

The perception of bodily sensations during emotion:  
A cross-cultural perspective

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Running Head: Bodily Sensations in Emotion

### Abstract

This paper reviews the research pertaining to the emotional and cultural determinants of felt bodily sensations. First, the relevant empirical literature addressing actual physiological arousal in emotion is presented. In a subsequent section, the cultural variation of actual physiological changes during emotion induction are examined. Then the review focuses not on the actual physiological changes but on the bodily sensations felt during emotion and on their cultural variations. A special development is given to a research program from our laboratory.

## The perception of bodily sensations during emotion: A cross-cultural perspective

Thomas Ots, a German physician and ethnologist, has reported the following experience from one of his travels in China:

"While riding a train, a Chinese friend and I had eaten a lot of snacks that did not mix well. I suddenly suffered from nausea and realized that I was pressing the epigastric region with one hand. I was sure that I had strained my stomach. At the same moment, my Chinese friend said that he was suffering from vertigo and he seemed very concerned about it. I inquired about his perception several times. He insisted that he was suffering from vertigo and only after some time he remarked that something was wrong with his stomach. I tried also to experience vertigo, and actually found it was not very difficult because the nausea was associated with a feeling of unclarity or confusion in my head."  
(Ots, 1990, p. 39)

This anecdotal story illustrates well how bodily changes in similar situations can be experienced very differently by members of different cultures. Such differences can originate at various levels of the somatisation processes, from the production of physiological changes, to their detection, to their labelling and, ultimately, to their memory. The present chapter will examine theories and research about the cross-cultural variations in this domain.

We will use emotion as a paradigm for studying cross-cultural differences in somatization. Indeed, as many somatic and psychopathological troubles, emotion is associated with physiological changes. These changes produce symptoms that people perceive and report. However, unlike somatic and psychopathological troubles, emotion can be produced and observed in laboratory settings, thus allowing for experimental studies. The findings derived from emotion research can then be generalized to other aspects of somatization.

At the beginning of the chapter, we will present the theoretical issues at stake in the cross-cultural study of emotion physiology. After, we will review the relevant empirical literature addressing actual physiological arousal and reported bodily sensations in emotion and their cultural variations. Finally, the implications of this research for the understanding of somatization will be presented.

Physiological changes in emotion

Since the last century, authors have been arguing in favor of the existence of genetically-determined biological markers of emotion. According to this view, the universe of emotion would consist in a limited set of "basic emotions". Each of them would be characterized by a set of specific patterns in different response systems, such as the facial-expressive response system, or the physiological response system. Darwin (1872) was the one who first proposed this view, with a particular accent on the typical facial expressive features that are observed in each of the basic emotional states. In a theoretical perspective that later became known as the peripheral theory of emotion, James (1884) and Lange (1885) independently proposed that each emotion was characterized by a specific pattern of peripheral physiological changes which, through bottom-up reafferences, would cause the subjective resonances consciously felt by the person. Darwin's view as well as the peripheral perspective are still largely influential on contemporary scene (e.g. Tomkins, 1962; Ekman, 1984; Izard, 1979).

In contrast to this conception stressing the physiological differentiation of emotion, other authors have developed a "general arousal" conception of emotion. Cannon (1927), the forerunner of this concept, proposed that the various emotions share a common set of well-delineated changes in the peripheral autonomic system. This state of general arousal, present in every emotional state, would prepare the organism to perform very quickly the energy-consuming efforts involved in adaptative actions like fight or flight. Many later authors adopted a similar perspective (e.g. Duffy 1951; Hebb, 1953, Lindsley; 1951; Schlosberg, 1954).

More recently, a quite different perspective on emotion emerged, stressing the social rather than the biological or physiological perspective. Schachter (1964) proposed that the state of general arousal would be no more than a precondition to the emotion. Its perception would elicit the initiation of a cognitive search process aimed at identifying the cause of the undergoing physiological changes. Often, the social context would offer a plausible justification. The particular causal attribution made would then determine the specific nature of the emotional state - joy, or anger, or fear and so on - felt by the subject. Thus, emotions would be largely plastic with regard to social-environmental factors. Such a perspective was later pushed further in Averill's (1980) social-constructivist theory of emotion. Here, the biological components of emotion are viewed as devoid of any critical role in the development of the emotional state. Emotions are considered as culturally-defined patterns of feelings and behaviors to be adopted by people when confronted to certain social circumstances. Thus, perceived bodily sensations, and even actual physiological manifestations would simply follow from the specific cultural pattern adopted at a given moment.

Obviously, these different perspectives hold different predictions about the cross-cultural comparison of physiological changes in emotion. In spite of their conflicting views on the existence of differentiated patterns, every biologically-based theory of emotion would argue in favor of the cross-cultural similarity of actual physiological responses recorded during emotional induction. To the contrary, the social perspective leads to expect that physiological changes in emotion show rather large variations as a function of the culturally prescribed feelings and behaviors. Nevertheless, the debate on cultural similarities and differences in this domain could not be pursued further without first considering the more fundamental question: Are there physiological response patterns that characterize each specific emotional state?

Since the fifties, laboratory studies conducted on Western subjects have recurrently addressed the question of the physiological patterning in emotion. Recently, Philippot (1992) reviewed the evidence so far. Eighteen studies were identified that had contrasted several physiological parameters between at least two relatively pure emotional states. Usually, the results of these studies led their authors to conclude that the emotions observed could be differentiated on the basis of the physiological parameters measured. However, the specific differences reported by each particular study are generally not replicated by the other studies. For instance, while some studies found heart rate to be faster in joy as compared to sadness, other studies did not find this contrast or they even observed the opposite. Actually, for each of the 10 physiological parameters considered, we have been unable to identify any cross-study consistency in the contrasts of the four emotions reviewed: joy, anger, fear, and sadness. Hence, the specific differences observed by each individual study should be attributed to factors alien to discrete emotion differentiation, such as the specific characteristics of the stimuli or procedures used to induce emotions in the laboratory. In a review comparing the physiology of fear and anger, Stemmler (1992) reached the same conclusion, and so does Zajonc and McIntosh (1992) in a review of 6 physiological studies using Ekman's facial action paradigm.

In sum, there is to date no strong empirical evidence supporting the idea that basic emotions are differentiated at the physiological level. One should not conclude from this statement that, in actuality, emotions only generate an undifferentiated state of physiological activation as proposed by the general arousal theories of emotion. Rather, our conclusion is that the studies that could appropriately answer to this question are still to be done. As developed by Stemmler (1991), such studies should control for individual variance and should involve systematic manipulations of situational and emotional parameters.

As there is no consensus within a culture about the patterns of physiological changes signaling basic emotions, cross-cultural studies have not been developed yet. There is a very recent exception, though. Indeed, Levenson, Ekman, Heider, & Friesen (1992) observed physiological changes in Indonesian subjects that were posing facial expressions of joy, anger, fear, disgust, and sadness. A previous study conducted by Levenson, Ekman & Friesen (1990) on US students had led the authors to the conclusion that patterned physiological changes could be evidenced such conditions of emotion induction. Comparing the physiological data collected on US students to the data collected on Indonesian subjects, Levenson et al. (1992) observed some cross-cultural consistencies in heart rate and temperature differentiations among several emotions. These results, however, should be interpreted with caution. Indeed, it is not clear whether the physiological changes observed are due to the activation of an emotional state per se, or whether they are the mere result of the physiological load implied by the contraction of facial muscles. Moreover, Levenson et al. (1992) noted that very few Indonesian subjects reported having felt the target emotions while performing the corresponding facial-expressive actions.

In sum, the empirical evidences that are presently available do not allow a definitive answer to the questions pertaining to cross-cultural variations in emotion physiology. As it is not yet established whether emotions are physiologically differentiated, the question of cross-cultural variation in this domain is still premature. However, there is another type of evidence relevant to these questions. Indeed, several studies have investigated the bodily sensations--the symptoms of physiological changes--that people report to have experienced in various emotional states. This research has yielded more definitive results that we will now review.

### The perception of bodily sensations during emotions

Despite the importance attributed by many theories of emotion to the perception of the physiological changes accompanying emotion, it is only in the last decade that empirical data started to be collected in that domain (e.g. Nieuwenhuys, Offenberg, & Frijda, 1987; Pennebaker, 1982; Scherer & Wallbott, submitted; Shields, 1984). Typically, in these studies, subjects are asked to recollect a past emotional experience and to report the bodily sensations they remember having felt during this event. A recent review of these studies (Philippot, 1992) revealed that people systematically report highly differentiated patterns of bodily sensation to characterize each basic emotion. Moreover, despite wide methodological differences, the bodily sensation patterns characterizing each emotion are remarkably similar across studies.

Specifically, joy is systematically associated with increased body temperature, heart rate acceleration, sensation of lump in the throat and some muscle symptoms. Anger is marked by sharper increases in body temperature and in heart rate, as well as in perspiration, breathing rate and muscle tension. Fear presents a similar pattern with two major exceptions: On the one hand, fearful subjects report lowered body temperature, on the other hand, they also report many stomach symptoms. Finally, sadness is associated with less bodily sensations, mainly in the stomach and throat areas.

Interpreting their findings, the authors of these studies generally propose that bodily sensations are a reflection of the actual physiological changes accompanying emotion. However, some major arguments would lead to predict the opposite. Most importantly, visceroreception research has shown that people are generally very poor perceivers of their physiological changes. Indeed, a wealth of studies has shown that detection performances for most physiological changes do not exceed chance level (for reviews see, Katkin, 1985; Pennebaker, 1982; Rimé, Philippot & Cisamolo, 1990). In this line, recent theoretical models of symptom perception have put a strong emphasis on selective biases and theory-driven processes (see e.g. Cacioppo, Andersen, Turnquist, & Tassinary, 1989; Pennebaker, 1982). According to these conceptions, the process of symptom perception is, at least partly, determined by the individuals' expectations about their physiological state. People would hold theories and representations about the way the body responds physiologically to different situations. When in these situations, such representations would play important functions in the perception and identification of bodily sensations. For instance, people would direct preferentially their attention toward the physiological responses predicted by their representations, or when confronted to very diffuse sensations, they would be more likely to identify them as responses congruent to their representations.

Our view is that such theory-driven processes in visceroreception are even more likely to occur during emotional experiences than during non-emotional experiences. Indeed, during emotion, individuals are confronted with a disruption of their normal course of action and by a sudden flow of information that overwhelm their processing capacities. In most of these situations of emergency, individuals' attention has to be allocated in priority to decision processes about behavioral and feelings alternatives. In addition, as developed above, humans are poorly equipped to perceive accurately most of their peripheral changes. However, they are motivated, by biological disposition and social learning, to maintain an explainable physiological condition (Cacioppo et al., 1989). Given these constraints, people are very likely to rely on a priori representations to define their confused body state and to selectively orient their attention to "expected" sources of information.

In this line, we have proposed that report of the bodily sensations associated with emotion was foremost a theory-driven process (Rimé et al., 1990). More precisely, we have postulated the existence of socially shared representations specifying the bodily changes that are typical of given emotions. We refer to these memory structures as social schemata. People's report of bodily sensations during emotion would be largely drawn upon these social schemata. We tested this hypothesis in a series of studies.

The first question, obviously, was to determine whether there are such things as "social schemata", or, in other words, whether people can access abstract representations that are socially shared and that specify the bodily changes typically expected for given emotions. It should be mentioned that this hypothesis had already been considered. Pennebaker (1982), for instance, in describing two studies showing that bodily sensations were differentiated across emotions, questioned his interpretation of his data in the following way:

"Could these specific findings merely reflect linguistic conventions and/or schema?

That is, does a person who feels angry assume that anger-related symptoms are present? Debriefing subjects in both of the above studies suggests not. I asked the majority of the subjects which symptoms they thought covaried with what emotions.

All subjects reported that they had little or no idea and further, that it was an impossible task to figure out." (pp. 88-89)

Yet, differences may in fact exist between people's perceived ability and their actual ability to report peripheral changes that vary with emotion. To test this possibility, we asked subjects to report at a very fast pace--they had less than 2 sec. to give their answer--to what intensity pairs of emotion and bodily sensation covary (Rimé et al., 1990). This procedure had been designed to prevent subjects to access their episodic memory and hence to rely on memory of past experiences to answer to our questions. In this manner, subjects' answers could only be either random or based on abstract representations stored in semantic memory. Contrary to the prediction of Pennebaker's subjects, our results demonstrated that the intensities of the bodily sensations are not randomly distributed across emotions. Rather, the analysis revealed that clearly distinct patterns of bodily sensations characterize each of the emotions investigated: joy, anger, fear, and sadness. Yet, our subjects, as those of Pennebaker, reported that the task was an impossible one and that they had the feeling of responding randomly. We replicated this findings in many different studies, and with up to 8 different emotions (Philippon, 1992). Hence, we are confident in stating that people can access social schemata defining the bodily sensations that are typical of given emotions.

A new question is then immediately raised: Can the bodily sensations reported by the subjects be predicted by the social schemata? In a further study (Rimé et al. 1990), we asked subjects to recollect the bodily sensations they felt in a recent, yet intense, experience of either



joy, anger, fear, or sadness. In a second condition, using the fast pace procedure described above, we asked subjects to report the typical intensity of bodily sensations for the same four emotions. Clear-cut results showed that the social schemata collected in the second condition can predict the bodily sensations recollected by the subjects of the first condition.

One could argue that people are more likely to rely on theory-driven processes when they have to remember bodily sensations as compared to when they are perceiving them. Indeed, as memory decays, reconstructive processes are activated to produce plausible answers for the forgotten items (Ross, 1989). Hence, one wonders whether social schemata could predict as nicely bodily sensations during their perception as during their recall. And as a matter of fact, no study had specifically investigated on line perception of bodily sensations during emotion induction. To answer this question, we induced six different emotions by exposing subjects to film excerpts (Philippot & Rimé, 1993, in preparation). Immediately after the end of each excerpt (that corresponds to the peak of the emotion), subjects were asked to report the intensity of a series of bodily sensations. The analysis of the results revealed that, in this condition too, the patterns of bodily sensations are clearly differentiated across emotions. Moreover, for each emotion, these "perceived" patterns are highly similar to those recollected from past experience by other subjects. But, most importantly for our question, the perceived patterns can also be predicted by the social schemata. Thus, our studies demonstrate that social schemata are reliable predictors of the "perceived" as well as of the "recalled" patterns of bodily sensations reported during emotion.

Yet, it could be that reported bodily sensations and social schemata are similar because both are based on actual physiological changes. Indeed, it could be that the social schemata consist in prototypical representations constructed by extracting the commonalities in the physiological responses perceived during given emotions. Hence the correlation between reported sensations and social schemata would be accounted for by a third variable: the actual physiological responses that would determine the two former variables.

To test this possibility, we again induced emotion in the laboratory and asked subjects to report their bodily sensations. But this time, we also measured a series of physiological parameters during the emotion induction: heart rate, skin conductance, skin temperature, respiration, and muscle tension (EMGs) (Philippot, 1991). Using correlations and multiple regressions, we attempted to predict each bodily sensation with the physiological parameters. These analyses showed very low and unsystematic relations between bodily sensations and actual physiological responses. In other words, contrary to the social schemata, the physiological responses turned out to be very poor predictors of the bodily sensations reported by the subjects.

In others studies, we gathered another source of evidence showing that while reported bodily sensations are largely determined by the type of emotion experienced, they are not modulated--or only to a very small extend--by individual or situational characteristics (Philippot, 1992). This finding is quite remarkable as the opposite has been found in psychophysiological studies investigating actual physiological changes (see Lacey, Kagan, Lacey, & Moss, 1960; Stemmler & Meinhardt, 1990)

Taken as a whole, this set of findings strongly suggests that the bodily sensations people report during emotion are the result of a (re-)constructive and unconscious process. Indeed, people hold abstract representations specifying the physiological changes thought to be typical of emotion, i.e. the social schemata. These memory structures can account for the bodily sensations people perceive during, or recall after, emotional experiences. Moreover, these social schemata seem to bare little relation with the actual physiological changes aroused by emotion.

In the light of these findings, the key question to understand bodily sensations report addresses the origin and nature of the social schemata. Given their inter-individual consistencies, our results suggest that social schemata could be thought of as social constructions (Averill, 1985). Their functions would be to give a plausible and differentiated explanation to diffuse and objectively not identifiable sensations of arousal. Worded otherwise, social schemata would maintain an explicable and socially acceptable physiological condition in a subject carried away by the chaos of emotion. If social schemata are indeed mere social construction, one should expect cross-cultural variation in the schemata and, hence, in bodily sensations report during emotion. This question has recently been investigated by a few studies.

#### Cross-cultural comparison of bodily sensations reported about emotions.

Various studies specifically aimed at comparing across cultures the bodily sensations typically associated with a specific emotion. The earlier one was conducted as part of a cross-national collaborative project investigating various aspects of the emotional experiences of joy, anger, sadness and fear in students samples of 9 European countries (Scherer, Wallbott, & Summerfield, 1986). The part of these data that regarded bodily changes were collected as answers to open questions and were analyzed by Rimé and Giovannini (1986). Not only did they found similar bodily sensation patterns in a North-South split of their subjects' sample but in a country-by-country comparison as well. Edelman and Iwawaki (1987) collected data regarding embarrassment in Britain and Japan with a procedure similar to the one described by

Rimé and Giovannini (1986). Their results showed that the same bodily sensations tended to be mentioned by most subjects within each of the two cultures. However, some differences were observed in that British students reported more marked temperature changes than Japanese students. Recently, Scherer and Wallbott (submitted) extended the early European investigation to 37 countries in 5 continents using this time a precoded answer questionnaire with 10 items, to be checked by the subjects for seven basic emotional states. Post-hoc, they aggregated bodily sensations items into three scales: ergotropic changes, trophotropic changes, and temperature changes. Although some statistically significant differences appeared across cultures, eta-square comparisons indicated that the amount of variance explained was much larger for the effects of emotion as compared to the effects of culture.

In a cross-cultural extension of Rimé et al. (1990), Hupka and co-workers (1992) asked American, German, Polish, and Russian students to report in which parts of the body they felt anger, envy, fear and jealousy. These authors speculated that the failure of previous studies to record clear-cut differences across cultures could be due to the low number of bodily sensations items proposed to the subjects. Extending this number to 31, they actually found significant effects of culture for 8 out of these 31 variables in the case of anger, for 6 of them in the case of envy, for 9 of them in the case of fear, and for 6 of them in the case of jealousy. Thus, some cross-cultural differentiation of emotion was evidenced, as was the case in the data collected by Scherer and Wallbott (submitted). However, here again, cross-cultural similarity seemed to predominate.

Overall, although in some of these studies some effects of culture were evidenced, no conclusive evidence can be drawn about the existence of sizable cultural differences in the bodily sensations that are attributed to emotion. However, several limitations of these studies may have contributed to the under-estimation of cultural differences. Rimé and Giovannini (1986) used only open answer questionnaires for collecting reported bodily sensations; this procedure limits the material communicated by each subjects to the few items that come to their mind when answering. Moreover, the cross-cultural comparison in this study was limited to Western European countries. Edelman and Iwawaki (1987) considered only one emotion. Although conducted on a wide variety of cultures, Scherer and Wallbott's (submitted) investigation exposed subjects to forced choice items with alternatives limited to the presence or absence of bodily sensations. In addition, the bodily sensations items were later aggregated into only three categories. It thus remains plausible that with more refined operationalizations and with more powerful statistics, wider effects of culture would be evidenced. We thus decided to design studies aiming specifically at examining this issue.

## New evidences from our laboratory

Philippot, Rimé, Feldman, Maric, & Saldarelli (1989) specifically addressed the cross-cultural differentiation in the social schemata of bodily changes in emotion that were evidenced by Rimé & al.(1990). Four countries, Belgium, Bolivia, Italy, and U.S.A. were investigated in such a manner that Northern and Southern cultures of the American and European continents would be represented. In each country, about 60 male and female university students were recruited on campus and volunteered to participate individually in the study. They were instructed that the study was concerned with the bodily sensations typically occurring during specific emotion. The investigator explained that he would state, one at a time, a series of 10 bodily sensations likely to occur during an emotion. The subjects were asked to checkmark on a four-point scales the typical intensity of each of these sensations for a specific emotion. After each sensation, a delay of about 1 second allowed subjects to write their answer on the sheet (this procedure is similar to the one described in Rimé et al., 1990). According to the condition to which they were assigned, subjects had to answer for the emotion of joy, anger, fear, or sadness.

Multivariate analysis of variance revealed that each emotion was characterized by a specific pattern of bodily sensations. These emotional profiles, however, were significantly modified by each culture. These aspects of the results are illustrated in Figure 1 that display the profiles of joy and anger in the 4 cultures. Globally, it appeared that Italian subjects tended to report less throat and breathing symptoms in anger, and more muscular relaxation in sadness, especially when compared to Northern American subjects. Also Northern American subjects tended to report more temperature increase than other nations in joy, anger, and fear. Yet, although statistically highly significant, these cultural differences only account for 6% of the bodily sensations variance. In contrast, the trans-cultural similarities in the patterns accounted for by emotion itself account for 27% of the variance. Thus, it seems that there are more similarities than differences across cultures in the patterns of bodily sensations associated with emotion. These findings are in line with those reported by Scherer and Wallbott (submitted).

Still, this research had some limitations with respect to its likelihood of evidencing cross-cultural differences in bodily sensations associated to emotions. One could argue that the four countries investigated, although geographically distant, still share many cultural commonalities. For instance, three of them use a Latin language. Moreover, Hupka et al.'s (1992) argument that limiting the number of bodily sensations to 10 might undermine the possibility of finding cross-cultural variations, should be taken into consideration.

To maximize the chance of finding sizable cultural variations, Philippot, Poortinga and Ambadar (in preparation) initiated a new project which included "social" emotions, such as

shame and guilt. It also focused on two markedly different cultures: Belgium and Indonesia. A total of eight emotions--joy, anger, fear, sadness, disgust, surprise, guilt, and shame--were compared between the two cultures. A more extensive bodily sensation questionnaire, jointly designed by the European and Indonesian researchers, has been created. In addition, to reduce method variance due to translation problems, emotions were indicated to the subjects by a short vignette describing a typical situation in addition to the emotion label. For example, for sadness, subjects were asked to report the intensity of the bodily sensations they would feel if they were sad because somebody they really loved were to be dead. Pretest studies ascertained that the vignettes evoked the target emotions with similar intensities in both cultures.

The data analysis yielded essentially the same results as the ones observed in the preceding study. Specifically, although statistically significant cultural variations were observed in the bodily sensations patterns attributed to each emotion, these differences only accounted for 8% of the variance. And again, the variance specifically accounted for by emotion was much greater: 32%. The analysis of the results also showed that some emotions, including the social emotions (joy, guilt, shame, and disgust), yield more cultural variations than the others (anger, fear, sadness, and surprise). Similarly, certain bodily sensations, such as temperature and respiratory changes or muscular sensations, are marked by more cultural variations than others.

Taken as whole, the results of these two studies suggest that, if the cross-cultural variations in the patterns of bodily sensations associated with emotion appears to be statistically significant, the cross-cultural similarities of these patterns are much more important. Still, these studies all suffer the same weakness: they addressed college students populations. One could argue that even if they belong to quite different cultures, students populations share more in common than the lay-persons of these different cultures would. Before drawing any definitive conclusion in this domain, non-college students, rural populations should be compared in markedly different cultures. Nevertheless, if the cultural background would be decisive in determining people's perception of their bodily sensations, school education would not be likely to dampen it to an extreme degree.

What are the possible origins for the social schemata ?

In this chapter, we have seen that, in laboratory as well as in field studies, the report of bodily sensations seem to be theory-driven rather than data-driven. This is, people seems to interpret and label their physiological condition from a priori representations, that we labelled social schemata, rather than from the sensory feedback of their actual physiological changes.

These evidences suggest that social schemata bare little relation with the physiological reality. Our first interpretation of this set of findings has been that social schemata could be thought of as social constructions whose function would be to give a plausible explanation to diffuse sensations of arousal.

If social schemata are indeed mere social constructions, one should expect cross-cultural variations in the schemata and, hence, in the bodily sensations reported during emotion. Yet, the cross-cultural data presented in this chapter suggest that social schemata are relatively similar across cultures. These results should be interpreted cautiously, though, given the limited set of cultures investigated, and the fact that these studies addressed only college students populations. Still, would social factors be determining, greater effects of culture should have been observed, even with these methodological limitations. These results are indeed quite paradoxical given the previous evidence that demonstrated the lack of correspondance between actual and reported arousal.

Quite evidently, the answer to this paradoxe is likely to be found in the origin of the social schemata. In other words, what are the possible, cross-culturally common, bases for the social schemata? We have proposed three possible origins for the social schemata (Philipot, 1992). It is to be noted that these three possibilites are not exclusive of one another.

One possibility is that people would accurately perceive their physiological changes during extremely intense emotional experiences. Such experiences might produce very salient physiological responses that would be easier to perceive. Prototypical schemata would then be constituted by extracting the changes that are common to several instances of a given emotion. For instance, if I can feel my heart pounding each time I am angry, I will construct a schema of anger that includes heart changes. It is to be noted that this position implies that emotions, at least when they are sufficiently intense, are differentiated at the physiological level, in the same way across cultures. As we have seen, this question is still to be investigated and surely constitutes a promising field of cross-cultural research.

A second possibility is that people could derive their social schemata from their experience of physiological changes in non-emotional states. For instance, strenuous exercise produces marked changes at the physiological level. It might be that most of these changes can be accurately perceived because of their intensity and because people's attention is generally focussed on their body when they are exercizing. People could then associate these physiological changes to emotions yielding similar body activity, or action tendencies (Frijda, 1986). More specifically, people could have an accurate perception of their physiological state as they are running. If they associate fear with "running away", they might constitute their schemata of fear on the basis of the bodily sensations they feel as they are running.

Finally, a third possibility is that social schemata would be based upon semantic similarities between concepts of emotions and of bodily sensations. For instance, the concept of "warmth" is semantically characterized as rather positive and mildly active in a way similar to the concept of "joy". If semantic proximity acts as a determining factor in bodily sensation report, the sensation of feeling warm should be more likely reported for joy than for, for instance, sadness, which being connoted as negative and passive is semantically distant from "warmth". One of our study (Philippot, 1989) has shown that semantic distance could predict to the bodily sensation patterns associated with specific emotions. In this perspective, the social schemata would reflect the basic semantic architecture of the mind rather than the actual physiology of emotion. As some basic aspects of the semantic structure are universal (Osgood, 1964), semantic judgment about emotion or bodily sensations should be equivalent in different cultures. This would explain the absence of sizable cultural difference in the social schemata defining bodily sensations in emotion.

A variant of this third possibility is that schematic bodily sensations would be derived from metaphors and symbols related to emotion. For instance, if anger is metaphorically described as a "boiling pot ready to explode" (Kovecses & Averill, 1984; Lakoff & Kovecses, 1983), feeling hot, muscles tensions, and perspiration may be associated to this emotion on the sole basis of symbolic meaning carried by these concepts.

Obviously, this field of research looks very promising and many investigations are needed before giving a more definitive answer about the origin of the social schemata. Our present position is that, most likely, several sources are contributing to the elaboration of the bodily sensation schemata. The metaphores of emotions, and of physiological changes, as well as the semantic connotations they carry are likely to influence the constitution of these schematic representations. But it is also quite likely that people's direct or vicariant observation of their physiological changes during extreme physiological arousal, whether emotional or not, can impact on, or modify, the bodily sensations schemata. In addition, people social sharing of their emotional experiences, as evidenced by Rimé, Philippot, Boca, and Mesquita (1992), is likely to contribute to the construction of the representation of emotion physiology and to their social uniformity and conformity.

#### Implications for somatization processes

In sum, we propose that, in most instances, reported bodily sensations are determined by theory-driven processes based on psychophysiological schemata. A possible exception to this general rule is contituted by instances of extremely intense physiological responses in

which data-driven process might become prevalent. The origin(s) of the psychophysiological schemata is (are) still to be determined. Most likely, several sources are contributing to their elaboration, such as the symbolic and metaphorical connotations of the state experienced and its associated physiological changes, experiences of extreme physiological arousal, and social sharing of personal experiences.



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### Figure Captions

Figure 1.

Cross-cultural comparison of the patterns of bodily sensations in joy and anger.