



Components of Emotional Meaning: A sourcebook

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CHAPTER

7 The global meaning structure of the emotion domain: Investigating the complementarity of multiple perspectives on meaning

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Abstract

The hypotheses about the overall structure of the emotion domain as proposed by the three main theoretical approaches in psychology is investigated. As predicted by the componential emotion approach, it is found that features from all emotion components contribute universally to the meaning of emotion terms. The prediction of the dimensional approach that emotion information can be represented adequately by a low-dimensional structure is confirmed. The four dimensions of VALENCE, POWER, AROUSAL, and NOVELTY emerge in that order of importance. A categorical representation of the data revealed the four major basic clusters of joy, sadness, fear, and anger and two smaller clusters of surprise and compassion. Moreover, it is observed that 82.1% of the emotion terms across the 34 samples could be correctly classified in one of the 24 a priori emotion term categories on the basis of their feature profiles.

Keywords: [valence](#), [power](#), [arousal](#), [novelty](#), [joy](#), [sadness](#), [fear](#), [anger](#), [compassion](#) and [surprise](#)

Subject: [Developmental Psychology](#), [Social Psychology](#)

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The present chapter provides a first overview of the meaning structure of the emotion domain on the basis of the GRID database. With the multidisciplinary perspectives that have guided the construction of the GRID instrument and the extensive data collection, an extremely rich database has been generated that can be analysed in many different ways and that can be used to answer very different research questions. This chapter focuses exclusively on the global or overall meaning structures that emerge from the GRID research across all languages, countries, and samples, as well as across all emotion terms and all emotion components. By doing this, the present chapter takes a universalistic stance: it aims at identifying the common denominator of meaning in the emotion domain. It is, however, important to interpret the results of the present chapter together with the results reported in the subsequent parts of the book, which focus on specificity of each emotion component (Part 3), on the relationship between meaning and psychological processes (Part 4), on

cultural differences in the meaning in the emotion domain (Part 5), on linguistic issues in the study of meaning of emotion terms (Part 6), as well as on the specific issues that have been raised by the contributors of the GRID project (Part 7). Searching for both general and culturally, linguistically, and psychologically specific aspects are not mutually exclusive, but complementary aims. The general patterns of meaning can be used as a point of reference to identify specificity, and vice versa, the identification of specificity clarifies the boundaries of general tendencies.

The analysis of the overall structure is guided by the hypotheses and research questions that were developed in the first part of this book (see Chapters 1 to 4), and that have been made explicit in Chapter 5. In the current chapter, we systematically restate those hypotheses and research questions, organized in terms of the three theoretical approaches from the psychological perspective on meaning that have guided the construction of the GRID instrument, namely the componential, the dimensional, and the basic emotion approach.

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7.1 The componential approach

Based on the Component Process Model of emotion (CPM; Scherer, 1984b; 2001; 2005b; 2009c; Chapter 1) the feature profile view on meaning suggests that the meaning of an emotion term can be decomposed into a profile of features. The CPM has been used to identify the components and features that are needed to define emotion terms. According to the CPM, an emotion is a process that is elicited by goal-relevant events and that consists of coordinated, synchronized changes in five emotion components, namely Appraisals, Bodily reactions, Feelings, Expressions, and Action tendencies, in order to prepare the organism to react adaptively to the event. According to this definition, an emotion term can be decomposed into features that represent the coordinated and synchronized changes in each of these five components. This implies the fundamental hypothesis of the GRID, namely that *features from ALL emotion components play a constitutive role in the meaning of emotion terms (Hypothesis 1)*, for the very reason that it is the synchronized activity between these components that constitute the emotion. If confirmed, the question arises *how salient each of these emotion components are in defining the meaning of emotion words (Research Question 1)*. The CPM predicts that features from all emotion components will be involved in the meaning of emotion terms, but does not specify the relative role or weight of individual components or features in the process. The additional hypothesis from the componential approach presented in Chapter 5, namely that each emotion component will be characterized by its own internal structure, is not investigated in the current chapter, but will be treated in the next part of this volume (see Chapters 8 to 13).

7.2 The dimensional approach

According to the dimensional approach, the emotion domain can be represented by a small number of dimensions. This approach has been very popular in psychological assessment of emotions and affects, as well as in psycholinguistic research on the meaning of emotion words (see Chapter 2). In psychological assessment there are four frequently used two-dimensional models for which it has been demonstrated, empirically, that they consist of a VALENCE and an AROUSAL dimension, or a rotation thereof (Yik, Russell, & Feldman-Barrett, 1999). Psycholinguistic research looking either at the connotative meaning structure of words in general (e.g., Osgood, May, & Miron, 1975; Osgood, Suci, & Tannenbaum, 1957) or at the psychological similarities between more narrowly defined emotion words (e.g., Fontaine, Poortinga, Sediadi, & Markam, 2002; Shaver, Schwartz, Kirson, & O'Connor, 1987; Schaver, Wu, & Schwartz, 1992) has identified a three-dimensional structure across languages, namely a VALENCE, POWER, and AROUSAL dimension. In consequence, when the *meaning* of emotion words is studied, three rather than two dimensions are to be expected.

A low-dimensional representation of the emotion domain is compatible with the CPM, because of the presumed synchronization of the emotion components. Related emotions will share comparable forms of synchronization and their respective feature profiles will overlap. If the CPM represents a plausible model of the emotion process, it can be expected that the overlap between the respective feature profiles will correspond to the psychological similarities between the emotion terms. This implies that the relative degree of overlap between the feature profiles can also be *represented by the three dimensions of VALENCE, POWER, and AROUSAL* (Hypothesis 2).

p. 108 In a preliminary study with the GRID instrument in three western languages (English, French, and Dutch), a fourth well-interpretable dimension was observed over and above the three dimensions of VALENCE, POWER, and AROUSAL (Fontaine, Scherer, Roesch, & Ellsworth, 2007). The fourth dimension particularly differentiated the term *surprise* from the other emotion terms. The dimension was characterized by Appraisals of suddenness and unpredictability, and by facial expressions of jaw drop and opening eyes widely. This early observation raises the research question of *whether the fourth dimension can be replicated across a broad range of languages and cultural groups* (Research Question 2a).

A subsequent research question concerns the stability of the dimensional structure after omitting individual emotion components. According to the CPM, each emotion component forms an integral and constitutive part of the emotion process. However, as the dimensional representation is based on the overlap between patterns of features defining the synchronized activity in each emotion component, it could be expected that four of the five components will be largely sufficient to identify the overall dimensional structure. It will thus be investigated *whether the overall dimensional structure is stable when only relying on four of the five emotion components* (namely, after removing the features representing the Appraisal, Bodily reaction, Expression, Action tendencies, and Feeling components, respectively) (Research Question 2b).

A particularly important question from the dimensional approach is why self-report assessment studies and psycholinguistic studies differ in the dimensionality they find empirically in the emotion domain (two versus three dimensions). Because the GRID instrument decomposes the meaning of emotion terms into an extensive pattern of 142 features, it is possible to *investigate more precisely how the three dimensions of VALENCE, POWER, and AROUSAL relate to one another, as well as to investigate their relative importance in defining the meaning structure of the emotion domain* (Research Question 2c).

7.3 The basic emotion approach

The basic emotion theories (e.g., Ekman, 1999; Izard, 1977) propose the existence of a few universal, biologically rooted, and categorically different emotion processes. There is little agreement between the different basic emotion theories about the exact number of basic emotions, except for four recurring families—joy, sadness, fear, and anger. The same four basic emotion clusters emerge in psycholinguistic research using emotion terms, namely a joy, a sadness, a fear, and an anger cluster (e.g., Fontaine, Poortinga, Sediadi, & Suprapti, 2002; Shaver, Schwartz, Kirson, & O'Connor, 1987; Shaver, Wu, & Schwartz, 1992). Thus one can reasonably hypothesize that *four basic clusters of emotion terms can be identified in the emotion domain on the basis of their feature profiles* (Hypothesis 3a).

The universality assumption in basic emotion theories implies that *terms for basic emotions can be expected to have a more stable meaning across languages and cultural groups than other emotion terms (Hypothesis 3b)*. As basic emotions are assumed to be evolutionary developed modules that are triggered by well-defined stimulus configurations, the expectation is that they tend to be encoded first and in the same way across languages and cultural groups. Much more linguistic and cultural variability is expected with respect to which specific intensity differences, blendings, contexts, or broader emotion schemata's that have been additionally encoded in emotion words (e.g., Izard, 2007; Plutchik, 2001).

p. 109 All of the hypotheses and research questions described above start from emotion terms in natural languages and concern both the feature profiles that are associated with these terms and the associations between the emotion terms on the basis of their respective feature profiles. It is also meaningful to reverse the question and start with the feature profiles. The fact that it was possible to identify a set of translation equivalent words for each of the 24 emotion words across languages and cultural groups seems to indicate that these 24 emotion words are differentiated from one another in similar ways. This observation also fits the concept of modal emotions within the CPM framework (Scherer, 1994; Chapter 1). Modal emotions are emotions that are triggered by typical, frequently occurring appraisal profiles that have adaptive functions in dealing with quintessential contingencies in life. Many of these contingencies are relevant across cultural and linguistic groups and are thus likely to be encoded in similar ways across cultural groups. If the meaning of emotion terms indeed consists of changes in each of the emotion components, and these patterns of processes are comparable between cultural and linguistic groups, then the feature profiles should allow the associated emotion term to be identified. The last research question of the present chapter is then *how well it is possible to identify the specific emotion words on the basis of the profiles of features (Research Question 3)*.

For a description of the samples that have been used in the current chapter the reader is referred to the previous chapter (see Chapter 6). For a description of the design, the instrument, and the data-analytic methods, the reader is referred to Chapter 5.

7.4 Results

The componential approach

The role of each emotion component in defining the meaning of the 24 emotion terms (Hypothesis 1) was studied in a very simple way: the variation in the likelihood ratings of the features of each component was investigated. Participants were asked to rate to what extent a feature was likely to be inferred if a certain emotion term was used. We can expect that those components that are relevant for differentiating emotion terms from one another will show a large variation in the likelihood of their features. In contrast, those components that are irrelevant will not show any variation at all. For each feature, the standard deviation has been computed across the 24 emotion words in each of the 34 samples. When these standard deviations are averaged per emotion component across all samples, it is indeed observed that each emotion component is involved in defining the meaning of emotion terms as predicted by Hypothesis 1. The average standard deviations range from 1.33 to 1.98: $M_{\text{expression component}} = 1.33$, $M_{\text{appraisal component}} = 1.35$, $M_{\text{bodily sensation component}} = 1.35$, $M_{\text{action tendency component}} = 1.60$, and $M_{\text{feeling component}} = 1.98$. It is thus observed that the emotion terms differ from the average score at least 1.33 scale points per component on average across samples and across features that define the respective component. To better interpret the meaning of these standard deviations, the Expression component can be taken as a point of reference. This can be justified given the long-standing tradition that treats expression as the hallmark of emotion because of its communicative function (Darwin, 1872). It can be observed that ALL emotion components differentiate emotion terms at least to the same extent as the Expression component.

To investigate whether some emotion components were more salient than others in defining the meaning of emotion words (Research Question 1), a repeated measures ANOVA was executed on the standard deviations of the features across the 24 emotion terms with the components as the between-subjects variable and the samples as the within-subjects variable. There was a significant effect of the emotion component [$F(4,130) = 7.79, p < 0.000, \text{partial } \eta^2 = 0.19$]. Tukey's post hoc pair-wise comparison tests, however, revealed that only the Feeling component was characterized by significantly more variation across the 24 emotion terms than the other four components. The other four emotion components did not differ significantly from one another.

The dimensional approach

p. 110 First, the dimensional representation of the emotion domain on the basis of the feature profiles was investigated (Hypothesis 2 and Research Question 2a). Then, it was investigated how stable the overall emotion structure is with only four of the five emotion components (Research Question 2b). Finally, the relative importance of the three dimensions of VALENCE, POWER, and AROUSAL as well as their mutual relationships were investigated (Research Question 2c).

The dimensional representation of the emotion domain. To investigate the dimensional structure of the emotion domain a principal component analysis (PCA) was executed on the 142 emotion features across all 24 terms in all 34 samples. Four criteria were relied upon to identify the number of factors, namely: (1) the a-priori expected structure, (2) the scree plot, (3) the replicability of the factor structure in the Germanic, the Latin, the Slavic, and the East-Asian language families (see Chapter 5 for more information), and (4) the interpretability of the resulting factor structure.

Based on the literature from the dimensional approach, three dimensions were expected (Hypothesis 2). The scree plot pointed to three larger factors and a few smaller factors (see Figure SM 1)². Three solutions, three-, four-, and five-factorial, turned out to be replicable between the Germanic, the Latin, the Slavic, and the East-Asian language families (see Table SM 1 for the congruence measures of the four-factorial structure). The factor structures that were stable across the four language groups were closely inspected. In the five-factorial solution only Action tendency features uniquely defined the fifth factor. Rather than cross-cutting the emotion domain, the fifth factor was a specific motivational factor. As the four-factorial solution could be well interpreted and was also stable across language families, the four-factorial solution was selected. The four-factorial solution accounted for 65.27% of the total variance in the database.

A close inspection of the factor loadings of the 142 emotion features on the four VARIMAX rotated factors (see Table 7.1) as well as of the average factor scores of the 24 emotion terms on these four factors (see Figure 7.1 to Figure 7.3, Table SM 2) confirmed the a priori expected structure. The first factor is clearly a VALENCE factor. The negative pole is characterized by negatively valenced Appraisals (e.g., "consequences are negative for the person"), Feelings (e.g., "felt negative"), Expressions (e.g., "frowned"), Action tendencies (e.g., "wanted to break contact with others"), and to a lesser extent Bodily reactions (e.g., "stomach troubles"). The positive pole is defined by positively valenced Appraisals (e.g., "in itself pleasant for the person"), Feelings (e.g., "felt good"), Expressions (e.g., "smiled"), Action tendencies (e.g., "wanted to sing and dance"), and to a lesser extent Bodily reactions (e.g., "muscles relaxing"). Anger, fear, and sadness terms are opposed to joy terms on this factor. Both *surprise* and *compassion* take a neutral position on this dimension. We will further refer to this factor as VALENCE.

Table 7.1 Loadings of all features in a four-factorial VARIMAX rotated structure

GRID features	VALENCE	POWER	AROUSAL	NOVELTY
felt good	0.95	0.23	−0.09	0.07
consequences positive for person	0.95	0.21	−0.07	0.05
in itself pleasant for the person	0.95	0.18	−0.06	0.09
felt positive	0.94	0.26	−0.09	0.07
smiled	0.94	0.20	−0.06	0.07
felt at ease	0.94	0.25	−0.14	0.05
wanted to sing and dance	0.93	0.21	−0.05	0.10
wanted the ongoing situation to last or be repeated	0.93	0.24	−0.11	0.08
wanted to be tender, sweet, and kind	0.93	−0.07	−0.15	−0.04
wanted to be near or close to people or things	0.89	0.00	−0.08	0.01
consequences positive for somebody else	0.87	0.24	−0.10	0.04
wanted to get totally absorbed in the situation	0.86	0.23	−0.10	0.02
wanted to go on with what he or she was doing	0.85	0.33	−0.16	−0.03
felt calm	0.85	0.10	−0.39	−0.04
important and relevant for person's goals	0.85	0.16	−0.03	0.02
felt in control	0.83	0.42	−0.21	−0.05
felt energetic	0.82	0.50	0.09	0.05
in itself pleasant for somebody else	0.82	0.25	−0.12	0.10
important and relevant for goals of somebody else	0.79	0.16	−0.13	0.02
wanted to take care of another person or cause	0.79	−0.02	−0.10	−0.18
felt strong	0.78	0.54	−0.04	−0.01
consequences able to live with	0.77	0.13	−0.18	−0.07
felt powerful	0.77	0.55	−0.05	−0.04
wanted to submit to the situation as it is	0.76	−0.08	−0.18	0.08
wanted to be seen, to be in the center of attention	0.76	0.54	−0.06	−0.01
muscles relaxing (whole body)	0.75	−0.05	−0.35	0.05
center of attention	0.73	0.11	0.14	0.06
confirmed expectations	0.72	0.23	−0.21	−0.20
wanted to comply to someone else's wishes	0.72	−0.22	−0.08	−0.10
wanted to show off	0.71	0.52	−0.08	−0.06

familiar	0.65	0.14	-0.18	-0.23
moved toward people or things	0.61	0.36	0.11	0.17
felt warm	0.59	0.31	0.34	-0.08
felt an urge to be active, to do something, anything	0.58	0.42	0.26	-0.15
felt an urge to be attentive to what is going on	0.58	0.28	0.16	0.03
produced a long utterance	0.57	0.52	-0.03	-0.02
consequences predictable	0.49	0.18	-0.30	-0.30
caused by the person's own behavior	0.48	-0.03	-0.11	-0.28
consequences avoidable or modifiable	-0.34	0.01	-0.10	-0.24
produced a short utterance	-0.38	-0.17	-0.17	0.24
hid the emotion from others by smiling	-0.41	-0.33	-0.14	-0.23
tried to control the intensity of the emotional feeling	-0.42	-0.13	0.00	-0.19
inconsistent with expectations	-0.52	-0.09	0.01	0.50
a lump in throat	-0.52	-0.51	0.16	-0.05
produced speech disturbances	-0.54	-0.39	0.42	0.15
felt restless	-0.55	-0.04	0.40	-0.06
wanted to do nothing	-0.56	-0.51	-0.38	-0.02
lacked the motivation to pay attention to what was going on	-0.58	-0.36	-0.33	-0.04
felt cold	-0.59	-0.51	-0.13	0.17
moved against people or things	-0.61	0.43	0.09	-0.06
wanted to be hurt as little as possible	-0.62	-0.46	0.05	-0.18
muscles tensing (whole body)	-0.63	0.19	0.58	0.08
in itself unpleasant for somebody else	-0.65	-0.17	-0.23	0.03
felt nervous	-0.66	-0.17	0.46	-0.11
lacked the motivation to do anything	-0.66	-0.49	-0.30	-0.05
consequences negative for somebody else	-0.68	-0.22	-0.21	0.02
felt weak	-0.69	-0.65	-0.03	-0.07
felt tired	-0.69	-0.38	-0.18	-0.15
got pale	-0.70	-0.53	0.16	0.21
had stomach troubles	-0.72	-0.36	0.29	0.01
felt out of control	-0.72	-0.06	0.39	0.03
wanted to withdraw into her/himself	-0.76	-0.54	-0.09	-0.17

felt exhausted	-0.76	-0.42	-0.03	-0.13
in danger	-0.77	-0.14	0.16	0.24
irrevocable loss	-0.78	-0.32	-0.05	0.07
wanted to disappear or hide from others	-0.80	-0.51	-0.01	-0.12
felt powerless	-0.80	-0.49	0.00	-0.07
violated laws or socially accepted norms	-0.81	-0.08	0.00	0.05
withdrew from people or things	-0.81	-0.33	-0.10	-0.10
wanted to run away in whatever direction	-0.82	-0.41	0.13	-0.01
wanted to undo what was happening	-0.84	-0.30	0.01	-0.15
wanted to flee	-0.84	-0.44	0.09	-0.05
wanted to keep or push things away	-0.84	-0.24	0.01	-0.06
felt inhibited or blocked	-0.86	-0.36	0.09	-0.04
wanted to do damage, hit, or say something that hurts	-0.86	0.31	-0.02	-0.10
pressed lips together	-0.87	0.04	0.04	-0.19
frowned	-0.88	0.18	-0.08	-0.05
wanted to oppose	-0.88	0.28	-0.01	-0.13
incongruent with own standards and ideals	-0.89	-0.09	-0.07	0.06
wanted to prevent or stop sensory contact	-0.89	-0.29	-0.04	-0.06
felt the urge to stop what he or she was doing	-0.89	-0.27	0.05	-0.05
wanted to destroy whatever was close	-0.89	0.19	0.02	-0.09
felt bad	-0.91	-0.33	0.00	-0.11
wanted to break contact with others	-0.91	-0.15	-0.08	-0.17
in itself unpleasant for the person	-0.92	-0.16	-0.05	0.04
treated unjustly	-0.92	-0.03	-0.09	0.10
consequences negative for person	-0.92	-0.19	-0.02	0.03
felt negative	-0.93	-0.22	-0.03	-0.15
increased the volume of voice	0.10	0.82	0.24	0.24
had an assertive voice	0.29	0.76	-0.15	-0.10
felt dominant	0.64	0.64	-0.09	-0.07
spoke faster	0.26	0.63	0.56	0.17
wanted to be in command of others	-0.18	0.61	-0.01	-0.29
wanted to take initiative her/himself	0.53	0.60	0.01	-0.18

wanted to act, whatever action it might be	0.10	0.55	0.32	-0.16
wanted to be in control of the situation	-0.11	0.51	0.19	-0.32
wanted to move	0.41	0.49	0.37	0.01
wanted to tackle the situation	0.27	0.48	0.09	-0.25
showed the emotion to others more than s/he felt it	0.39	0.42	-0.10	0.25
caused intentionally	0.10	0.35	-0.21	0.00
felt alert	0.01	0.34	0.29	-0.01
changed the melody of her or his speech	0.23	0.27	0.09	0.26
showed the emotion to others less than s/he felt it	-0.20	-0.32	-0.18	-0.23
showed tears	-0.04	-0.56	-0.04	-0.01
had a trembling voice	-0.46	-0.59	0.28	0.10
felt submissive	-0.45	-0.60	-0.08	-0.18
wanted to make up for what she or he had done	-0.27	-0.62	-0.12	-0.32
spoke slower	-0.03	-0.62	-0.57	-0.13
wanted someone to be there to provide help or support	-0.45	-0.63	0.06	-0.10
wanted to hand over the initiative to someone else	-0.15	-0.64	0.01	-0.09
closed her or his eyes	-0.04	-0.65	-0.18	0.00
felt weak limbs	-0.30	-0.68	0.30	0.25
fell silent	-0.43	-0.70	-0.23	-0.06
decreased the volume of voice	0.02	-0.76	-0.31	-0.21
breathing getting faster	-0.07	0.28	0.83	0.18
heartbeat getting faster	0.25	0.25	0.83	0.15
perspired, or had moist hands	-0.32	-0.12	0.79	-0.05
sweat	-0.33	-0.06	0.76	0.00
felt hot	0.04	0.21	0.75	-0.11
produced abrupt body movements	-0.07	0.46	0.54	0.41
felt shivers	-0.04	-0.17	0.48	0.35
blushed	0.36	0.16	0.47	-0.13
required an immediate response	-0.06	0.14	0.40	0.39
was in an intense emotional state	0.12	-0.01	0.40	0.03
did not show any changes in face	0.03	0.09	-0.63	-0.28
did not show any changes in vocal expression	0.27	0.05	-0.63	-0.23

breathing slowing down	0.38	-0.28	-0.64	0.02
did not show any changes in gestures	0.07	-0.07	-0.67	-0.25
heartbeat slowing down	0.05	-0.38	-0.69	0.07
had no bodily symptoms at all	0.23	0.10	-0.77	-0.06
unpredictable	0.00	-0.10	0.21	0.75
suddenly	0.15	0.00	0.24	0.69
had the jaw drop	0.14	0.00	-0.01	0.64
caused by chance	0.42	0.03	0.11	0.62
opened her or his eyes widely	0.32	0.45	0.36	0.53
caused by a supernatural POWER	0.48	-0.06	-0.02	0.51
had eyebrows go up	0.20	0.46	0.03	0.48
caused by somebody else's behavior	-0.16	0.30	-0.12	0.40
enough resources to avoid or modify consequences	-0.02	0.08	-0.15	-0.27
will be changed in a lasting way	0.24	-0.27	-0.21	-0.31
wanted to overcome an obstacle	0.13	0.25	0.19	-0.34
experienced the emotional state for a long time	0.24	-0.25	-0.14	-0.49

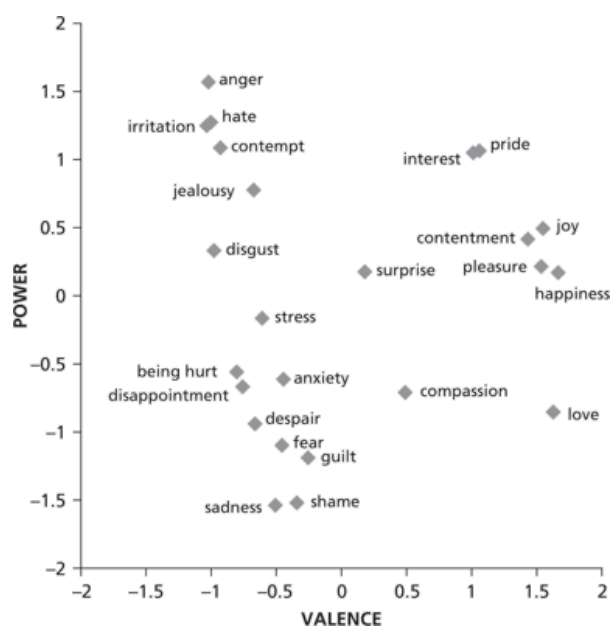


Figure 7.1 Plot of the average factor scores for the 24 emotion words on VALENCE and POWER.

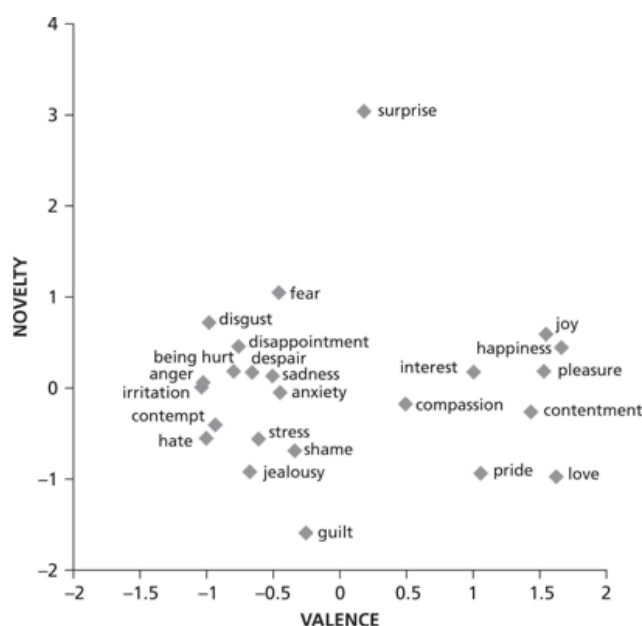


Figure 7.3 Plot of the average factor scores for the 24 emotion words on VALENCE and NOVELTY.

The second dimension is a **POWER** factor. This factor is mainly defined by Expressions (e.g., “increased volume of the voice”), Action tendencies (e.g., “wanted to hand over the initiative to someone else”), and Feelings (e.g., “felt submissive”) that imply that the person has **POWER** over the situation and the people in the situation. There was also one Bodily reaction that defined the negative pole of this dimension, namely “felt weak limbs.” Moreover, the features that define **POWER** refer to the three facets that have been identified in the literature factor, namely control versus lack of control (“wanting to control the situation”), potency/strength versus weakness (“felt weak limbs”), and dominance versus submissiveness (“felt dominant”). On this second dimension anger terms are opposed to fear and sadness terms. Moreover, *love* is opposed to *pride* and *interest*. We further refer to this factor as **POWER**.

The third dimension can be clearly interpreted as an **AROUSAL** dimension. Most of the features defining this dimension stem from the Bodily reaction component. “Heartbeat slowing down”

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and “breathing slowing down” are opposed to “heartbeat getting faster” and “breathing getting faster” on this dimension. Moreover, the absence of facial, vocal, and gestural expressions defined the negative pole of this factor, while the appraisal “required an immediate response” also loaded positively on this factor. On this factor anger and fear terms are opposed to sadness terms. For the positively valenced terms, mainly *love* is opposed to *contentment* on this factor. This factor is referred to as **AROUSAL**.

The fourth factor is defined by Appraisals (e.g., “unpredictable” and “sudden”) and facial expressions (“jaw drop” and “opening eyes widely”) that are triggered by the experience of a novel event. Moreover, “experiencing an emotion for a long time” loads negatively on this factor. On this factor the emotion word *surprise* is strongly differentiated from all the other emotion words (a difference of about two standard deviations with *fear*, which is the second highest scoring emotion word on this dimension). The fourth dimension thus represents a short-lived emotional reaction to novel events. Therefore we label this factor as NOVELTY.

Thus, as predicted, the three most important dimensions in the emotion domain are VALENCE, POWER, and AROUSAL (Hypothesis 2). Moreover, a fourth NOVELTY factor, which had already been identified in a preliminary study with three languages, could also be identified across all languages, countries and samples (Research Question 2a). When VALENCE, POWER, AROUSAL, and NOVELTY written in small capitals are used in the remainder of this chapter and the remainder of this book, it means we refer to these factors as they have been measured by the GRID instrument.

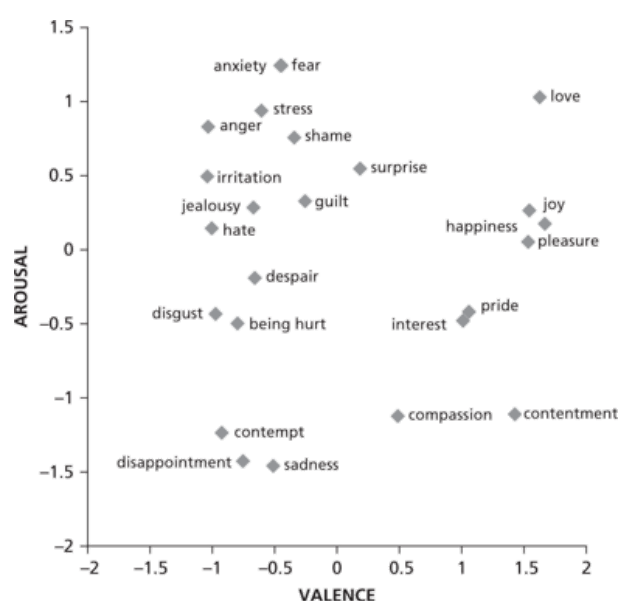


Figure 7.2 Plot of the average factor scores for the 24 emotion words on VALENCE and AROUSAL.

The stability of the overall dimensional structure with only four of the five emotion components. To probe the stability of the overall four-factorial structure, we have investigated whether and to what extent the structure is stable on the basis of features from only four of the five emotion components (Research Question 2b). This was investigated in five separate analyses, after removing the Appraisal, the Bodily reaction, the Expression, the Action tendency, and the Feeling features, respectively. Each of the “reduced” four-factorial structures was orthogonally Procrustes rotated toward the full four-factorial structure. The stability of these Procrustes rotated, reduced structures was investigated in two ways. First, the congruence measures (Tucker’s phi’s) between the full and the Procrustes reduced factors were computed (see Table 7.2). Second, bivariate correlations were computed between the factor scores based on all emotion components and the factor scores based on only four of the five components (see Table 7.2). In total 19 of the 20 congruence measures (Tucker’s phi) and 18 of the 20 bivariate correlations were higher than 0.95 indicating a very high congruence between the full and the reduced factor structures. AROUSAL was a bit less stable when the Bodily reaction features were removed: After removal, the correlation of the factor scores was 0.84. Moreover, NOVELTY was somewhat less well represented when the Appraisal features were removed. The congruence measure between the full and the reduced NOVELTY factor was 0.82, and the correlation of the factor scores before and after removal of the Appraisal features was 0.70. The four-factorial structure is thus by and large independent from the individual emotion components that constitute the emotion domain and can thus be considered as a very stable and robust structure of the emotion domain.

Table 7.2 Stability (Tucker’s phi on factor loadings and Pearson correlation between factor scores) of the overall factor structure after removing the features from each component, respectively

Removed component	VALENCE		POWER		AROUSAL		NOVELTY	
	ϕ	r	ϕ	r	ϕ	r	ϕ	r
Feeling	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Bodily reaction	1.00	1.00	1.00	1.00	0.94	0.84	0.98	0.94
Facial expression	1.00	1.00	0.99	0.99	0.99	0.99	0.99	0.97
Vocal expression	1.00	1.00	1.00	0.98	1.00	0.99	1.00	0.94
Action tendency	1.00	0.99	1.00	0.98	1.00	0.98	0.99	0.96
Appraisal	1.00	0.99	1.00	1.00	1.00	0.98	0.82	0.70

The relationships between, and the relative importance of, VALENCE, POWER, AROUSAL, and NOVELTY. Given the vigorous debates between adherents to different dimensional models in the literature, and the failure to identify the POWER dimension in self-report models, alternative dimensional representations of the meaning structure were investigated. The goal was to further probe the relationships between and the relative importance of VALENCE, POWER, AROUSAL, and NOVELTY (Research Question 2c).

We started by comparing a four-dimensional representation with orthogonal (VARIMAX) and oblique (PROMAX) rotation. The obliquely rotated factors could be interpreted in exactly the same way as the orthogonally rotated factors, namely as VALENCE, POWER, AROUSAL, and NOVELTY. The correlations between the obliquely rotated factors additionally revealed a substantial correlation between the VALENCE and the POWER factor ($r = 0.48$). The correlations among the remaining factors were small (VALENCE–AROUSAL $r = -0.16$, VALENCE–NOVELTY $r = 0.07$, POWER–AROUSAL $r = 0.15$, POWER–NOVELTY $r = 0.08$, and AROUSAL–NOVELTY $r = 0.23$). In an oblique rotation, the first VALENCE factor accounted for 43.20% of the total variance, the POWER factor accounted for 23.30%, the AROUSAL 9.80%, and the NOVELTY factor for 5.30% compared to 39.11%, 13.45%, 8.26%, and 4.45%, respectively in the VARIMAX rotated solution. Thus, although the oblique rotation revealed a substantial correlation between the VALENCE and the POWER factor, they did not coincide. POWER clearly emerged as the second strongest factor in a structure with four orthogonal factors.

To further investigate the relative importance of each of these four dimensions, the one-, the two- and the three-factorial solutions have been studied and compared with the four-factorial solution. Factor scores were computed for a one- up to a three-factorial representation (after VARIMAX rotation) and these factor scores were correlated with the factor scores in the four-factorial solution (see Table 7.3). We only discuss the correlations larger than 0.30. The one-factorial model accounted for 44.41% of the total variance. The single factor correlated with VALENCE ($r = 0.93$) and to a lesser extent with POWER ($r = 0.38$). The two-factorial model accounted for 55.82% of the total variance. The first factor again related mainly to the VALENCE factor ($r = 0.95$), and to a lesser extent to the POWER factor ($r = 0.30$). The second factor was about as strongly related to the POWER factor ($r = 0.67$) as to the AROUSAL factor ($r = 0.70$). A plot of the average coordinates of the terms in the two-dimensional solution showed that the positive emotion terms are opposed to the anger, sadness, and fear terms on the first factor (see Figure 7.4). Moreover, anger terms are opposed to sadness terms on the second factor, with the fear terms being closer to the anger than to the sadness terms. Thus, in a two-factorial solution, the first dimension is basically a VALENCE dimension and the second dimension is a combination of POWER and AROUSAL. The three-factorial solution accounted for 61.72% of the total variance. After VARIMAX rotation the first two factors corresponded very closely to the VALENCE ($r = 0.99$) and the POWER ($r = 0.98$) factors, respectively. The third factor was both related to the AROUSAL ($r = 0.88$) and NOVELTY ($r = 0.48$) factors.

Table 7.3 Pearson correlations between the factor scores in a VARIMAX rotated four-factorial solution with the factor scores in a one-, a two-, and a three-factorial solution after VARIMAX rotation

Factors	VALENCE	POWER	AROUSAL	NOVELTY
One-factorial solution				
Factor 1	0.93	0.38	-0.04	0.04
Two-factorial solution				
Factor 1	0.95	0.30	-0.13	0.01
Factor 2	-0.11	0.67	0.70	0.22
Three-factorial solution				
Factor 1	0.99	0.01	-0.06	0.10
Factor 2	0.01	0.98	0.14	-0.12
Factor 3	0.01	-0.07	0.88	0.48

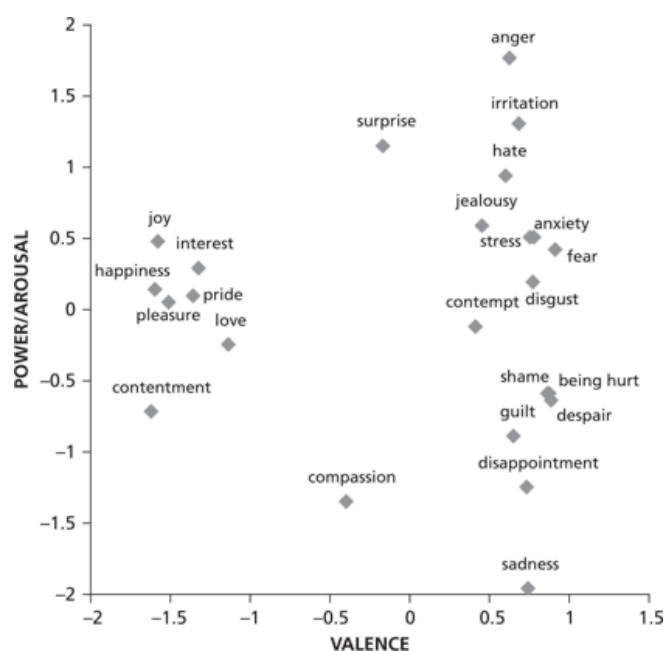


Figure 7.4 Plot of the average factor scores for the 24 emotion words in a two-factorial VARIMAX rotated structure.

We thus observed that the one-factorial solution represents mainly the VALENCE factor. In the two-factorial solution the second dimension was a mixture of POWER and AROUSAL. It was only in the three-factorial solution that POWER was fully separated from AROUSAL. In the three-factorial solution the third factor was still a combination of AROUSAL and NOVELTY. It was in the four-factorial solution that these two last factors got fully separated.

p. 119 The basic emotion approach

The categorical structure of the terms, which was predicted from the basic emotion approach was investigated with hierarchical average linkage cluster analysis (Hypothesis 3a). Then, the stability of the emotion profiles was studied for all emotion terms. It was investigated whether the stability was different for basic and non-basic emotions (Hypothesis 3b). Finally, it was investigated how well it was possible to identify the correct emotion term on the basis of the profiles of features across samples and languages (Research Question 3).

The hierarchical cluster structure of the emotion domain. To investigate which clusters of emotion terms could be identified, an average linkage hierarchical cluster analysis was executed on the averaged squared Euclidean distances between the 24 emotion terms, which were computed on the basis of the standardized profiles across the 142 emotion features (see Figure 7.5). The hierarchical cluster analysis revealed two higher-order clusters (a positive and a negative emotion cluster) and four major basic emotion clusters, namely: (1) a joy cluster consisting of the emotion words *joy*, *happiness*, *pleasure*, *pride*, *love*, and *interest*; (2) a fear cluster containing the words *fear*, *anxiety*, *stress*, and *disgust*; (3) a sadness cluster consisting of the words *sadness*, *disappointment*, *being hurt*, *despair*, *guilt*, and *shame*; and (4) an anger cluster containing the words *anger*, *irritation*, *hate*, *jealousy*, and *contempt*. Moreover, *surprise* and *compassion* each formed a separate basic cluster in their own right at this level.

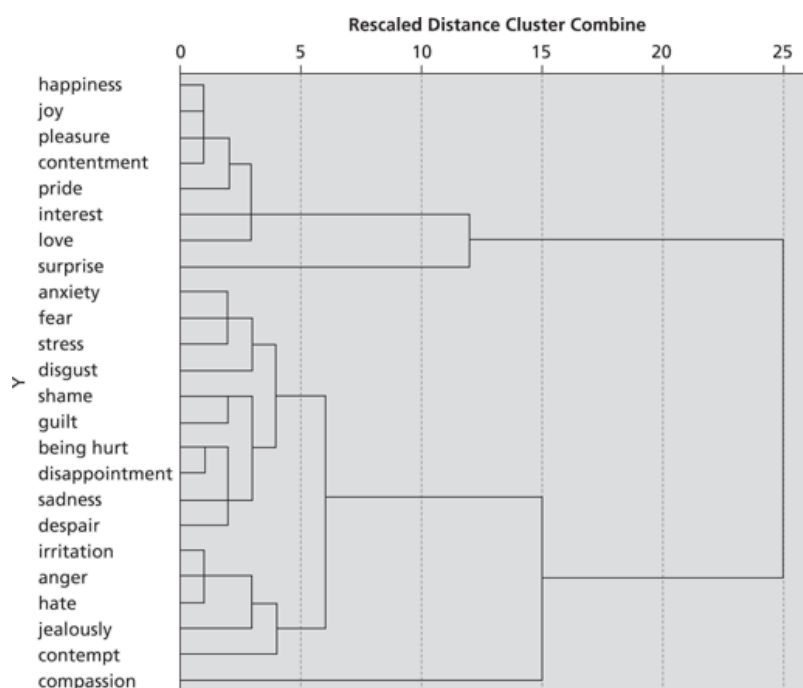


Figure 7.5 Dendrogram of a hierarchical cluster analysis on the average profile similarities between the 24 emotion words.

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Stability of feature patterns. The expectation that basic emotion terms have a more stable feature pattern than other emotion terms (Hypothesis 3b) was investigated by computing, for each emotion term, the correlation between the average feature pattern and the sample-specific feature pattern. Across the 34 samples the pattern correlation was on average 0.93 for joy, 0.92 for happiness, 0.92 for fear, 0.92 for shame, 0.91 for sadness, 0.91 for pleasure, 0.91 for interest, 0.91 for anger, 0.90 for being hurt, 0.90 for pride, 0.90 for guilt, 0.90 for love, 0.90 for stress, 0.89 for disgust, 0.89 for disappointment, 0.89 for irritation, 0.89 for hate, 0.89 for despair, 0.88 for anxiety, 0.87 for jealousy, 0.86 for surprise, 0.86 for contentment, 0.78 for contempt, and 0.72 for compassion. Paired-sample t-tests indicated that only *contempt* and *compassion* had a significantly less shared meaning compared to the other 22 terms (at a significance level of 0.01). Except for two terms, there was thus very little evidence for differences in the stability of the meaning of the 24 emotion terms across languages and cultural groups (Hypothesis 3b).

Identifiability of 24 emotion categories. The identification of the emotion terms on the basis of their respective feature profiles (Research Question 3) was investigated by executing two multiple discriminant analyses (MDA), one on the basis of the 142 emotion features and one on the basis of the four overall factors (see Table 7.4). On the basis of the 142 features it was possible to correctly identify 82.1% of the emotion terms (after cross-validation). Confusions (larger than 15%) were observed between joy, happiness, and pleasure, as well as between anger and irritation. More importantly still, 69.4% could be correctly identified (after cross-validation) when only using the scores on the four overall factors of VALENCE, POWER, AROUSAL, and NOVELTY.

Table 7.4 Classification accuracy (in percent) for the 24 emotion words in discriminant analyses based on the four overall factors and on all features

Emotion words	Classification based on the four factors	Classification based on all features	
	Accuracy	Accuracy	Confusion > 15% with
being hurt	41.2	85.3	
sadness	82.4	88.2	
shame	79.4	91.2	
guilt	97.1	94.1	
compassion	79.4	94.1	
disappointment	76.5	85.3	
love	97.1	97.1	
contentment	67.6	73.5	
happiness	58.8	38.2	joy
pride	82.4	91.2	
pleasure	38.2	67.6	joy
joy	67.6	44.1	happiness
interest	79.4	97.1	
surprise	100	100	
despair	35.3	91.2	
stress	70.6	91.2	
anxiety	50.0	76.5	
fear	82.4	94.1	
jealousy	73.5	91.2	
hate	67.6	79.4	
irritation	11.8	58.8	anger
anger	67.6	70.6	irritation
disgust	94.1	88.2	
contempt	64.7	82.4	
<i>Total</i>	69.4	82.1	

7.5 Discussion

Of the hypotheses formulated on the basis of the componential, the dimensional, and the basic emotion approaches, all but one (namely greater stability of basic emotion terms) were confirmed. We discuss the results per approach.

The componential emotion approach

The fundamental assumption of the CPM is that emotions are not affective states, but rather multicomponential processes that are triggered as a reaction to concrete events, which are relevant for the person's needs, goals, and values. The present study clearly confirmed that all the emotion components included in the GRID instrument, namely Appraisals, Bodily reactions, Action tendencies, Expressions, and Feelings contribute substantially to the meaning of emotion terms. Across all languages, countries, and samples people not only infer information about a feeling state, but also about the probable meaning of the event, the probable bodily reactions, the probable expressions, and the probable motivational changes when emotion words are used. Thus, emotion words convey very rich information as predicted by Hypothesis 1. It is clear that the first hypothesis has only been investigated in a very rudimentary way in the current chapter. The specific internal structures for each separate emotion component, which are reported in Part III (see Chapters 8 to 13), further contribute to the confirmation of Hypothesis 1.

Four of the five emotion components contribute to the same extent to the meaning of emotion words. Only the Feeling component is comparatively more important in differentiating the meaning of emotion words (see Research Question 1). This could be explained by the very nature of the Feeling component in the emotion process according to the CPM. In the CPM, the Feeling component is a read-out system that brings the emotion process to (sub)consciousness (Scherer, 2009c; see also Chapter 1). Thus, the Feeling component can be expected to be the most accessible during the emotion process, and is therefore probably also most strongly related to the differentiation of emotion terms in language.

The dimensional approach

It was confirmed that the meaning of emotion terms, which was evaluated on 142 different features can be represented rather well in a low-dimensional space. As already observed in the seminal work of Osgood and colleagues (Osgood, May, & Miron, 1975; Osgood, Suci, & Tannenbaum, 1957), who used a very different methodology, the three most important dimensions are VALENCE, POWER, and AROUSAL in that order of importance (Hypothesis 2). Moreover, the existence of a fourth smaller factor was replicated, which had already been observed in the first preliminary study using the GRID instrument with three languages (Research Question 2a) (Fontaine, Scherer, Roesch, & Ellsworth, 2007).

The first factor, replicated across all 25 languages, is a very salient VALENCE factor. This factor alone accounts for 1.5 times more of the total variance than the three other factors together. This factor is also clearly bipolar. Thus, when it comes to the meaning of emotion terms, the positive and negative VALENCE are mutually exclusive qualities. The importance of the VALENCE factor in the emotion domain can be attributed to the fundamental evaluation that affects all emotion components: do the consequences of the eliciting event match the needs, concerns, or values of the person or not. A positive or negative outcome for this fundamental appraisal issue has profound consequences for the functioning of each of the components.

The second dimension is the POWER dimension. The lost child of the dimensional approach to emotion has been found again in this GRID study. As extensively explained in Chapter 2, early research by Osgood and colleagues established that POWER was the second dimension in the affective structure of language (e.g., Osgood, May, & Miron, 1975; Osgood, Suci, & Tannenbaum, 1957). In the current literature on the dimensional approach to emotion, however, the POWER dimension has almost fully disappeared. The four most popular affect models do not contain any reference to the POWER factor. The rediscovery of the POWER factor in the GRID study is, therefore, highly relevant: the features in the GRID instrument were selected because of their theoretical relevance for operationalizing each of the emotion components. They were not intended to operationalize the POWER factor. An inspection of the factor loadings shows that the second factor is to an important extent an interpersonal factor. It is a well-known and robust finding in social psychological research that interpersonal orientations can be represented in two dimensions that closely correspond to our VALENCE and POWER dimensions (e.g., Wiggins, 1979). However, the POWER dimension is not restricted to the interpersonal realm. Also having or wanting control over the situation, or just the opposite having no control defines this dimension. Furthermore, a plausible set of Bodily reaction features that imply weakness define the second dimension, an observation that is further developed in Chapter 9 on Bodily reaction. Thus, when people across the world use emotion words they convey information about POWER, as was already pointed out by Osgood and colleagues (1957). Moreover, this dimension integrates the three different facets of POWER that have been proposed in the literature, namely control, strength/potency, and dominance.

The third factor represents the classic AROUSAL dimension. Although not exclusively, this factor is predominantly defined by Bodily reaction features. It fits the conceptualization of this factor in the self-report tradition as an AROUSAL factor.

The last factor is a NOVELTY factor. It is the smallest factor, but throws new light on *surprise* and serves as an important differentiator for other emotions. *Surprise*, occupying an extreme position on the NOVELTY dimension, is not an emotion like the other emotions, as it is generally very short and is often rapidly succeeded by another emotion reflecting the VALENCE aspect of the situation. When we first discovered this factor in our preliminary study, we proposed to label it with the term “unpredictability”, which is also one of the features loading highly on this fourth dimension (Fontaine et al., 2007). However, we have decided to relabel this factor to NOVELTY, as unpredictability seems too technical and narrow as a descriptive label for this dimension. NOVELTY reflects better the breadth of this factor and is also an established term in other areas of psychology. One may ask why this dimension emerges for the first time in the GRID research. One possible explanation is that *surprise* is rarely included in emotion research (although it is considered as a basic emotion by many basic emotion theorists). Moreover, even if *surprise* is included but is the only term reflecting the NOVELTY dimension, it is unlikely to yield a separate dimension in similarity ratings. Probably the most important explanation is that the GRID instrument is the first instrument to have (unintendedly) sufficiently operationalized the NOVELTY dimension by its defining Appraisals and Facial expressions. Still, when only taking the results with the GRID instrument into account, the question remains whether this factor is due to the specific features included in the GRID instrument, or is a genuine factor in the meaning structure of the emotion domain. In Chapter 14, we present evidence that it is also possible to identify the NOVELTY dimension using a very different methodology, which supports the interpretation of the NOVELTY dimension as a genuine dimension in the representation of the emotion domain.

We observed that the four-factorial structure is a rather robust structure. Even after removing each of the five emotion components one-by-one, we observed a very robust overall four-factorial structure (see Research Question 2b). This confirms the expectation that most of the information on the synchronization between the emotion components can already be identified if only a part is known about the emotion process. The VALENCE and the POWER dimension are not at all affected by the removal of a single emotion component. The AROUSAL dimension is somewhat affected by removing the Bodily reaction component, and the NOVELTY factor somewhat by the removal of the Appraisal component. One possible explanation for the latter observation is that conscious attention is automatically triggered in a NOVELTY reaction, and that, in consequence, the emotional reaction to NOVELTY is more defined by the Appraisal component than is the case for the other emotions. This fits the notion that the reaction to NOVELTY is by its very nature short-lived. From the moment the novel situation is interpreted, the emotional reaction either disappears because the event is eventually interpreted as irrelevant for the concerns and goals of the person, or turns into another emotion depending on the precise meaning of the event.

p. 124 The comparison of different dimensional representations of the meaning structure allows hypotheses to be generated as to why the second most important dimension in the emotion domain did not manifest itself more forcefully in self-report models (see Research Question 2b). As the oblique rotation revealed, VALENCE and POWER features are conceptually related: having positively valenced experiences may produce feelings of POWER. Most importantly, POWER itself is positively valenced (see Chapter 1). The GRID data clearly shows though that VALENCE and POWER cannot be reduced to one another. Another relevant observation is that POWER only emerges as the second factor in a three- or four-factorial solution. When the emotion structure is based on only two factors, the second factor contains information about both AROUSAL and POWER. Based on these empirical findings we can conclude that the emotion terms, used in typical self-report instruments, clearly refer to the POWER dimension. This generates the hypothesis that in the two-factorial models that dominate the current literature VALENCE and AROUSAL are confounded with POWER.

The basic emotion approach

The present results offer clear support for the position that a dimensional and a categorical representation of emotion information are compatible rather than conflicting. While a very coherent dimensional structure is stably identified, a categorical representation also fits the meaning data. As was already well demonstrated in similarity sorting research (Fontaine et al., 2002, Shaver et al., 1987), there are two superordinate clusters of positive and negative emotion terms and four major basic emotion clusters distinguishing joy, anger, fear, and sadness terms as expected (see Hypothesis 3a). Moreover, *surprise* and *compassion* form two separate basic clusters of their own. With the dimensional structure in mind, the reason for why these two terms each form separate clusters is very different. *Surprise* is identified in the dimensional structure as a term that is really differentiated from the other emotion terms, especially on the NOVELTY dimension. Moreover, *surprise* is probably a possible antecedent for the other emotions, and can thus turn into positive or negative emotions depending on the interpretation of the novel situation. *Compassion*, however, just takes an intermediate position between positive and negative emotion terms, possibly because it is inherently defined by both positive and negative emotion features. On the one hand, it is triggered by the suffering of others which is inherently negatively valenced. On the other hand, it implies an interpersonal bond with the suffering person and a tendency to help and control the situation, which both have a more positive VALENCE. These opposing valences may create ambivalence.

No evidence was found for the hypothesis derived from the basic emotion theories that the meaning profile of basic emotions should be more stable than the meaning profile of non-basic emotion terms (see Hypothesis 2b). On the contrary, we found that emotion terms that are not considered as basic emotions by any basic emotion theorist (like *being hurt*) had a very high stability of their meaning pattern, and that *contempt* which is considered basic according to some, like Ekman (1999), showed significantly less stability than so-called non-basic emotion terms. A possible explanation is that the basic emotion approach is far less focused on the interpersonal context of emotions than a linguistic approach. The need to label emotional experiences and to use emotion words is emerging particularly in communication contexts, which are inherently social in nature. We observed that emotion processes that are typically experienced in social contexts, like shame, guilt, pride, and being hurt have meaning profiles that are as stable as those of emotion terms that are not specifically interpersonal in nature.

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Two of the 24 terms have a considerably less stable meaning, namely *compassion* and *contempt*. For *compassion* there is a plausible explanation. As compassion inherently merges positive and negative features, slight differences in the salience of the positive or the negative features will create substantial differences in the profile correspondence due to the importance of the VALENCE factor in the emotion domain. The lack of stability of *contempt*, however, is difficult to explain. It is unlikely that there are systematic differences in the meaning of *contempt* across languages and cultural groups, as we observe both for *contempt* and for *compassion* that the patterns are not only less stable across samples, but are also the least reliable within samples both within western and non-western languages (see Chapter 6). It is a matter for future research to identify why the meaning of *contempt* is so unstable both within and across linguistic and cultural groups.

The most impressive evidence for the categorical view stems from the discriminant analyses (see Research Question 3). The feature profiles across all 142 features allowed to correctly identify the matching emotion term (out of a set of 24) for over 80% of the 816 profiles (compared to a random correct assignment of 4.2%). Moreover, when the feature profile was reduced to only the scores on VALENCE, POWER, AROUSAL, and NOVELTY, almost 70% of the corresponding terms could still be correctly identified. The latter finding excludes random hits due to the sheer number of features as an explanation for the high identifiability. The odds of correctly versus incorrectly classifying an emotion term on the basis of the four overall factor scores was 54.4 times larger than what can be expected on the basis of random classification. This finding clearly supports the idea that emotion words do refer to rather clearly defined subdomains across languages and language groups.

7.6 Conclusions

The results described in this chapter offer strong support for our position that the three emotion approaches in psychology are not mutually exclusive when it comes to the meaning of emotion terms. The confirmation of hypotheses from one approach did not imply a disconfirmation of hypotheses stemming from the other emotion approaches. In fact, when studying the meaning of emotion terms, these three emotion approaches are complementary. Being able to represent the emotion domain in a low-dimensional space does not imply that a variation on these underlying dimensions is all there is. It does not exclude that the emotion process consists of changes in each of the emotion components, as predicted by the componential approach. The low-dimensional space just represents the coherence of changes in the emotion components. In the CPM this overlap is attributed to the synchronization process. The low-dimensional representation does not exclude a categorical representation as proposed by the basic emotion approach neither. We can clearly identify the four basic emotion clusters of joy, sadness, anger, and fear on the basis of emotion profiles. Moreover, it is possible to identify the correct emotion label among a set of 24 labels on the basis of the feature profiles, even if the latter consist only of the scores on the four factors of VALENCE, POWER, AROUSAL, and NOVELTY. We conclude that, while the three emotion models that underlie the three dominant approaches in psychology on meaning may disagree as to the mechanisms underlying the emotion process, they are complementary when it comes to the meaning of emotion terms. ↴

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Notes

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- 2 All supplementary materials (SM) are available at website: <http://www.affective-sciences.org/>. See Appendix 1 (“Availability”) for further details.