

# Psychophysiological Comparison Theory: On The Experience, Description, and Assessment of Signs and Symptoms

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(Received July 7th, 1988)

(Accepted November 21st, 1988)

A model is outlined to distinguish between the appraisal of signs and symptoms, and between cognitive and social sources of distortion in patients' descriptions of symptoms. The model is also extended to address the problem of calibrating symptom descriptions within and across individuals. Specifically, a formulation is specified to minimize distortions in symptom reports attributable to variable symptom perspectives and to social biases. We conclude by discussing the implications of the model for improving history-taking activities in order to obtain more accurate interpretations of patient reports of symptoms.

*Key words:* patient decision-making; symptoms; signs; history-taking; social norms; attribution; cognitive models of disease.

## Introduction

Medical models traditionally provide a framework for understanding the disease process in terms of etiology, diagnosis, prognosis, and amenability to treatment. However, maladaptive patient behaviors (e.g. patient delay, non-compliance) are emerging as a new challenge for medical and behavioral scientists, and this has resulted in increased interest in the processes underlying patient decision-making. Recent analyses have focused on the role of patients' implicit models of illness, with the starting point being the detection of some manifestation of a disease: individuals who detect an unexplained change in bodily sensation or function are assumed to compare this change with those believed to be associated with an illness [1–4], or with the experiences of other people [5], to achieve some understanding of its significance. People's mental representations of symptoms and disease are depicted in these models as highly idiosyncratic [6], influential in governing a

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person's emotional and behavioral reactions to symptoms [7-12], and important predictors of patient compliance with treatment [13,14].

Manifestations of disease are not as homogenous as is often assumed in these analyses, however. First, symptoms are often assumed to be perceived as neutral and possibly general changes in arousal, whereas manifestations of disease can be negative and quite specific [15]. Second, an important distinction made in applied pathologic physiology is that between signs and symptoms: "Strictly speaking, symptoms are subjective, apparent only to the affected person. Signs are detectable by another person and sometimes by the patient himself" [16, p. 1]. Although some bodily changes, given current technologies, have components that can be classified both as symptoms and as signs (e.g. fever), many serve only as a symptom (e.g. pain) or only as a sign (e.g. elevated blood pressure).

Although the existing research on illness prototypes indicates that the activation of a prototype can guide both patients' and physicians' search for signs and symptoms, MacBryde and Blacklow's [16] distinction suggests that symptom reports can represent a special problem for patient and physician appraisal and decision-making because, unlike a sign, the underlying symptom experience is unavailable for public scrutiny or verification. Our purpose in this paper is to extend our earlier formulation of the cognitive processes underlying patient delay [8]. We begin by reviewing briefly the cognitive and social processes posited to be involved in the appraisal of signs and symptoms, and we outline a means of conceptualizing and assessing a major determinant of illness appraisals -- the symptom experience.

### **Psychophysiological comparison theory**

According to psychophysiological comparison theory (PCT), individuals are motivated, by biological disposition and by social learning, to maintain an explicable physiological condition [8,15]. The detection of unexplained signs and symptoms, therefore, can mobilize individuals to evaluate their physiological condition. The strength of this motivation is posited to be a function of factors such as the salience, personal relevance, and perceived consequences (e.g. probability of occurrence, severity, potential restriction of freedom) of these unexplained signs and symptoms. In addition, the extent to which an individual's limited cognitive resources are then devoted to the appraisal process is posited to be proportional to the strength of this motive, relative to all extant motivational states, competing for these limited cognitive resources.

Central to the evaluation of signs/symptoms are cognitive structures composed of data an individual has about bodily changes and physiological conditions. We have termed these cognitive structures psychophysiological schemata to emphasize: (a) their inclusion of facts and beliefs about the physiological consequences of (i) normal physiological conditions (e.g. menopause), (ii) transiently disruptive conditions (e.g. fatigue), and (iii) disease (e.g. cancer); and (b) their role in an active process of symptom perception wherein (i) expectations created by the information in memory lead to attentional focus, selective monitoring, and confirmatory biases in perception, and (ii) the incoming symp-

toms and signs alter the contents and organization of these cognitive structures and, hence, subsequent perceptions and categorizations of signs and symptoms.

Moreover, psychophysiological schemata are viewed as being specifiable but often complex because they are shaped and modified by a wide variety of experiences over the course of an individual's life. Observational learning (e.g. one's father may have had hypertension and, thus, one may have developed beliefs regarding the symptomatology of the "silent killer"), direct experience (e.g. one's previous illnesses/conditions may form strong bonds between specific symptoms and diseases), and reading or instruction can all contribute to the development or modification of these cognitive structures. Once a schema is created, information in the schema can be primed or activated predictably by external (e.g. time of day or month) or internal (e.g. symptoms) stimuli. Implicit models of illness can therefore be subsumed under this more general framework of patient thought and decision-making about bodily events.

#### *Cognitive structure and psychophysiological comparison processes*

As in memory generally, the activation of a sign or symptom can affect the likelihood of activating other pieces of information in long-term memory, depending on the structure in which these data are stored. Fundamental to psychophysiological schemata are that: (a) a central piece of information in each schema is a physiological condition, or tag, that constitutes a plausible cause for various signs and/or symptoms (e.g. a disease label), and (b) there are sign-tag and/or symptom-tag bonds that vary in strength (i.e. connectivity) and specificity.

If two pieces of information are simply linked, then the activation of one (e.g. bumps across the face and body) can increase the likelihood of the activation of the other (e.g. measles prototype). More complex linkages between pieces of information are probably more prevalent such that the activation of one (e.g. discharge of blood) leads to the partial activation of two or more associated conditions (e.g. menstruation, cancer), or to the activation of a particular physiological condition (e.g. menstruation) only in the presence of another moderator variable (e.g. time of month). In each case, however, the activation of a potential physiological condition as an explanation for a sign or symptom rests on the implicit comparison of the latter events with representations of these signs and symptoms in long-term memory, and the associative bonds between these representations and tags in psychophysiological schemata. More specifically, let  $N$  denote the number of stimulating events that access a representation in memory (e.g. signs, symptoms, external stimuli) at a given point in time,  $\text{tag}_j$  represent a particular physiological condition linked to one or more of these stimuli,  $a_i$  the strength of the excitatory or inhibitory activation of the bond between the  $i$ th stimulus and the  $j$ th tag, and  $c_i$  the weighting of the connection between the  $i$ th stimulus (e.g. symptom) and the  $j$ th tag. The probability that the activation of a particular tag (e.g. disease label) exceeds threshold can be simply expressed as follows:

$$P(\text{tag}_j) \propto \sum_{i=1}^N a_i \times c_i \quad (1)$$

We have termed this component of the categorization process the psychophysiological comparison stage to underscore the reciprocal influence between the incoming information from interoceptors, proprioceptors, and exteroceptors and one's prior knowledge relating this sensory information to physiological functions and conditions [8,15].

As can be seen from inspecting Eqn. (1), the outcome of these comparisons are influenced by factors such as the number and strength of the sign-tag or symptom-tag bonds and environmental and contextual information that might prime (i.e. partially activate or make more accessible) one or more particular accounts. To illustrate, consider a 45-year-old woman who experiences an episode of irregular vaginal bleeding. If she considers her age, the health experiences of her peers, and a recent article in *Women's Day*, each of which is linked associatively to the physiological condition of "menopause", then the resulting activation of memory may be sufficient to assess menopause as the likely cause of the vaginal bleeding. However, another woman with the same sign may activate two potential physiological explanations — "menopause" for the same reasons as above, and "cancer" because of her exposure to educational materials circulated by the American Cancer Society that links irregular bleeding to cancer. Once one or more potentially plausible explanations for the signs/symptoms have been activated, efforts by the individual to confirm some or eliminate others become a part of the appraisal process.

Note, too, that the precision of a person's appraisal of a sign or symptom can vary dramatically and predictably: the more nondescript the sign or symptom, the greater the number of potential matches in long-term memory and the greater tends to be the likelihood of making errors when linking these bodily events to a particular physiological condition. This is due to the fact that as the specificity of the sign or symptom decreases, the number of tags to which this sign or symptom is connected increases, and activation of these connections contributes to the activation of multiple tags in memory. Feelings of general fatigue, for instance, can be explained in more ways than can fatigue in a specific muscle group, just as feelings of neutral and diffuse arousal evoke a wider spectrum of potential explanations than feelings of tension and irritability [17,18].

Finally, an individual may detect a sign/symptom but not have a prior explanation for it nor possess any psychophysiological schema that harbors a plausible account for it, that is, the activation of no tag exceeds threshold. A familiar example of this is the emergence of a new allergic reaction in a patient. Since the physiological reaction to the allergen, by definition, is atypical in the population and initially for the patient, the connections between the bodily reaction and physiological condition are weak or non-existent. In such instances, the appraisal process is posited to move along two fronts: (a) the most activated schema directs the individual's attention to and detection of confirmatory signs/symptoms (e.g. selective monitoring and confirmatory biases in hypothesis testing; suggestion effects), and (b) the individual's psychophysiological schemata would become more differentiated and complex in structure. Examples of the latter include the alterations in knowledge

structure that encode the facts that skin contact with certain ivys of the genus *Rhus* evoke itching and inflammatory allergic reactions; the use of sulfanilamide to combat infection can cause sores and swelling in susceptible individuals; menopause is not simply a physiological characteristic of women, but it is more common in women during their mid-40s. Again, a reciprocal influence between a patient's incoming signs/symptoms and prior knowledge structures is the rule.

To summarize, signs and symptoms trigger and guide the appraisal process, and thereby shape psychophysiological schemata and behavior. The appraisal of signs or symptoms can therefore be characterized by iterations of hypothesis generation (i.e. schema activation), hypothesis testing, and error correction. Unlike the scientific method, however, these processes are biased toward analogical reasoning and toward suppressing the fragility of one's personal control and mortality [8,19].

For instance, Cacioppo et al. [8] found that although the similarity between symptoms and a disease prototype increases the likelihood that the person will infer the presence of the disease given the symptom (logical consistency principle), equally plausible but less threatening accounts are embraced more quickly (hedonic consistency principle). In an illustrative finding in our study of newly diagnosed patients with gynecologic cancer, the hypothesis of "menopause" as opposed to the hypothesis of "cancer" was embraced more readily and was associated with reports of lower motivation to continue searching for an explanation for the first signs/symptoms of their cancer. Only after additional data (e.g. worsening of the signs or symptoms) began to call this less threatening hypothesis into question did innocuous explanations begin to become less prevalent and cancer as a possible explanation increase in prevalence [see, also, 20,21].

It should be recognized that an important boundary condition in this model is its focus on private rather than public beliefs and presentations. Patients can and do seek to gain secondary reinforcers through public presentations of dire circumstances or illness interpretations. The individual who extols on the likely dire significance of a newly detected symptom, for instance, cannot be assumed to do so simply through personal conviction in this interpretation; there are important social rewards to be garnered by this behavior, as well [5].

Finally, although signs and symptoms have not been distinguished in the extant models of illness appraisal, subtle differences in an individual's appraisal of a sign versus a symptom can be expected given differences in the social and cognitive forces operating on each. We turn to this task next.

### **Distinctions between signs and symptoms**

A physiological sign is defined in terms of an objective, physical referent (e.g. lump, fracture, temperature), whereas a symptom is defined in terms of a subjective experience (e.g. nausea, pain, fatigue). The physical referent for and public nature of signs place reality constraints on their description and appraisal, which are weaker or absent in the case of symptoms. Symptoms, therefore, tend to be more difficult to communicate accurately and are more

likely to be misrepresented. There is also more room for self-doubt, and for suspicion by others of malingering, when dealing with physiological symptoms rather than signs. Hence, although defensiveness, denial, wishful thinking, and rationalizations are posited to occur in response to both signs and symptoms, all else constant, these information processing biases tend to be more prevalent and have a greater behavioral effect in the case of symptoms than signs.

Furthermore, although some bodily reactions, such as a fever, can serve both as signs and symptoms, the symptomatic component of these reactions still constitutes a private experience that can be shared with others only indirectly through some form of abstract representation (e.g. language, expressions of distress or emotion, metaphor, multimodal matching). The symptoms of two individuals with a temperature of 100°F, for instance, can differ with one individual feeling more feverish than another, just as two individuals who have undergone similar surgeries (and tissue damage) can experience quite different levels of postsurgical pain. Physiological signs, therefore, do not constitute entirely satisfactory standards against which to judge symptoms [22].

Analyses of the relationship between symptoms and illness appraisal, patient delay, disease manifestation, treatment efficacy, and patient compliance are all made less sensitive by the possible distortions in symptom experience that can occur when translating this experience into a symptom report (e.g. intensity ratings of nausea). Two individuals may describe their symptoms in an identical manner even though they have very different symptom experiences, or they may describe their symptoms in very different terms despite having similar symptom experiences. Indeed, the same individual may describe the same symptom differently on two separate occasions — even when both descriptions are tendered in good faith. This is due in part to the fact that, in the absence of a physical referent, the perspective upon which people draw when translating their symptom experiences to symptom reports can vary dramatically across individuals, and within individuals across time and situations.

### **Cognitive and social distortions of symptom reports**

#### *Variable symptom perspectives*

The concept of the patient's perspective when translating a symptom experience to a symptom report refers to the range of symptom experiences or ideas of which a patient thinks. This range of symptom experiences is bounded at one end by the ideas or experiences of which the patient thinks when considering how the symptom would feel if it were maximally intense, and bounded at the other end by the ideas or experiences of which the patient thinks when considering how the symptom would feel if it were minimally intense or absent. The ideas and associations constitute endpoints, or the upper and lower anchors, of the individual's symptom perspective at that given point in time.

To illustrate, the sensations described as "very cold" by a southerner may not be the same as those described as "very cold" by a northerner even when the effects of sensory adaptation are controlled. Similarly, the symptom

experience meant by the term "cold" during the summer may not be the same as is meant by this term during the winter even though the same individual may be rating how cold it feels on both occasions [23,24]. These distortions in the translation between symptom experience and symptom report is not due to impression management or evaluation apprehension, but rather is cognitive in origin: they are attributable to variations in the frame of reference, or perspective, that the individual accesses when translating the symptom experience into a symptom report.

*Variable symptom perspectives, not unreliable symptomatologies*

Importantly, the variability in symptom reports within and across individuals can create the illusion that symptoms are inherently unreliable. Even reference to normative data on symptom ratings (e.g. intensity), which may work at the aggregate level, can create the impression that symptomatologies possess low reliability at the individual level due to the variability in perspectives between individuals at a given moment in time, or within individuals across time. Health professionals may therefore be inclined either to discount symptom reports, or to use symptom reports only to guide their search for objective signs.

The difficulties of symptom assessment and interpretation may appear to justify a discounting of symptom reports in the absence of confirmatory physiological signs, but there are at least three reasons to pursue the meaning of symptom reports per se. First, patient decisions — ranging from those regarding the need to seek medical treatment to those regarding compliance with treatments — are influenced by the detection and interpretation of symptoms [11,25]. Second, there are some disorders for which symptom reports are the earliest, if not the primary, data upon which medical recommendations must be based (e.g. migraine headaches, chronic back pain). Early diagnosis and treatment could be advanced, therefore, if the distortion of symptom experiences inherent in symptom descriptions could be discerned during history taking and symptom assessment.

Third, patient-physician communication may benefit from an unraveling of the meaning of symptom reports. For instance, even though a physician's references to symptoms during patient counseling may have a medical basis, the patient's translation of these references into a personal symptom experience that he or she can monitor may be distorted due to differences in symptom perspectives held by the physician and the patient. Thus, a physician's instruction to the patient to seek further treatment if a particular intensity of a symptom is felt (e.g. pain, ringing in ears) is subject to the same miscommunications as are the patient's descriptions of symptoms to the physician. Untangling the morass of symptom experience and symptom report, therefore, may enrich our understanding of a major category of determinants of psychophysiological comparison processes, patient decision-making, patient delay, and patient-physician communication, as well as improve the comparability of symptom reports and their utility in the diagnosis and treatment of disease.

In sum, cognitive and social forces such as variable symptom perspectives

can distort the presentation of symptoms, and this can leave the impression that symptoms are essentially unreliable and, therefore, invalid unless supported by parallel evidence from physiological signs. In the following section, we adapt and extend Ostrom and Upshaw's [26] variable perspective theory of attitudes and Fishbein and Ajzen's [27] theory of reasoned action, which were developed to address cognitive and social biases in the expressions and manifestations of social attitudes, to address these issues in the study of symptoms.

*Symptom reports corrected for variable symptom perspectives*

Previous analyses and measures of symptoms have either failed to distinguish between a person's experience of a symptom and the language the person uses to describe the intensity of the symptom, or they have assumed perfect correspondence between the symptom experience and the symptom report [28]. Variable perspective theory [26], however, can be adapted to the study of symptoms to suggest that an individual's perspective — anchored by the most extreme and least extreme symptom experiences activated when translating the symptom experience into a symptom rating — mediates the relationship between the symptom experience and symptom report. Let  $SE$  denote the intensity of the symptom experience,  $SR$  the intensity of the symptom report,  $L$  the intensity of the least extreme occurrence of the symptom that the individual thinks of at the time of reporting (i.e. the individual's interpretation of what the meaning is for the lowest endpoint on the rating scale, or the "lower anchor" of the perspective), and  $U$  the intensity of the most extreme occurrence of the symptom that the individual thinks of at the time of reporting (i.e. the interpretation of the upper endpoint on the rating scale, or the "upper anchor"). Given that there is a symptom experience to report, the relationship between symptom experience and symptom description can be expressed as follows

$$SR \propto \left[ \frac{SE - L}{U - L} \right] \quad (2)$$

Equation (2) clearly explicates three predictable sources of variance in symptom descriptions: (a) the symptom experience, which is the primary interest; (b) the lower anchor of the symptom perspective; and (c) the upper anchor of this perspective. Thus, changes in symptom reports can result from either a change in the underlying symptom experience and/or by a change in the patient's perspective on the symptom. To illustrate, Eqn. (2) suggests that an individual who complains of chronic back pain may describe his or her pain as being less extreme following major surgery either because the underlying cause was partially alleviated or because the specific pain of major surgery elevated the patient's upper anchor for pain. A change in symptom report due to the former represents a direct effect on symptom experience and, hence, would be expected to endure if the surgery was effective. A change due to the latter does not constitute any change in symptom experience, however, and therefore would not endure; with the passage of time, the memory of the pain following major surgery can be expected to fade, and with this fading the initial perspec-

tive and symptom description (i.e. complaints of chronic pain) can be expected to return approximately to presurgery levels.

The resulting variability in symptom report over time is not due to an inherent unreliability of symptom experiences, but rather is the result of either failing to distinguish between a person's experience of a symptom and the language the person uses to describe the symptom, or assuming perfect correspondence between the symptom experience and the symptom report. Determining whether the postsurgical report of pain-relief is due to a change in symptom experience or symptom perspective is important, however, in order to evaluate the efficacy of the surgery, to formulate post-surgical recommendations, and to interpret any subsequent "relapse."

An additional modification to Eqn. (2) may be helpful in correcting symptom reports for variable symptom perspectives. Briefly, inspection of Eqn. (2) reveals that the relationship between the intensity of the symptom report and symptom experience is assumed to be linear across the rating dimension or scale. This relationship can be specified more generally by rewriting Eqn. (2) as follows:

$$SR \propto \left[ \frac{SE - L}{U - L} \right]^k \quad (3)$$

If the translation of symptom experience to symptom rating is linear, then  $k = 1$ , and Eqn. (3) reduces to Eqn. (2). Most rating scales used in symptom assessments have ordinal rather than interval properties; however, and it is conceivable that symptom ratings do not vary linearly across the full range of symptom experiences. Equation (3) provides a means of mapping symptom reports into symptom experiences to accommodate such nuances. Briefly, if the intensity of a symptom report increases but reaches a magnitude as the intensity of the symptom experience approaches  $U$ , then  $k < 1$ . This would be the case if it initially took relatively small changes in the intensity of a symptom to lead to significant changes in reports, but larger and larger differences in the experience of the symptom were required to obtain changes in the language used to report the intensity of the symptom as the intensity of the symptom increased across the range of the individual's perspective. Such functions are perhaps particularly likely when there is a rich language for expressing weak, but not strong, intensities of a symptom. Alternatively, the relationship between the intensity of symptom reports and symptom experience could potentially be best represented as a positively accelerating function for some symptoms; in such cases,  $k > 1$ .

#### *Symptom reports corrected for social norms and self-presentation*

Equations (2) and (3) focus exclusively on the effects of variable perspectives on symptom reports. Symptom reports vary also as a function of the individual's beliefs about the social rewards and punishments to be gained in a partic-

ular situation [12,17]. To consider these social forces, Eqn. (3) can be elaborated as follows

$$SR \propto \left\{ \left[ \frac{SE - L}{U - L} \right]^k + \left[ \sum_{i=1}^N (NB)_i \times (MC)_i \right] \right\} \quad (4)$$

where  $NB_i$  (normative beliefs) represents a person's  $N$  expectations that particular reference groups or individuals (e.g. physicians, health professionals, family) reinforce particular symptom reports; and  $MC_i$  represents the person's motivation to comply with each referent group or individual. Normative beliefs are expressed in units of proportion of the rating scale and can take on positive or negative values (e.g. as when the normative pressure is to exaggerate or attenuate the intensity of the symptoms reported). Thus, the first component of Eqn. (4) indicates that the individual's perspective affects the translation of the symptom experience to a symptom report, and the second component of Eqn. (4) — the sum of the products of normative beliefs and motivation to comply — indicates how this self report can be distorted due to the extant secondary rewards from the physician, health staff, and significant others.

To illustrate Eqn. (4) applied to the study of sex differences suggests at least four sources of variance in symptom reports: (a) the symptom experience (e.g. due to differences in physiological endurance, pain tolerance), (b) the thoughts and ideas that are accessed when thinking about the endpoints on the symptom rating scale (i.e. the perspective), (c) the accessibility or importance of specific social norms or roles (e.g. masculinity and stoicism), and (d) the structure of social rewards in the context (e.g. evaluation apprehension, self-presentational motives, social norms). Finally, note that the influence of these social forces is negligible if: (a) the normative beliefs are negligible, (b) they coincide with the symptom experience, or (c) the motivation to comply is negligible.

### Implications for history taking activities and symptom assessment

#### *Assessment instruments*

Potential problems in contemporary history taking and symptom assessment (e.g. symptom inventories, intake interviews), and possible means for gauging symptom experiences within and across individuals, are suggested by Eqns. (2)–(4). First, assessments of the following forms are common (cf. 28): (a) "How much nausea do you feel now?"; (b) "Are you feeling mild, moderate, or severe nausea?"; (c) "Adjust the volume of this audio amplifier to match the intensity of your nausea"; (d) "Right now, at this moment, I am experiencing nausea" (0 = not at all, 10 = very much); and (e) "Mark on this line how much nausea you now feel" (mild to extreme). These questions, expressed in the past tense (e.g. "How much nausea have you been feeling during the past week?") are common in history taking assessments. As is evident from Eqns. (2) and (3), however, the underlying symptom experience can be masked by differences in what symptom experiences the patient associates with the endpoints of these rating scales.

The present analysis suggests that the symptom experience might be better quantified by expressing the symptom report as a function of the width of the perspective the individual accessed when translating this feeling into a rating, or by wording questions about symptom experiences to capitalize on specific and consensually held referents for the lower and upper anchors of the perspective to be used. For example, the preceding questions might be revised accordingly: (a) "Rate to what extent you feel nausea" (0 = not at all, 10 = very much), and describe your thoughts about what level of nausea corresponds to each endpoint on the scale"; (b) "How frequently have you felt nausea during the past three days?"; or (c) "If 0 is the feeling of no nausea whatsoever and 10 is just sufficient nausea to induce vomiting, rate the extent to which you feel nausea at this moment". Corresponding forms of (a) and (c), expressed in the past tense with an explicit time specified, might also prove useful in history taking activities.

### *Caveats*

Questions of the form "Rate to what extent you feel nausea" require that patients indicate not only the intensity of their symptom experience on a rating scale, but also what symptom experiences they associate with the endpoints of this rating scale. To quantify these verbal descriptions, and hence to interpret the individual's symptom rating, requires the construction of (or, when available, reference to) a normative dataset of symptom descriptions. Although somewhat cumbersome and unreliable when applied to a single symptom description, technical procedures exist for identifying consensually understood terms and labels [e.g. see 29,30].

Questions of the form "How frequently have you felt nausea during the past three days?" are the simplest and attenuate distortions due to variable perspectives. This is because, by asking patients only to make presence/absence judgments, the more variable upper-anchor of individuals' perspective is rendered irrelevant. Distortions can nevertheless plague symptom assessments, including inaccurate recall of symptom experiences and criterion-response biases (e.g. differences in certainty required before one acknowledges the presence of a symptom experience). This form of assessment also fails to distinguish between mild and intense symptom experiences, resulting in a person who has frequent but weak symptoms being viewed as more symptomatic than a person who has slightly less frequent but much more intense symptoms.

Assessments of the form "If 0 is the feeling of no nausea whatsoever and 10 is just sufficient nausea to induce vomiting, rate the extent to which you feel nausea at this moment" can attenuate distortions due to variable perspectives when endpoints are identified that have a clear and consensual meaning. Two caveats apply to this form of question, too. Early research on the effects of experimenter-provided scale-endpoints on judgments revealed that these endpoints could themselves introduce rating distortions if one or more endpoints differed dramatically from the range of stimuli to be judged [31, pp. 249–250]. More recently, research has shown that ratings on scales with extreme endpoints (relative to the range of stimuli being judged) compress the ratings [32–34]. To minimize rating distortions, therefore, it is suggested that

the symptom scale-endpoints that be specified to reflect as closely as possible the range of the intensities of the symptom experiences that are of interest.

#### *Dealing with social biases and social change*

Equation (4) further suggests that prior social leaning and the social rewards to be obtained in a particular situation can distort symptom reports, only part of which are attenuated by attention to variations in symptom perspectives. Perhaps the most important tact that can be taken to minimize this form of bias is to establish an honest, non-evaluative, and reassuring rapport with the patient. Securing symptom reports in an anonymous fashion (e.g. using computers), or acknowledging the potential influence of these biases and appealing for accurate reports of the symptom experiences in the context of a supportive environment, can also help attenuate distortions due to the extant social rewards [29,30].

Several additional implications regarding patient-physician communications might be noted. The symptom experience described by the patient is based on a within-subjects comparison; that is, it is made in the context of the individual's personal symptom history. As our society becomes more mobile, the practice of medicine more specialized, and specialists replace family physicians, health care professionals are less and less familiar with the specific symptom histories of individual patients. The natural tendency, therefore, is to interpret the patient's symptom report in terms of reports from other patients; that is, the symptom interpretation by the physician is based on between-subjects comparisons. This can lead predictably to a distortion in the symptom experience and, hence, to communications and decision-making that do not represent accurately the available evidence. Although this particular problem can exist when interpreting signs (e.g. a heart rate of 40 beats/min) as well as symptoms [cf. 35], the symptom reports have been simpler to discount as being unreliable. Careful history taking to determine an individual patient's symptom history and perspective is, therefore, especially important if health care professionals are to avoid some of the pitfalls of between-subjects comparisons.

Finally, patient education and counseling may involve instructions on symptom monitoring, especially as patients become important partners in the treatment of a wide variety of chronic disorders (e.g. diabetes, pain management). As we have noted, counseling about the symptoms to be monitored is subject to the same distortions as those plaguing symptom assessment. Hence, the contingencies for patient action may be clarified by recognizing the distinctions between symptom descriptions and symptom experiences, understanding the role of symptom perspectives and social forces in the translation of symptom experiences to symptom descriptions, and adopting procedures that minimize variations in these cognitive and social frames of reference.

#### **Acknowledgement**

The present research was supported by National Science Foundation Grant No. BNS-8414853.

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