supported to the extent that it cannot be rejected.

For ease of interpretation, we transformed the two dimensional PCA model into a polar plot in which the factor loadings are transformed into angles (symbolized as theta (θ) in polar connotations) of a circle. So, rather than being represented by two factor scores, each emotion is given an angular localization in the polar diagram. This configuration is displayed in Figure 3.

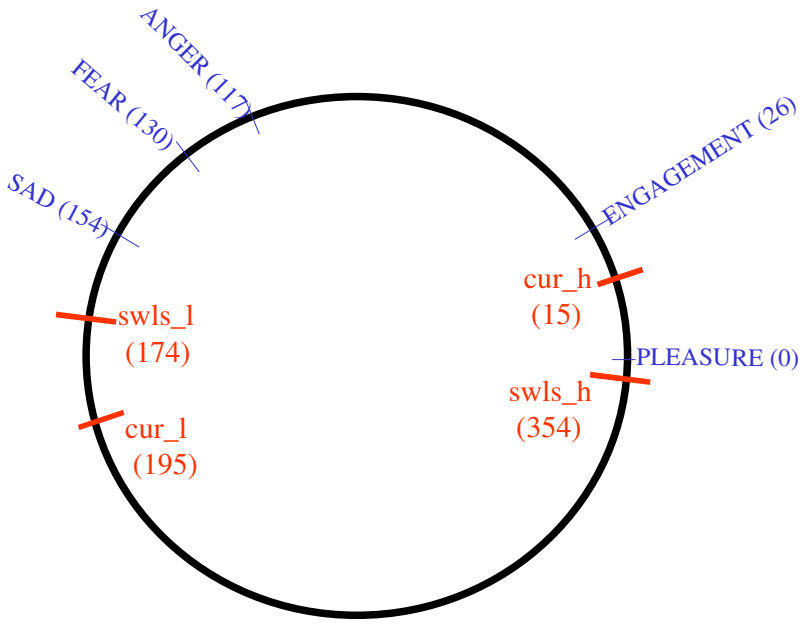



*Figure 3.* Polar plot of the emotions in Study 1. The location of the emotions are notated outside the circle, and location of the life satisfaction (swls) and curiosity (cur) high score groups (_h) and low score groups (_l) inside. (Angles in parentheses.)

The SWLS and curiosity scales were significantly, but moderately correlated ($r$ = .22, $p$ < .001). We further identified the location of individuals with a high score on the SLWS, and individuals with a high score on the curiosity sumscore. As predicted, the high satisfaction group reported their everyday emotions to be in the pleasant area. The emotions reported by the high curiosity group are located in the engagement sector (Figure 3). Hypothesis (2) and (3) are confirmed.

## Study 2

### *Methods*

*Participants*

Two hundred questionnaires (each with a lottery ticket and a postage-paid return envelope) were distributed to Norwegian travellers who were lined up to embark a ferry crossing a fiord in northern Norway. A total of 131 returned surveys with usable data were received, resulting in a response rate of 66%. The sample was comprised of 52% women, and the participants had a mean age of 44 years (range = 19 to 73 years, *SD* = 13).

*Materials*

*Satisfaction with life* was again measured with the Satisfaction With Life Scale. Cronbach's alpha for the SWLS was .90. Participants were separated into a

high SWLS group (n = 60) and a low SWLS group (n = 69), based on the median split of the SWLS sumscore variable.

*Curiosity* was again measured with the five item curiosity subscale from the Work Preference Inventory. Cronbach's alpha for the curiosity scale was .76. Participants were separated into a high curiosity group (n = 70) and a low curiosity group (n = 59), based on the median split of the curiosity sumscore variable.

*Emotions* were measured in a semi-projective procedure. Participants were asked to give their opinions about how other people might feel in different situations. A series of drawings were then presented; each of which had a set of six emotions attached to them. The items were Satisfaction, Sadness, Interest, Anger, Challenge and Pleasantness. Participants were asked to indicate how much the person on the drawing felt of each emotion from 1 (not at all) to 5 (very much). The faces of the people in the drawings displayed as little emotional expression as possible. In one of the drawings a woman in full academic regalia is awarded for her achievements in front of an audience. In another drawings, a woman is working on a jigsaw puzzle, and in a third drawing a man puts together a building-kit chair. There were a total of eight drawings in the questionnaire. To save space, only the three abovementioned drawings will be presented here.

*Results*

The six emotion variables were entered into a principal component analysis, revealing two components with Eigenvalues above 1.00, and explaining 70.5% of the total item variance. Following the procedure of Study 1, the correlation matrix was found to be consistent with the simplex criteria (cf. Appendix B). Again, our first hypothesis cannot be rejected. Next, a polar representation was constructed as depicted in Figure 4.

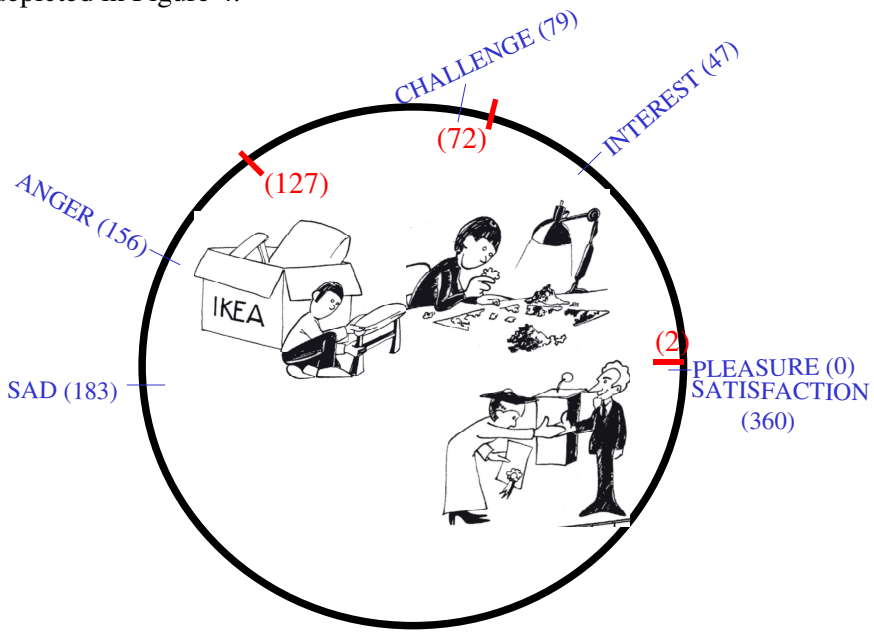



*Figure 4.* Polar plot of the emotions in Study 2. The location of the three drawings are mapped inside the circle together with their angular position. (Angles in parentheses.)

Figure 4 shows that the goal achievement drawing is located at 2 degrees, which is very close to pleasant and satisfaction. The two activity-drawings are located

at 72 and 127 degrees for the "jigsaw puzzle" episode and the "chair building" episode respectively. We interpret these results as supportive of hypothesis (4).

The SWLS and curiosity variables were significantly, but moderately correlated ($r = .22$, $p < .05$). We further identified the location of the two life satisfaction groups and the two curiosity groups. As expected, the high satisfaction group was clustered close to the pleasure area, at 355 degrees. The high curiosity group was situated at 65 degrees, between interesting and challenging. As was the case in our fist study, hypothesis (2) and (3) was conformed in Study 2 (Figure 5).

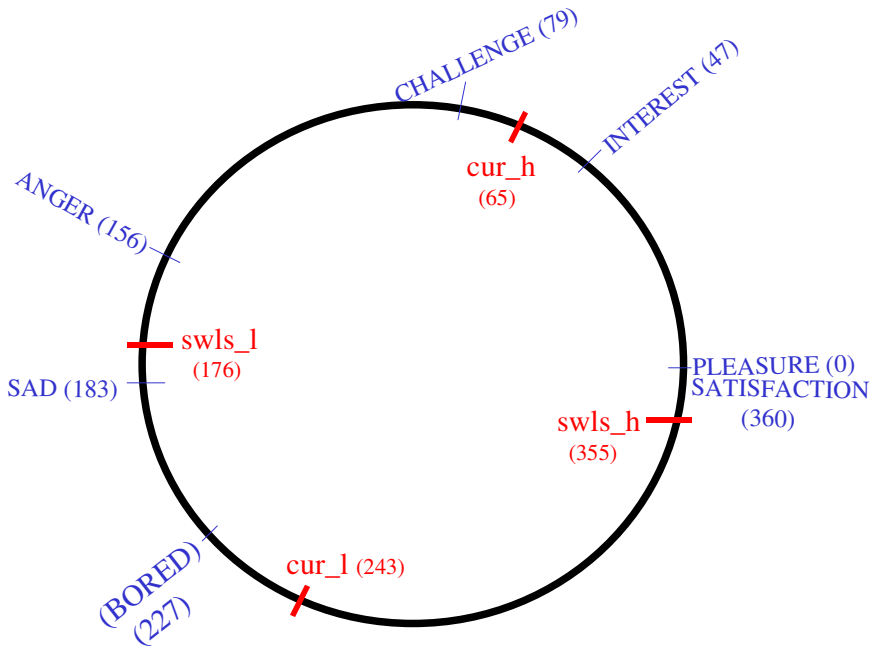



*Figure 5.* Polar plot of life satisfaction and curiosity in Study 2. Location of the life satisfaction (swls) and curiosity (cur) high score groups (_h) and low score groups (_l) inside. (Angles in parentheses.)

## Conclusion

Our hypotheses were confirmed in two empirical studies. This implies that a single dimension may explain the data structure normally considered to be a two-factor circumplex. Hence, we suggest that the circular pattern of emotions could represent a simplex structure, and that the causal mechanism generating these emotions is goal status as elaborated in the Communicative theory of emotions (Oatley, 1992).

We further found that life satisfaction is typically biased toward pleasure, which is the feeling of need fulfillment and goal accomplishment. A personal disposition toward curiosity, on the other hand, was found to be biased towards interest and engagement, which are feelings generated by Panksepp's SEEKING system (Panksepp, 1998).

Compared with the emotion circumplex, we believe that the simplex model offers a more coherent explanation of emotions. The reason for this is basically that it has proven difficult to for the components of valence and arousal (which are the two most common factors of an emotion circumplex) to provide a reasonable explanation for the complex nature of emotions. It is reasonable that, for instance, the loss of an

important goal is capable of producing feelings of sadness, but it is more doubtful that a certain combination of valence and arousal is the cause of such feelings.

Equally relevant for the aim of this workshop is the result that individuals with high scores on life satisfaction tend to emphasize the goal fulfillment aspects of their lives, whereas individuals with a curiosity orientation tend to emphasize the goal seeking aspects of life. The emotional life of these two groups thus seem to be qualitatively different from each other. We should be careful not to mash these experiences together in a big and vague pleasure-concept. Not only do the two feeling states represent different phenomenological states. They also represent different kinds of action and motivation.

An important implication of this finding is that the measures commonly used in empirical well-being studies seem to equate happiness with the tendency of having rather than the doing aspects of life. To the extent that both perspectives are important for a good life, studies to come need to include them both. We must recognize that the existing body of well-being knowledge is biased toward the happiness of having, and that much work remains before we are equally knowledgeable about the happiness of doing.

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## APPENDIX A

The concept of a simplex was suggested by Guttman (1954) to describe a set of variables whose intercorrelations reveal a simple order (the term simplex is a contraction of the phrase "simple order of complexity"). A simplex may, however, be generated by other sources than an ordered complexity. For example, in Coombs' theory of unfolding data (Coombs, 1964), a simplex may be accounted for by data that reflect variation in both individuals and variables. Similar arguments have been suggested by Thurstone (1928) and are elaborated by Rasch (1960), and Luce and Tukey (1964). In the following, however, we will restrict ourselves to give a short presentation of the Coombs simplex. This model holds that psychological data reflect properties of both persons and items, according to (A1):

$$z_{ij} = a_j (x_i - y_j)^2 + b_j \qquad \text{(A1)}$$

where $z_{ij}$ is the response given by person *i* to item *j,* where *i* and *j* are assumed to be linearly related to the squared distance between the points $x_i$ and $y_j$. $a_j$ and $b_j$ are constants associated with stimulus *j*. Two common factors (or principal components) would be required to reproduce the intercorrelations of items conforming to (A1). The first factor will represent the underlying dimension, and the additional factor will reflect the item(s) whose position represents the median of the dimension (Coombs & Kao, 1960).

The geometrical representation of a Coombs simplex is a straight line, or a genotypic space ordered from smallest to largest. In a two dimensional factor analysis this line is transformed to a semicircle curved along the circumference of a plot with factor 1 and factor 2 as the x axis and y-axis respectively (see Figure A2). The Coombs simplex is further defined as a set of variables for which:

$$r_{jl \cdot k} = -1 \qquad (j < k < l) \qquad \text{(A2)}$$

where $r_{jl \cdot k}$ is he partial correlation between variables j and l controlling for k.

In addition, when variable *k* is not intermediate to variables *j* and *l*, the partial correlation will be:

$$r_{jl \cdot k} = 1 \qquad (j < l < k) \text{ or } (k < j < l) \qquad \text{(A3)}$$

Since Coombs' model is restricted to data without errors, Davison (1977) has proposed a metric, unidimensional unfolding model, building on Coombs theory, but not constrained by the assumption of error free data. Following Davison, a correlation matrix may still represent a simplex pattern even if A2 and A3 are violated, if the variables confirm to (A4) or (A5)

$$r_{jl \cdot k} = < 0 \qquad (j < k < l) \qquad \text{if} \quad r_{jk} . r_{kl} = < 0 \qquad \text{(A4)}$$

$$r_{jl \cdot k} = > 0 \qquad (j < l < k) \text{ or } (k < j < l) \qquad \text{if} \quad r_{jk} . r_{kl} = > 0 \qquad \text{(A5)}$$

where and $r_{jk} . r_{kl}$ is the product of the correlation between the variables *j* and *k* multiplied with the correlation between the variables *k* and *l*.

The number of partial correlations to be tested is given by (A6).

$$\frac{n!}{2\,(n-3)!} \qquad \text{(A6)}$$

Other characteristics of a simplex are the following:

(a) As one moves from the diagonal towards corners of the correlation matrix, the correlations should become smaller and smaller (upper part of Table A1)

(b) The sum of the columns of the correlation matrix should be curvilinear, with the lowest totals at the endpoints of the table (Table A1- bottom row).

Table A1
Representation of a Simplex Correlation Matrix

| Variables | V1 | V2 | V3 | V4 | V5 |
|---|---|---|---|---|---|
| V1 | 1 | ρ1 | ρ2 | ρ3 | ρ4 |
| V2 | ρ1 | 1 | ρ1 | ρ2 | ρ3 |
| V3 | ρ2 | ρ1 | 1 | ρ1 | ρ2 |
| V4 | ρ3 | ρ2 | ρ1 | 1 | ρ1 |
| V5 | ρ4 | ρ3 | ρ2 | ρ1 | 1 |
| SUM | SUM-A | SUM-B | SUM-C | SUM-B | SUM-A |

*Note.* ρ1 > ρ2 > ρ3 > ρ4; SUM-A < SUM-B < SUM-C.

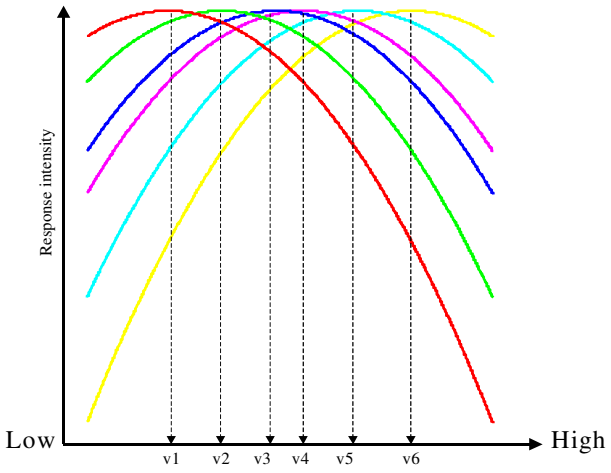



*Figure A1.* The curvilinear order between response intensity of variables (v1 to v6) on the underlying dimension (from low to high) in a Coombs' simplex with the optimal response for each item at successively higher levels on the underlying dimension (dotted arrows).

(c) The data generating the correlation matrix should be curvilinearly ordered to the underlying dimension that is supposed to cause the observed responses (Figure A1).

(d) Factor analysis (or a principal component analysis) for the correlation matrix should yield a semicircular, two-factor structure. Along the semicircle, variables will be ordered by their positions on the stimulus dimension (Figure A2).

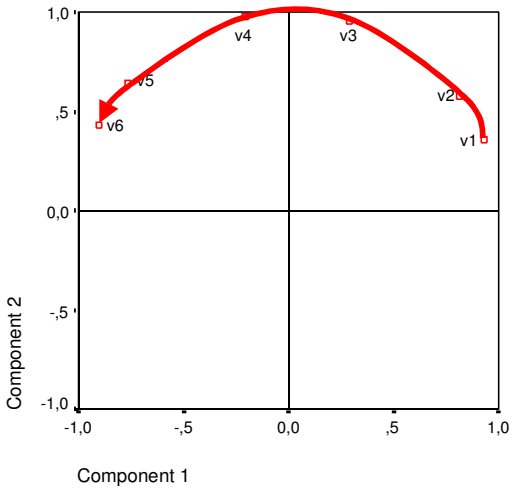



*Figure A2.* The semicircular two-principal component structure for variables v1 to v6. The curved arrow represents the underlying dimension, running from low to high (cf. Figure A1).

## Example

Hypothetical data were generated for six variables and 1000 cases based on A7. This is a variation of A1, in that density function curves are generated rather than quadratic curves. The general formula for the probability density function of the normal distribution is:

$$f(x) = \frac{e^{-(x-\mu)^2/(2\sigma^2)}}{\sigma\sqrt{2\pi}} \qquad \text{(A7)}$$

Where $\mu$ is the location parameter, $\sigma$ is the scale parameter and $e$ is the exponential constant 2.718. The case where $\mu = 0$ and $\sigma = 1$ is known as the standard normal distribution.

In the simulation we constructed a variable $x$ with score range 0-10, and with the 1000 cases randomly and evenly distributed along this variable. The following location parameters ($\mu$) were used for the six generated variables: 2.5, 3.5, 4.5, 5.5, 6.5, 7.5, thus implying equal intervals along the x-variable. The scale parameter ($\sigma$) was set to 2.00. The curves generated by A7 are presented in Figure A3.

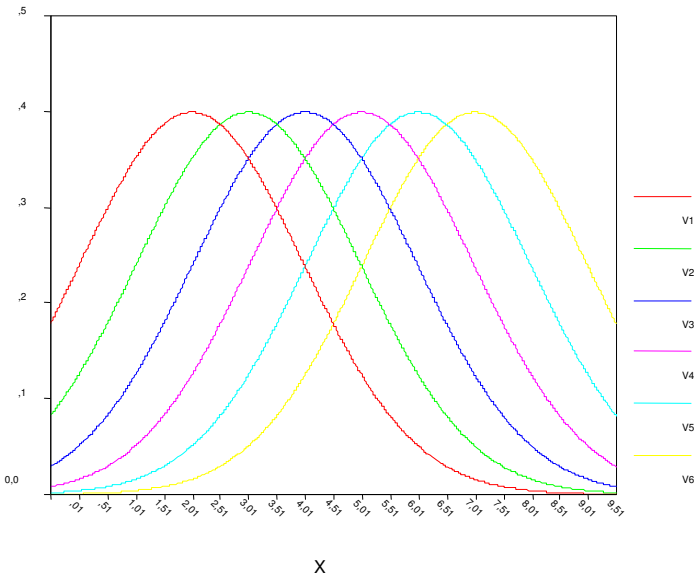



*Figure A3.* The curvilinear relation between variables V1 to V6 and the underlying dimension ordered from low to high.

Following (A6) the total number of possible partial correlation for a correlation matrix with six variables is:

$$\frac{1x2x3x4x5x6}{2\ (1x2x3)} = 60$$

The upper part of Table A3 shows the zero-order correlations among the six variables generated by (A7). They all get smaller as one moves from the diagonal toward the lower left corner (and upper right corner) of the matrix. Further, the sum of each column is high in the middle and tapers off towards the beginning and the end of the list of variables. The centre part of Table A3 shows all 60 possible partial correlations for these data and their corresponding product-sums (all possible pairs of $r_{jk}.r_{kl}$). The partial correlations reveal that all the 20 correlations in which the variable being partialled out (i.e., *k*) is intermediate to the other two variables (i.e., *j* and *l*) are negative (cf. (A4)). The remaining 40 correlations in which the variable being partialled out is not intermediate to the other two variables are all positive (cf. (A5)). The bottom part of Table A3 summarizes this information.

*Table A3*

Correlations, Sums and Partial Correlations for Hypothetical Simplex Data

Zero-Order Correlations

| | 1. | 2. | 3. | 4. | 5. | 6. |
|---|---|---|---|---|---|---|
| 1. | 1.00 | 0,86 | 0,42 | -0,17 | -0,66 | -0,91 |
| 2. | 0,86 | 1 | 0,82 | 0,33 | -0,25 | -0,66 |
| 3. | 0,42 | 0,82 | 1 | 0,81 | 0,33 | -0,17 |
| 4. | -0,17 | 0,33 | 0,81 | 1 | 0,82 | 0,42 |
| 5. | -0,66 | -0,25 | 0,33 | 0,82 | 1 | 0,86 |
| 6. | -0,91 | -0,66 | -0,17 | 0,42 | 0,86 | 1 |
| **SUM** | **-0,46** | **2,10** | **3,21** | **3,21** | **2,10** | **0,54** |

| Partial correlations (Rjl.k) Intermediate | | | Not Intermediate | | |
|---|---|---|---|---|---|
| -0,98 | -0,92 | 0,99 | 0,99 | 0,99 | 0,99 |
| -0,94 | -0,94 | 0,98 | 1,00 | 1,00 | 1,00 |
| -0,90 | -0,96 | 0,96 | 0,99 | 1,00 | 0,99 |
| -0,89 | -0,93 | 0,83 | 0,96 | 0,99 | 0,65 |
| -0,96 | -1,00 | 0,97 | 0,95 | 0,89 | 0,90 |
| -0,93 | -0,96 | 0,90 | 0,97 | 0,97 | 0,97 |
| -0,94 | -0,89 | 0,65 | 0,89 | 0,95 | 0,83 |
| -1,00 | -0,90 | 0,86 | 0,83 | 0,56 | 0,96 |
| -0,96 | -0,94 | 0,56 | 0,83 | 0,86 | 0,98 |
| -0,92 | -0,98 | 0,58 | 0,58 | 0,96 | 0,99 |

| Cross products (Rjk*Rkl) Intermediate | | | Not intermediate | | |
|---|---|---|---|---|---|
| 0,71 | -0,14 | 0,34 | 0,36 | -0,07 | -0,08 |
| 0,28 | -0,07 | -0,06 | 0,27 | 0,27 | 0,27 |
| -0,22 | 0,27 | 0,17 | -0,08 | 0,27 | 0,36 |
| -0,57 | 0,14 | 0,60 | 0,11 | -0,07 | 0,15 |
| 0,34 | 0,66 | -0,14 | -0,15 | -0,28 | -0,22 |
| 0,14 | 0,34 | -0,22 | -0,21 | -0,21 | -0,14 |
| -0,07 | -0,57 | 0,15 | -0,28 | -0,15 | 0,60 |
| 0,66 | -0,22 | -0,54 | -0,57 | -0,38 | 0,17 |
| 0,27 | 0,28 | -0,38 | -0,57 | -0,54 | -0,06 |
| -0,14 | 0,71 | -0,78 | -0,78 | 0,11 | 0,34 |

Number of partial correlations in accordance with (A4) and (A5)

| | | |
|---|---|---|
| Intermediate | 20 | 100 % |
| Not Intermediate | 40 | 100 % |
| Total | 60 | 100 % |

*Note.* Rjl.k = correlations between any possible pair of items *j* and *l* when *k* is partialled out. Rjk*Rkl = the cross product when multiplying any possible correlations between items *j* and *k* with any possible correlations between items *k* and *l*.

Figure A4 shows that how the items conform to (d). In the factor analysis, the first factor explains 55.2% of the variance, and the second factor explains 43.1%.

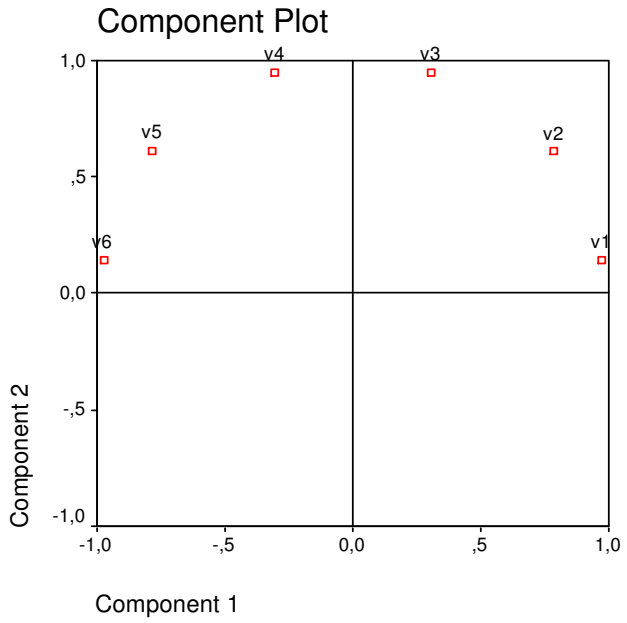



*Figure A4.* The principal component plot for items V1 to V6

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## APPENDIX B

The correlation matrices are tested against the guidelines presented in Appendix A.

*Study 1.*

*Table B1*

Simplex Characteristics for the Correlation Matrix in Study 1

Zero-Order Correlations

| | | 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|---|---|
| 1. | PLEASURE | 1,00 | 0,54 | -0,35 | -0,33 | -0,60 |
| 2. | ENGAGEMENT | 0,54 | 1,00 | -0,10 | -0,22 | -0,40 |
| 3. | ANGER | -0,35 | -0,10 | 1,00 | 0,40 | 0,45 |
| 4. | FEAR | -0,33 | -0,22 | 0,40 | 1,00 | 0,57 |
| 5. | SADNESS | -0,60 | -0,40 | 0,45 | 0,57 | 1,00 |
| **SUM** | | **0,26** | **0,82** | **1,39** | **1,41** | **1,02** |

| Partial correlations (Rjl.k) | Intermediate | Not Intermediate | |
|---|---|---|---|
| | -0,35 | 0,54 | 0,01 |
| | -0,26 | 0,51 | -0,11 |
| | -0,49 | 0,41 | 0,32 |
| | -0,22 | -0,25 | 0,39 |
| | -0,53 | -0,12 | 0,20 |
| | -0,20 | 0,01 | 0,31 |
| | -0,40 | 0,11 | 0,44 |
| | -0,53 | -0,01 | 0,49 |
| | -0,34 | 0,09 | 0,54 |
| | 0,29 | -0,06 | 0,48 |

| Cross Products (Rjk*Rkl) | Intermediate | Not Intermediate | |
|---|---|---|---|
| | -0,05 | 0,04 | -0,23 |
| | -0,12 | 0,07 | -0,32 |
| | -0,22 | 0,24 | 0,12 |
| | -0,14 | -0,13 | 0,02 |
| | -0,16 | -0,27 | 0,25 |
| | -0,04 | -0,34 | 0,21 |
| | -0,04 | -0,19 | 0,04 |
| | -0,19 | -0,09 | 0,20 |
| | -0,13 | -0,18 | 0,09 |
| | 0,23 | -0,18 | 0,18 |

Number of partial correlations in accordance with (A4) and (A5)

| | | | |
|---|---|---|---|
| | Intermediate | 10 | 100% |
| | Not Intermediate | 20 | 100% |
| | Total | 30 | 100% |

*Note.* Rjl.k = correlations between any possible pair of items *j* and *l* when *k* is partialled out; Rjk*Rkl = the cross product when multiplying any possible correlations between items *j* and *k* with any possible correlations between items *k* and *l*.

*Study 2.*

*Table B2*

Simplex Characteristics for the Correlation Matrix in Study 2

Zero-Order Correlations

| | | 1. | 2. | 3. | 4. | 5. | 6. |
|---|---|---|---|---|---|---|---|
| 1. | SATISFACTION | 1,00 | 0,79 | 0,48 | 0,13 | -0,44 | -0,51 |
| 2. | PLEASURE | 0,79 | 1,00 | 0,48 | 0,15 | -0,46 | -0,48 |
| 3. | INTEREST | 0,48 | 0,48 | 1,00 | 0,52 | -0,23 | -0,38 |
| 4. | CHALLENGE | 0,13 | 0,15 | 0,52 | 1,00 | 0,02 | -0,18 |
| 5. | ANGER | -0,44 | -0,46 | -0,23 | 0,02 | 1,00 | 0,42 |
| 6. | SADNESS | -0,51 | -0,48 | -0,38 | -0,18 | 0,42 | 1,00 |
| **SUM** | | **1,45** | **1,49** | **1,89** | **1,65** | **0,31** | **-0,12** |

| Partial correlations (Rjl.k) Intermediate | | | Not Intermediate | | | |
|---|---|---|---|---|---|---|
| | 0,19 | -0,45 | 0,72 | 0,19 | 0,53 | 0,10 |
| | 0,02 | -0,50 | 0,78 | 0,48 | 0,52 | 0,17 |
| | -0,15 | -0,46 | 0,73 | 0,44 | 0,54 | 0,11 |
| | -0,24 | -0,46 | 0,72 | 0,37 | 0,50 | -0,13 |
| | -0,17 | -0,28 | 0,49 | 0,08 | -0,02 | -0,12 |
| | -0,39 | -0,34 | 0,44 | 0,18 | -0,01 | 0,02 |
| | -0,40 | -0,40 | 0,37 | 0,08 | -0,08 | 0,25 |
| | -0,14 | -0,36 | 0,15 | -0,20 | -0,18 | 0,25 |
| | -0,41 | -0,32 | 0,05 | -0,32 | -0,19 | 0,37 |
| | -0,36 | -0,21 | -0,29 | -0,15 | 0,09 | 0,43 |

| Cross products (Rjk*Rkl) Intermediate | | | Not intermediate | | | |
|---|---|---|---|---|---|---|
| | 0,38 | 0,00 | 0,23 | 0,38 | 0,06 | -0,07 |
| | 0,12 | -0,02 | 0,02 | 0,08 | 0,07 | -0,12 |
| | -0,36 | 0,00 | 0,20 | 0,10 | 0,00 | -0,07 |
| | -0,37 | -0,03 | 0,24 | 0,18 | 0,07 | -0,07 |
| | 0,25 | 0,01 | 0,07 | 0,10 | -0,21 | -0,07 |
| | -0,11 | -0,09 | 0,10 | -0,01 | -0,22 | -0,20 |
| | -0,18 | -0,18 | 0,19 | 0,09 | -0,16 | 0,22 |
| | 0,25 | -0,19 | -0,01 | -0,35 | -0,25 | 0,22 |
| | -0,11 | -0,09 | 0,09 | -0,20 | -0,23 | 0,09 |
| | -0,18 | 0,01 | -0,21 | -0,40 | -0,06 | 0,00 |

Number of partial correlations in accordance with (A4) and (A5)

| | | |
|---|---|---|
| Intermediate | 20 | 100% |
| Not Intermediate | 40 | 100% |
| Total | 60 | 100% |

*Note.* Rjl.k = correlations between any possible pair of items *j* and *l* when *k* is partialled out; Rjk*Rkl = the cross product when multiplying any possible correlations between items *j* and *k* with any possible correlations between items *k* and *l*.