The Structure of Subjective Emotional Intensity

Joep Sonnemans and Nico H. Frijda

University of Amsterdam, The Netherlands

Emotions vary in intensity. But *what* is it that varies? There are many parameters that can be considered parameters of emotional intensity, and it is unclear how these parameters are related. The main question of this study is: Is the subjective intensity of emotion one dimensional, and, if not, what are its dimensions? We sampled 222 instances of emotions, and for each instance subjects completed a questionnaire. The subjects also drew a diagram of the course of their emotion over time. A factor analysis of the intensity questions and the diagram variables yielded six factors: (1) duration of the emotion and delay of its onset and peak; (2) perceived bodily changes and strength of felt passivity; (3) recollection and re-experience of the emotion; (4) strength and drasticness of action tendency, and drasticness of actual behaviour; (5) belief changes and influence upon long-term behaviour; and (6) overall felt intensity. Most specific dimensions correlated moderately with overall felt intensity. Special attention is given to the relation between intensity and the duration of emotion.

INTRODUCTION

One of the most noticeable aspects of an emotion is its intensity. If someone describes an emotional experience, he or she will almost always refer to its intensity. It is therefore puzzling that this aspect of emotion has been almost completely ignored as a specific object of research.¹ This is even more puzzling if we consider the traditional concern of experimental psychology with the intensity of experiences (psychophysics), and the interest of the clinical psychologists with emotional disturbances which often take the form of inappropriately intense or weak emotions (in the given situation).

Requests for reprints should be sent to Joep Sonnemans, University of Amsterdam, CREED E1-610, Roeterstr 11, NL-1018 WB Amsterdam, The Netherlands.

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¹ An exception is the research of Diener, Larsen, and colleagues (Diener, Larsen, Levine, & Emmons, 1985; Larsen, Diener, & Emmons, 1986; Larsen & Diener, 1987). However, their research focuses primarily on individual differences in emotional intensity, and is not specifically concerned with the structure of emotional intensity.

Although apparently straightforward, the notion of the intensity of an emotion is problematic. The various phenomena that might qualify as indices of intensity tend to be only moderately correlated. In past decades, many studies found low correlations among physiological parameters of emotional upset (summarised in Frijda, 1986; Venables, 1984). Correlations between subjective variables, physiological variables, and behaviour also tend to be low (Hodgson & Rachman, 1974; Lang, 1984; Rachman, 1990). In other words, it is problematic how the intensity of an emotion should be operationalised or measured. Of course, one could arbitrarily take the intensity of subjective feelings as the criterion. But even in that regard, several different questions might be put to the subjects, that would not necessarily receive the same answers. In fact, "How intense was vour feeling?" is only one of them, and not necessarily the best one for obtaining information on what one would want to know: The subject's estimate or feeling of the magnitude of impact of the emotional event, or of the intensity of the process of which feelings, behavioural changes, etc., are the manifestations.

The present study is restricted to an analysis of subjective emotional intensity. The concept of subjectively experienced emotional intensity also seems straightforward, but it is not. In fact, even the answer to the simple question "How intense was your emotion?" may not be. Certainly, subjects easily answer such a question, but it is unclear what underlies their answers. Is intensity an elementary aspect of emotional experience, much as the loudness of a sound or the brightness of a light? Or is it constructed out of the awareness of various response aspects, such as the awareness of one's physiological responses, action tendencies, and actual behaviour? Theories of emotional experience like those of Bem (1972), Schachter (1964), Zillmann (1983), or Frijda would certainly suggest this to be so. Also, is felt intensity based on direct intensity readings only, or do more indirect assessments enter into it, such as those of duration, or the anticipated or actual effects? The latter type of cue might plausibly influence intensity ratings given in retrospect; they may also influence such ratings at the time of impact as it may well be possible to glimpse the duration or future effects of one's emotion: "It will be a long time before I get over this". And, as we pointed out, they may be plausibly linked to some aspect of the magnitude of the emotion process, even if that was not sensed at the time of impact, and did not enter one's subjective intensity rating.

To the extent that those various aspects of experience do not perfectly covary there is ambiguity in the notion of the subjective intensity of emotion. Emotions may be felt to be intense for quite different reasons. A sudden loud noise can cause fright that makes the subject jump and choke, causing an experience that would be called intense; and a personal loss may cause someone to ponder for hours and to feel that life has become devoid of meaning, which also might be called an intense feeling. The two kinds of intensity would not seem to be comparable, or meaningfully ranked on the same scale. There may be consequences to such a state of affairs that might show subjective emotional intensity not to be truly one-dimensional. That is, even if subjects can indicate the intensity of their emotion on a given scale (we will call such a scale a scale of "overall subjective intensity"), the resulting ratings may not always be transitive or consistent, and pairwise comparisons of relative intensity may sometimes be undecidable for the subject. The issue is, of course, comparable (and, in fact, in part identical) to that of the unidimensionality of preferences or likings: although one's likings can be expressed on a linear scale, the results encounter the problems mentioned.

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These complexities lead to the main question of this study: Is subjective emotional intensity a truly one-dimensional concept? This implies two separate questions. First, are there several parameters of emotional experience that can be meaningfully considered as intensity parameters, in that they reflect the magnitude of emotional impact or the intensity of a presumed emotion process, and that vary more or less independently? If this is so, which are the dimensions along which the intensity of subjective emotional response might be measured? Secondly, how are overall subjective ratings of emotional intensity related to these more specific intensity dimensions? More particularly, is it plausible to view overall subjective intensity as derived from some combination of the more specific subjective intensity parameters? The hypothesis that emotional intensity is a multidimensional concept implies that the answer to the overall intensity question is the result of some computation over the more specific intensity dimensions or parameters.

Thus, the hypothesis to be tested is that subjective emotional intensity is multidimensional. The theoretical considerations have been extensively discussed by Frijda, Ortony, Sonnemans, and Clore (1992). In essence, the argument is that emotions are multicomponential phenomena (Scherer, 1984), that the various components have a certain independence, and that the phenomena consist, not of momentary states, but of processes that stretch out over time. The major components are affect (the feeling of pleasantness or unpleasantness), appraisal (the awareness of the meaning of the emotional event), state of action readiness, and behaviour; additional components include cognitive tunings and belief changes. Each component may vary more or less independently in magnitude, and each may vary more or less independently in duration. This applies to the objective components, such as expressive behaviour, action readiness, and physiological response, and to the subjective components, such as affect, appraisal, belief changes, and one's awareness of the objective components. Also, emotions have consequences that also reflect the magnitude of impact of the eliciting event, and that might (or might not) influence the individual's estimate of the intensity of his/her emotion, such as later recurrence of the event in thought, influence upon one's conduct of life, and the formation of long-term goals.

These theoretical starting points, together with our restriction to subjective intensity, decide which aspects of emotion are included in our study. We include the subjective estimates of the intensity of physiological arousal, action tendencies, and the drasticness of actual behaviour. We also include parameters like the latency of emotional reaction (the time between the eliciting event and the first reaction), and the time between the first reaction and the most intense moment of the emotion. And we include emotion duration. Emotion duration, of course, is an important aspect of emotion that also varies in magnitude. Surprisingly, it has been largely neglected in the emotion literature. We do not know of systematic treatments, except the cross-cultural study reported by Scherer, Walbott, and Summerfield (1986), and our own discussion in Friida, Mesquita, Sonnemans, and Van Goozen (1991). To include duration among the potential intensity parameters may evoke dissent. However, a priori one would expect onset speed, peak amplitude, and duration to be correlated and together to constitute the hallmarks of an "intense" response, as they are in other domains (e.g. startle). Because, conceptually, duration would still appear to be a separate aspect, we consider the relation between the various intensity parameters and the duration of emotion as a separate research question.

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Finally, we include spontaneous recollection and re-experience of the emotion, and awareness of long-term consequences, such as changes in beliefs about the self, others, institutions, and things, and changes in long-term behaviour. The rationale for this inclusion has been given earlier.

We did not include intensity aspects of appraisal, such as the degree of appraised goodness or badness of the eliciting situation. It is true that such appraisals, in so far as they are conscious, belong to the emotional response, and, indeed, Larsen et al. (1986) considers the answer to the question; "How bad/good was the situation?" an index of felt emotional intensity. However, these appraisals are closely connected to the antecedents of the emotion. Because we also tried, in the present project, to examine the determinants of emotional intensity, we preferred to include appraisal of the perceived importance of the situation among the possible determinants of intensity.

To summarise, we study these three research questions: (1) Is emotional intensity a unidimensional concept and, if not, which are the separate intensity dimensions in the domain of emotional experience? (2) What are

the relationships between overall felt intensity and the different dimensions of emotional intensity? (3) What are the relationships between the various intensity measures, including overall felt intensity, and the duration of an emotion?

PRELIMINARY STUDY

A preliminary study of the previously mentioned questions was reported by Frijda et al. (1992). In that study, 306 subjects were asked to recall an instance of one of the four emotions of fear, anger, sadness, or joy. Each subject completed a written questionnaire on aspects of the intensity of the recalled experience. An oblique factor analysis produced nine factors, of which one factor embodied global intensity variables (overall felt intensity, peak amplitude, average felt intensity). All other factors showed moderate correlations with this factor, but none with each other. The study concluded that "... it appears that emotion intensity is a concept involving multiple dimensions ..." In a stepwise regression analysis, with overall felt intensity as the dependent variable, four specific intensity parameters entered the equation: arousal, recollection/re-experience, duration, and drasticness of the behaviour. Thus, these four parameters appeared to be independent intensity variables.

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AIMS OF THE PRESENT STUDY

The present study intends to replicate and extend the results of the preliminary study. The questionnaire has been improved, both in content and methodology. In the present study, the questionnaire was administered by computer. A program was developed that enabled the subjects to draw a diagram of the course of the emotion over time on the computer screen. The program analysed the diagram, and on the basis of the shape of the diagram several questions were presented to the subject; this appeared to be a better way to measure temporal aspects of emotions than merely asking for answers on 5-point scale questions. Another advantage of the computer administration is that questions could be branched; irrelevant questions were skipped automatically.

As in the preliminary study, in the present study, recollection data were gathered. To diminish distortions with regard to emotion that occurred a long time ago, in five of the sessions the instructions asked to report emotions that had occurred no longer than one week ago. Because longterm effects of emotions also qualify as intensity indices, subjects were also asked at a later time about the more recent emotions that they had reported. In addition, in one session they were asked for the most intense emotion of the past year. Six emotion instances were gathered from each subject to enable us to investigate the contribution of individual differences in intensity ratings. Questions on the determinants of the emotion instances were also included. The results relevant to these two issues will be reported elsewhere.

Method

Subjects. A total of 37 subjects (10 men and 27 women, mean age 22 years), all psychology students, participated in this study and completed all 7 sessions and the final written questionnaire. The students received course credits for their participation.



FIG. 1. An outline of the procedure of this study

Procedure. Figure 1 outlines the procedure. During the first session, two questionnaires were administered: one on the strength of the individual's concerns and one a personality questionnaire. In the first session the operation of the computer was explained; the subject practised drawing diagrams on the screen, and a shortened version of the questionnaire was demonstrated. It was stressed that all data would be treated anonymously, and that after the experiment the connection between names and emotions would be destroyed. Subjects reported an emotion, once a week, during a 6 week period (sessions two to seven). There were two rooms with an available computer and the subjects could reserve a room at a convenient time. No one else was present in the room and they only saw the experimenter when they had problems operating the computer or answering a question. The subjects were asked to recall an emotion that took place in the previous week, except in the 4th session when they were asked for their most intense emotion of the previous year.

Questionnaires. The subjects first described their emotion on paper; they were asked to describe, first what had happened, and then to describe their subjective experience. After that they answered the questions on the computer. The questions in the computer program successively asked subjects:

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- to label the emotional situation with just a few words; this description was used as a cue when asking about that emotion in later sessions;
- to select the emotion-words that might characterise the emotion. The subjects were provided with a list of 18 emotion words from which to choose. They could also type an emotion word of their own choice; in that case they were asked what emotion word in the list resembled most that "own word". If more than one emotion word was selected, the subject was asked to indicate the emotion word that best applied to his or her emotional experience;
- to answer the intensity questions proper. The questions are reproduced in Appendix 1;
- to draw the diagram. Subjects drew a diagram of the course of their emotion over time (time on the horizontal axis, intensity on the vertical axis; see Figs 2a and 2b). The computer program identified important moments in the diagram, such as the beginning, the end, peaks, and valleys. Questions were then asked about these moments. The subject had to indicate, for each peak in the diagram, which of the emotion words checked earlier applied to that moment. The subject was asked to indicate the time spans between all important moments in the diagram. Through open-ended questions the connections between the written description of the emotion and the diagram were established. The open-ended question were only presented when applicable. They were:



FIG. 2a. The computer screen during the drawing of the diagram.



FIG. 2b. Example of a computer screen during the questions about the diagram.

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Start: Can you indicate what happened at A, the start of the emotion? (You can refer to things in the story you wrote).

Peak: Moment . . . is a top. Can you explain what happened at that moment or what you did to cause the emotion to become less intense?

Beginning of a valley: Moment . . . is the beginning of a valley. Can you tell what happened at that moment (or what was the situation at that moment)?

End of a valley or a one-point valley: Moment . . . is a valley. What happened at that moment that caused the emotion to become more intense?

End of emotion: Moment . . . is the last moment of the diagram. Can you tell what happened at that moment which caused the emotion episode to be closed?

• concern and appraisal questions. These questions were intended to study the determinants of emotional intensity. Results of this part of the study will be reported elsewhere.

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At the end of the 3rd, 4th, 5th, and 6th session some questions were posed about the recall and re-experiences of the emotions reported in the earlier sessions. The same questions about the emotions reported in the last sessions were asked in a written questionnaire, which was sent to the subject 2 weeks after the last session.

Computer Program. The larger part of the computer program was written and compiled in Microsoft Basic. Additional use was made of Macintosh Toolbox routines. The answer dialogs were made in ResEdit (a dialog is a particular window in the Macintosh interface, which a program can use to communicate with the user). All subjects received a private floppy disk with a system file and the program. The program started automatically when the subject inserted the disk in the Macintosh computer. During the session the data were saved on the disk and at the end of the session the disk was ejected automatically. The program displayed a window with the question at the top of the screen, and after a (built-in) delay of 2-4 seconds (depending on the length of the question) the answer dialog was displayed beneath the question. Only after choosing an answer with the mouse could the subjects continue to the next question. It was also possible to return to (a limited number of) previous questions to correct an answer. The program did not require knowledge of or experience with a Macintosh computer.

An important part of the program involves the drawing (by the subject) of a diagram about the course of the emotion. The computer program analysed the diagram to identify important points (see Appendix 2). First, the diagram was smoothed, to prevent errors in which unevenness might be recognised as a peak. The beginning and the end of the emotion were identified, as was the highest peak (the absolute maximum of the curve). Then, local maxima and local minima were determined. These local maxima and minima were only identified as important moments if the difference with neighbouring points was sufficiently large. If the curve was flat for a long period between two peaks (in a valley), two important moments were identified (beginning and the end of the valley). If the period between the beginning of the diagram and first peak was flat for a long period, it was interpreted by the program as a delay in onset of the emotion. Subjects could also indicate important moments in the diagram, not detected by the program (by clicking the mouse at the relevant part of the diagram).

Results

Some of the questions in the questionnaire were omitted from the final analysis. These questions repeated questions about the emotion the subject had reported two weeks before (re-experience of the emotion and change of everyday life). These questions turned out to be highly correlated with the original questions.

Several new variables were constructed from parameters of the diagrams the subjects had drawn. To obtain more adequate information on emotions with durations longer than 1 hour, three duration variables were constructed, in addition to the 5-point verbal question: the time to the first peak in the diagram, the time lapse of the beginning of the emotion to the end of it's first peak, and the duration of the entire diagram. These new variables appeared to correlate slightly better with the other intensity variables than the 5-point scale variable.

Two more variables were constructed. *Diagram: height peak* is the maximum value of the diagram (in screen pixels). *Diagram: area* was obviously based on the area of the diagram. Because the style of the diagram differs considerably between subjects, the diagram is stretched or shrunken vertically so that the maximum of the "corrected" diagram equals the score on *intensity feeling: peak* (×30 screen pixels). *Diagram: area* is the area of this corrected diagram (in pixels).

The subjects were not asked for emotions of a specific kind; they were free to choose what recent emotion to report. This procedure has advantages in that the subsequent labelling of the emotions may be held to have been less constrained (in 87% of the cases more than one emotion word was checked by the subject, after which he/she was asked to indicate the emotion word that best applied to the experience), and in that the subjects selected emotions of sufficient salience to themselves. A disadvantage of this procedure could have been that subjects reported very unequal numbers of each of the emotions to be analysed; it might have been, for example, that all sadness emotions were supplied by only a few subjects. Fortunately, the distribution of the emotions over the subjects appeared to be fairly equal.

Dimensions of Emotional Intensity. The scores on the intensity questions and the variables constructed on the basis of the diagram (29 variables in all) were subjected to a principal components analysis (orthogonal, with ortotran/varimax rotation). The 222 emotions are all about different emotional situations and are considered as independent (N=222), although they were reported by only 37 subjects. The analysis yielded six factors with eigenvalues > 1, that explain 68.1% of the total variance. All questions asking for global intensity ("How intense was the emotional feeling at its peak?" "How intense was the emotional feeling during the whole emotional episode?" "On the whole, how intense was the emotion?" Height and area of the diagram) formed one factor. Because we expected overall felt intensity to be dependent on the more specific intensity variables, the principal components analysis was repeated without the overall intensity variables. This latter analysis yielded five factors with eigenvalues > 1; these show the same structure as the first five factors in the first factor analysis. The factors explain 67.1% of the variance. Table 1 shows the loadings of the questions on these factors after rotation. On the basis of these loadings, the factors are named as follows.

- 1. Recollection and re-experience of the emotion.
- 2. Duration of the emotion and delay.
- 3. Action tendency (strength, drasticness) and drasticness actual behaviour.
- 4. Belief changes and long-term behaviour.
- 5. Perceived bodily changes (strength, duration) and strength passivity.

In this factor analysis, the 222 emotion accounts were assumed to be independent, although provided by only 37 subjects. To examine whether differences between subjects had influenced the results, the factor analyses were repeated with recoded variables. For each variable and each subject, the scores were standardised, so that no more differences in means or variances of these recoded variables between subjects existed. The factor analyses of these recoded variables yielded exactly the same factors as those using unrecoded variables.

The results confirm our expectations regarding the presence of relatively independent groups of variables having to do with the magnitude of emotional response, as felt by the subject. Duration, strength of action tendency, bodily effects, recollection, and changes in long-term behaviour and beliefs form to a high degree independent parameters. Emotions that

Variable	1	2	3	4	5	Communality
Delay		0.644				0.466
Time to peak		0.790				0.650
Duration emotion	0.338	0.679				0.614
Diagram: Time to peak		0.826				0.723
Diagram: Duration 1st peak		0.815				0.754
Diagram: Duration diagram	0.337	0.711				0.686
Strength bodily changes					0.857	0.845
Duration bodily changes					0.862	0.832
Strength passivity					0.540	0.353
Recollection 1st 24 hours	0.776					0.725
Re-experience 1st 24 hours	0.839					0.740
Strength re-experience 1st 24 hours	0.863					0.838
Recollection 1st week	0.789					0.728
Re-experience 1st week	0.855					0.789
Strength re-experience 1st week	0.854					0.833
Frequency of re-experiences	0.541					0.425
Drasticness action tendency			0.809			0.751
Strength action tendency			0.774		0.314	0.760
Drasticness action			0.681	0.331		0.581
Belief change things				0.684		0.578
Belief change people				0.483		0.357
Belief change self				0.706		0.636
Long-term behaviour				0.793		0.755
Changing daily life	0.325			0.717		0.684
Variance contribution of the factors (%) 22.0	15.2	8.4	12.5	9.0	

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TABLE 1 Orthogonal Transformation Solution Varimax

Note: Eigenvalues > 1: all cases, N = 222 (loadings > 0.3 or < 0.3).

can be considered intense in some regard need not be so in another one. For instance, bodily upset and the vigour of emotional impulse are just separate aspects of motion. Furthermore, the variance contributed by all factors is considerable. Evidently, the experience of emotional intensity is a differentiated one.

Most factors require little comment except for factor five. It is noteworthy that the questions that pertain to passivity (dislike of doing something, not able to do something) appear in the same factor as those pertaining to felt bodily arousal. It may be that passivity allows more attention to bodily cues; it may also be that the questions on passivity just touch on bodily feelings, and not on (absence of) action readiness.

		1	2	3	4	5	Overall Felt Intensity
1.	Recollection and re-experience					•	
	(7,α=0.93)	1.000					
2.	Duration of the emotion and delay						
	(6,α=0.85)	0.346	1.000				
3.	Action tendency, drasticness of actual						
	behaviour $(3,\alpha=0.74)$	0.354	0.142	1.000			
4.	Belief changes and long-term behaviour						
	(5,a=0.82)	0.564	0.379	0.392	1.000		
5.	Perceived bodily changes, strength						
	passivity $(3,\alpha=0.74)$	0.344	0.221	0.362	0.372	1.000	
	Overall felt intensity $(3,a=0.87)$	0.562	0.155	0.558	0.510	0.467	1.000

TABLE 2 Correlations among the Intensity Scales

Note: The number of items of the scale and the reliability, Cronbach's α , are in brackets.

In view of subsequent analyses we constructed scales of the intensity dimensions, based on the factor analysis. The scales include the highestloading variables. Whereas the dimensions from the factor analysis were orthogonal, the scales are intercorrelated. Table 2 presents these correlations among the scales and their reliabilities. Reliabilities are such that the scales provide reasonable measures of the different aspects of the intensity of response.

The Relationships of Intensity Dimensions with the Overall Felt Intensity Scale. Overall felt intensity of an emotion has been hypothesised to be some composite result of more specific intensity assessments. To test this hypothesis, a stepwise regression was carried out, with the summed score as the dependent variable, and all other scales as predictors (see Table 3).² The hypothesis was confirmed. All five scales entered the equation of which action tendency and drasticness of actual behaviour, bodily changes, and recollection and re-experience are the most important. All make independent contributions. The combined result is a multiple correlation of 0.723; about 50% of overall felt intensity of emotion is explained by the felt strength of action impulse and behaviour, by autonomic upset, and by the intrusion of the emotion into thought. The contribution of these

 $^{^2}$ Significance tests for regression analyses assume independence of cases; because 37 subjects produced the 222 cases analysed, the results of the regression analyses are primarily for descriptive purposes. The pattern of involvement by the various factors in overall intensity is apparent from the sizes of the correlations, and the conclusions do not hinge on tests of significance.

Step	Overall Felt Intensity	r	R	R ²
1	Recollection and re-experience	0.562	0.562	0.315
2	Action tendency, drasticness of actual behaviour	0.558	0.680	0.463
3	Perceived bodily changes, strength passivity	0.467	0.708	0.501
4	Belief changes and long-term behaviour	0.510	0.716	0.513
5	Duration of the emotion and delay	0.155	0.723	0.523

TABLE 3 Stepwise Regression of the General Felt Intensity Scale (F > 4 criterion). All Emotions (N = 222)

variables to overall felt intensity is considerable, particularly when the (un)reliabilities of the predictors are taken into account. The duration of emotion is included in the prediction equation, although the correlation of duration with overall felt intensity is low.

Roughly the same prediction results are obtained when the individual variables, and not the scale scores, are used (R = 0.695). The multiple correlation is slightly lower, and duration does not reach a significant contribution. We will discuss the duration-intensity relationship later.

The relation between overall felt intensity and the intensity parameters is not necessarily the same for all emotions. Therefore, the stepwise regression analysis was repeated for the separate emotions or emotion groups for fear, sadness, anger, disappointment, and the positive emotions. Table 4 shows the correlations and the results of the stepwise regression analysis. Recollection and re-experience, and action tendency and behaviour, correlate highly with overall felt intensity for all emotions. The duration of emotion correlates positively for disappointment, positive emotions, and sadness, but the correlation for anger is low and for fear even negative. All in all, the differences between the emotions appear to be relatively small.

Using multiple regression analysis implies a linear and additive model of overall felt intensity. If one of the intensity parameters in the regression equation changes, the overall felt intensity will change, and will do so linearly. However, it may well be that the function relating underlying variables to overall felt intensity is neither linear nor additive. For instance, overall felt intensity may well be based on the most salient aspects of the emotion only, e.g. on the aspect that is most intense. Subjects thus may use a non-additive model: Overall felt intensity may be based on the parameter with maximal intensity. It might be that an emotion is felt to be intense if the arousal is high, or if there is a strong urge to action, or if it crops up in thought, or if the emotion has a long duration.

To test this possibility, a series of new variables was calculated. The intensity scores on the items were transformed to standard scores, and

		Fear (n=25)	Sadness (n=19)	Anger (n=41)	Disappointment (n=17)	Positive Emotion (n=84)	All (N=222)
1.	Recollection and						
	re-experience	0.523	0.469	0.528	0.715	0.628	0.562
2.	Duration of the emotion						
	and delay	-0.206	0.223	0.118	0.422	0.259	0.155
3.	Action tendency, drasticness of actual						
	behaviour	0.5 4 8	0.661	0.544	0.437	0.507	0.558
4.	Belief changes and						
	long-term behaviour	0.525	0.264	0.433	0.338	0.580	0.510
5.	Perceived bodily changes, strength						
	passivity	0.471	0.549	0.367	0.599	0.376	0.467
Mı	ultiple correlations, all						
din	nensions	0.804	0.726	0.735	0.838	0.731	0.723
Mι	ltiple correlations,						
dimensions in <i>italics</i>		0.697	0.661	0.676	0.715	0.730	0.723

TABLE 4 Correlations between the General Intensity Scale and the Specific Intensity Scales

Note: The multiple correlations in the last row are the result of a stepwise regression (F > 4 criterion) and include only the items in italics. All positive emotions are analysed together because the major difference between the positive emotions appears to be their intensity (love was most intense, followed by hope, happiness, joy, and pride), see Sonnemans (1991).

maxima of several groups of scores were calculated for each emotion instance. These maximum intensity parameters correlated 0.457 with the overall felt intensity.

However, if a variable represents the maximum of several parameters, the variance becomes very small. Therefore, the maxima of several of the standardised scale scores were calculated, and correlated with overall felt intensity (Table 5). If we compare these correlations with the multiple correlations in Table 3, we see that the maximum of *Recollection and re-experience* and *Action tendency and drasticness of actual behaviour* correlates 0.652 with overall felt intensity, which is only slightly lower than the multiple correlation of these variables with overall felt intensity (0.680, see Table 3). Adding other variables reduces the correlation of the maximum variable with the overall felt intensity, perhaps partly as a result of the smaller variance.

Apparently, the additive model and the maximum model of overall felt intensity, although conceptually completely different, were equally successful in describing the relations between overall felt intensity and the intensity parameters. A choice between the models can therefore not be

Correlation of the Overall Felt Intensity Scale with Some Constructed Variables

Overall Felt Intensity	R
Max scales 1 & 3: Recollection and re-experience & Action tendency, drasticness of actual behaviour	0.652
Max scales 1 & 3 & 4: Recollection and re-experience & Action tendency, behaviour & drasticness of actual behaviour & Belief changes and long-term behaviour	0.648
Max scales 1 & 3 & 4 & 5: Recollection and re-experience & Action tendency, drasticness of actual behaviour & Belief changes and long-term behaviour & Perceived bodily changes, strength passivity	0.641
Max all scales: Recollection and re-experience & Action tendency, drasticness of actual behaviour & Belief changes and long-term behaviour & Perceived bodily changes, strength passivity & Duration of the emotion and delay	0.510

Note: The maxima are calculated on the basis of the standard scores of the intensity scales.

made. For testing nonlinear additive models, data are lacking in the present study.

The Relationship between Duration and Overall Felt Intensity. The duration of emotions varies considerably; as it did in the present sample of emotions. As we indicated, it seems plausible that an intense emotion lasts longer than a less intense one. However, the correlations between duration and overall felt intensity turn out to be only 0.26 (for duration as indicated in the diagram) and 0.38 (for the estimated duration of bodily effects). These correlations are even lower when the instances of fear and anger are considered separately.

The low correlation between emotion duration and overall felt intensity can be explained, however, by the fact that emotions or emotion episodes can terminate for several different reasons, and not merely because the emotion has run its course and petered out. It is remarkable how many studies have focused on the causes and the onsets of emotions, whereas none gave any attention to their termination. Emotions may terminate for reasons that have nothing to do with the properties of the emotion as such. For example, the meaning of the situation may have changed (Frijda et al. 1991). If someone is very angry because of suffering a slight, but the offender apologises, it is likely that the anger will end sooner than if no apology is made.

To investigate whether such factors indeed might influence the correlation between duration and intensity, we analysed the question that was asked at the last point of the diagram: "Can you tell what happened at that moment, which caused the emotion to end?" The answers were

			Duration Diagram	Duration Bodily Changes
Situation change	Situation changes or the			
	inderstanding of the subject of the	(0.052*	0 361#
Talking	Talking with others about the	(n = 78)	0.255	0.201
Turking	emotional situation	(n=12)	-0.545	0.068
Sleep	Subject falls asleep	(n=19)	0.119	0.363
Distract	The attention of the subject is diverted by the environment or by	(
	an activity	(n=45)	0.485*	0.383*
Habituation	Habituation: Appraisal stays the	. ,		
	same but the urgency lessens	(n=20)	0.409	0.250
Regulation	Regulation: Active seeking of diversion, trying to think of other			
	things, relativising of the situation	(n=19)	0.473*	0.673*
Distract/Habituation/		. ,		
Regulation		(n=84)	0.408*	0.405*
All emotions		(N=222)	0.259*	0.384*

TABLE 6 The Correlations between the Overall Felt Intensity Scale and the Duration of the Emotion, separated by the Cause of the Ending of the Emotion

Note: The cause of the ending of 16 emotions could not be classified.

* Statistically significant (P < 0.05).

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categorised *post hoc*, according to the schema in Table $6.^3$ This table shows the correlations between overall felt intensity and duration, separately for instances with different kinds of terminations.

When the emotion ended because of a change in situation, the correlation between overall felt intensity and duration is 0.253 (duration diagram) and 0.261 (duration bodily changes). When, however, the emotion had ended through efforts made by the subjects to control the emotion, it rises to 0.473 and 0.673, respectively. Indeed, these correlations suggest that the way an emotion ends is an important aspect of the emotion, and modulates the relationships between duration and overall felt intensity. They also indicate that duration of emotion can be considered as being an aspect of emotional intensity to the extent that such duration is not caused by events external to the emotion itself.

³ This part of the study is exploratory. The answer categories were formed to obtain insight into the kind of answers given and for future use in other questionnaires. In this study, the subjects had to fill in their answers, so it is likely they reported only one cause even when more causes existed. Therefore, in future studies it would be preferable if answer categories were used and the subject could check more than one cause. Because only one person coded the answers the reliability is unknown.

DISCUSSION AND CONCLUSION

The results of this study indicate that emotional intensity is multidimensional. Even with regard to subjective aspects of emotion, intensity can be assessed by means of quite different variables that vary independently. An emotion can be considered intense because it has deeply influenced one's conduct of life, or carries all signs of being likely to do so in the future, or it can be considered intense because it has engendered powerful autonomic upset. The five factors found in the orthogonal factor analysis of different subjective variables (Table 1) can be considered as dimensions of intensity for two reasons: they represent the intensity of different components of the emotion; and they are correlated with overall felt intensity. Overall felt intensity is the result of some joint function of different underlying subjective dimensions, and the joint function appears to be different for different emotions or on different occasions. Research has to discover which those different occasions are, i.e. which are the specific determinants of the different parameters of intensity. These various results confirm the conclusions of the preliminary study as reported in Friida et al. (1992), with the exception that in this study recurrence and duration of emotion emerge as different factors (factors 1 and 2), whereas in the preliminary study they loaded on one factor.

The five dimensions of intensity established by this study cannot be considered the only dimensions of emotional intensity because this study was concerned only with subjective intensity. If objective measures are included, such as the objective duration of the emotion, actual physiological responses, and observable behaviour, additional dimensions of intensity will appear. These dimensions may or may not correspond to those found in our analysis of self-reports.

The multidimensionality of emotional intensity has consequences for other emotion research. The use of only one subjective intensity parameter (overall felt intensity) in research is problematic. It is unlikely that antecedents and consequences of emotions are consistently connected with overall felt intensity across all kinds of emotions, or that they are consistently connected with all parameters. If emotional intensity has to be assessed in an experiment (e.g. in order to examine to what extent the experimental situation has induced emotions), several intensity parameters should be used. In any case, the divergence of measures for the intensity of emotion is not so much caused by the unreliability of the measurements, but also by the multidimensionality of the concept of intensity itself. Each emotion component, presumably, has its own specific determinants.

The multidimensionality of emotional intensity suggests that nontransitivity will obtain in pairwise comparisons of the felt intensity of different emotions, and perhaps even of different instances of the "same" emotion. Such nontransitivity should be studied to examine the actual consequences of the multidimensionality found here.

We suggest that the overall felt intensity is some function of specific intensity parameters. The precise form of the function is not yet clear: It may be linear or nonlinear, additive or nonadditive. Both an additive model (multiple regression) and a maximum model performed rather well, and equally well. Perhaps a more complex model (which embodies both additive and maximum aspects) will do better. It might also be that there are individual differences in the way the overall felt intensity is (intuitively) construed from the intensity parameters.

The correlations among overall felt intensity and the specific intensity parameters and also the stepwise regressions (Table 4) suggest that the structure formed by the intensity variables differs between emotions. Clearly, overall felt intensity may have different meanings for different emotion types. This may cause difficulties in comparing intensity of different emotions.

The correlation between duration and overall felt intensity is, for some emotions, low or even negative (anger and fear; Table 4). The relation between duration and intensity is complex (Frijda et al. 1991). The low correlations between duration and overall felt intensity may be caused by the external situation which also influences the emotional duration. The results of the present study suggest that the connection between emotional intensity and duration of the emotion can be clarified by considering the manner in which emotions end.

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APPENDIX 1

The Intensity Questions

The original questionnaire is in Dutch. The Dutch version of the questionnaire is available from the author and also the questionnaire computer program in either Dutch or English (the program works on a Macintosh Plus only). The questions are presented in a window at the top of the screen, the answer categories are displayed in a dialog-box with radio-buttons (this means that only one box can be checked). The words in Column 1 are references to Table 1; they were not part of the questionnaire. In this appendix, the first and last of the 5-point scales are presented only.

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Delay	Sometimes an emotion caused by an event arises immediately, but it also can happen that it takes some time before the reaction occurs. How long did it take, after the moment of the event, before the FIRST emotional reaction occurred? (0-5 secs-more than 1 hour)
Time to peak	The time between the moment of the event and the moment of the first emotional reaction is compared with what one would expect: $(0-5 \text{ seconds}-\text{more than 1 hour})$
Duration emotion	How long did the whole emotion last? (0-5 seconds-more than 1 hour)
Feeling peak	How intense was the emotional FEELING at the peak? (low intense-very intense)
Feeling episode	How intense was the emotional FEELING during the whole emo- tional episode (thus not only at the peak)? (low intense—very intense)

Strength bodily (After listing bodily changes.) On the whole, how strong were these bodily changes? (very weak—very strong) Duration bodily How long did the bodily changes last (the bodily change with the longest duration)? (0–5 seconds—more than 1 hour) Recollection first 24h Did it happen that the episode "popped" into your mind, during the fIRST 24 HOURS after the events? (not at all—continuous) Re-experience first 24h (If yes.) Were these recollections accompanied with an emotion (this can be a re-experience of the first emotion, or a different kind of emotion)? (never—always) Strength re-experience Did it happen that the episode "popped" into your mind, during the FIRST 24 HOURS accompanied with an emotion (this can be a re-experience of the first 24 hours) after the events? (not at all—continuous) Re-experience first Were these recollections accompanied with an emotion (this can be week are-experience first Were these recollections accompanied with an emotion (this can be a re-experience of the first emotion, or a different kind of emotion? (never—always) Strength re-experience How powerful was this emotion? (very weak—very powerful) first week How powerful was this emotion? (very weak—very powerful) first week How often did it happen that this re-created the emotion? (once—more than five times) Drasticness action (After listing action tendencies.) How drastic were the actions you had an impulse to take? (e.g. killing someone is more drastic than calling names, to embrace someone		
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If both of the two "Strength passivity" questions are filled in, *Strength passivity* is the maximum of these values, if no lessening of activity was caused, *Strength passivity* is coded 0.

APPENDIX 2

Recognition of Important Moments in the Diagram



FIG. A1 Example of the recognition of important moments in the diagram. First the curve was smoothed (running mean of 5 pixels width), then the beginning (A), the end (F), and the absolute maximum (B) was found. A local minimum is found at C and a local maximum is found at D. A local minimum is accepted as such only if the difference in height with point 20 pixels to the left and right is at least 5 pixels. To determine whether there is a long flat period between the peaks at B and C, first c1 and c2 were calculated, c1 = c + 0.10(b - c) and c2 = c + 0.10(d - c). The program sought the moment C1 between B and C where the diagram reaches the value c1, and also the moment C2 between C and D where the diagram reaches the value c2. If the distance between C1 and C2 is large enough (more than 30 pixels) then C1 is recognised as an important moment of the type "beginning of a valley" and C2 of the type "end of a valley". If C1 and C2 are close together, C is recognised as an important point of the type "valley". Essentially the same procedure is followed to determine whether an extra important point between A and B is needed (delay in onset of the peak), this is not shown in the diagram.

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