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Self-Complexity as a Cognitive Buffer Against Stress-Related Illness and Depression

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This prospective study tested the self-complexity buffering hypothesis that greater self-complexity moderates the adverse impact of stress on depression and illness. This hypothesis follows from a model that assumes self-knowledge is represented in terms of multiple self-aspects. As defined in this model, greater self-complexity involves representing the self in terms of a greater number of cognitive self-aspects and maintaining greater distinctions among self-aspects. Subjects completed measures of stressful events, self-complexity, depression, and illness in two sessions separated by 2 weeks. A multiple regression analysis used depression and illness at Time 2 as outcomes, stressful life events and self-complexity at Time 1 as predictors, and depression and illness at Time 1 as control variables. The Stress × Self-Complexity interaction provided strong support for the buffering hypothesis. Subjects higher in self-complexity were less prone to depression, perceived stress, physical symptoms, and occurrence of the flu and other illnesses following high levels of stressful events. These results suggest that vulnerability to stress-related depression and illness is due, in part, to differences in cognitive representations of the self.

The basic hypothesis of this article is that a complex cognitive representation of the self serves to moderate the adverse physical and mental health effects of stressful events. Both major life events (e.g., divorce, death of a spouse, job loss) and the accumulation of minor hassles are associated with physical and mental health problems (see Dohrenwend & Dohrenwend, 1978; Kanner, Coyne, Shaefer, & Lazarus, 1980; Silver & Wortman, 1980; Thoits, 1983a). But although the association between stressful events and physical or mental health problems is consistently observed, it tends to be only weak to moderate. Some people are more susceptible than others to the adverse consequences of stress. Circumstances that adversely affect some people leave others seemingly unaffected. Individual differences in reactions to stressful events have led researchers to posit factors that moderate the relation between stressful events and their adverse outcomes. The moderator most cited as a buffer against the unhealthy consequences of stress is social support (e.g., Cassel, 1976; Cobb, 1976; Cohen & Hoberman, 1983; Dean & Lin, 1977; Kaplan, Cassel, & Gore, 1977; LaRocco, House, & French, 1980). Other moderators include cognitive coping strategies (e.g., Lazarus & Launier, 1978; Pearlin & Schooler, 1978; Silver & Wortman, 1980; Taylor, 1983), locus of control (e.g., Johnson & Sarason, 1978; Lefcourt, 1981), private self-consciousness (Mullen & Suls, 1982), and hardiness (Kobasa, 1979).

There is a growing recognition that self-cognitions play a role in coping, depression, and various mental health processes (e.g., Beck, 1976; Cantor & Kihlstrom, 1986; Higgins, Klein, & Strauman, 1985; Kuiper & Derry, 1981; Linville, 1985). The model proposed in this article suggests that individual differences in vulnerability to stress are due, in part, to differences in cognitive representations of the self; more specifically, to differences in the complexity of self-representations. As I define the concept, greater self-complexity entails cognitively organizing self-knowledge in terms of a greater number of self-aspects and maintaining greater distinctions among self-aspects. The basic hypothesis is that greater self-complexity moderates the adverse impact of stressful events on physical and mental health outcomes. Thus, greater self-complexity is a protective factor for people under stress.

Consider the example of a woman going through a divorce. Assume that she has a simple self-representation with only two important self-aspects, wife and lawyer. Furthermore, assume that these two self-aspects are closely associated in memory, perhaps because her husband is also an attorney with whom she has shared many professional experiences. In this case, the negative affect and self-appraisal associated with her divorce will be massive because it will spill over to affect her thoughts and feelings about both important aspects of her self. In contrast, consider a woman with a more complex self-representation that involves several important self-aspects, for example, wife, lawyer, tennis player, and friend. Furthermore, assume that the self-aspect *wife* is not closely associated in memory with other self-aspects. In this case, negative affect and self-appraisal associated with the divorce are less likely to spill over

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and adversely affect her feelings about other self-aspects. Thus, there will be three unaffected self-aspects to buffer against negative feelings associated with the divorce.

When self-aspects are few and undifferentiated, a stressful event in one aspect tends to spill over and color thoughts and feelings about other aspects. For people who maintain more aspects and perceive greater distinctions among self-aspects, the impact of a negative event is likely to be confined to a smaller proportion of their self-representation. Thus, they are more likely to maintain positive thoughts and feelings about some self-aspects despite the negative impact of stress in one area. These positive thoughts and feelings about other self-aspects may act as buffers against the negative thoughts and feelings that result from stressful events. The greater the proportion of unaffected self-aspects, the greater the potential buffering effect. If one assumes that negative thoughts and feelings about various self-aspects contribute to stress reactions and their physical and mental health consequences, then maintaining more distinct self-aspects should act as a buffer against these adverse consequences of stress.

The Self-Complexity Model

The prediction that greater self-complexity provides a buffer against the adverse consequences of stress is based on an extension of Linville's model of the relation between self-complexity and affective extremity. In this section, I will briefly summarize the key assumptions of this model and then discuss its implications for physical illness and depression. (For a fuller description of the model, see Linville, 1985.)

Self-Representation

The self-complexity model assumes that knowledge about the self is represented in terms of multiple cognitive structures, which are referred to here as *self-aspects.* This assumption is consistent with a variety of theories that view the self as multifaceted (e.g., Gergen, 1971; Greenwald & Pratkanis, 1984; James, 1892; Kihlstrom & Cantor, 1983; Kuiper & Derry, 1981; Markus & Nurius, 1986; Rogers, 1981; Rosenberg & Gala, 1985). For instance, a woman might think of herself in terms of various social roles (lawyer, friend, mother), kinds of relationships (colleague, competitor, nurturer), types of activities (running, playing tennis, writing), superordinate traits (hard-working, creative), goals (career success), and so forth. Each role, relationship, activity, goal, and superordinate trait in the self-representation may serve as a self-aspect, each with its own set of features, propositions, and affects. These self-aspects are assumed to be structures in a larger associative network. Not all self-aspects are activated at any given time. Rather, specific self-aspects are activated depending on such factors as the context and associated thoughts, their relation to currently activated self-aspects, and their recency and frequency of activation.

Self-representations may differ in terms of both the number of self-aspects and the degree to which distinctions are made among self-aspects. Two self-aspects are distinct to the extent to which they are represented by different cognitive elements. For instance, if each self-aspect is represented by a set of features and propositions, it is distinct to the extent that it is represented by different features or propositions. As defined in Linville's model, greater *self-complexity* involves having more self-aspects and maintaining greater distinctions among self-aspects.

The Spillover Process

Self-complexity is important because it partially determines the impact of experiences on thoughts and feelings about various self-aspects. When people experience a negative event, the self-aspect most relevant to the immediate context is activated, and negative thoughts and feelings evoked by the experience tend to become associated with the activated self-aspect. For instance, a tennis player who has just lost an important match is likely to feel dejected. These negative feelings are likely to become associated with this person's "tennis player" self-aspect, as are negative thoughts or inferences evoked by the defeat (e.g., "I performed poorly under pressure"). Likewise, experiencing a positive event triggers positive thoughts and feelings that become associated with activated self-aspects.

The model further assumes that activation spreads from the originally activated self-aspect to associated self-aspects. A self-aspect will become activated to the degree that it is related to currently activated self-aspects. Feelings and inferences associated with the originally activated self-aspect spill over and color feelings and inferences regarding associated self-aspects. For instance, if our tennis player is a courtroom lawyer by profession, her "tennis player" and "courtroom lawyer" self-aspects may be closely related because both are highly competitive and stressful activities. Thus, defeat on the tennis court may spill over to lead her to conclude, "Competition brings out the worst in me," which will make her feel worse about herself as a lawyer as well. The more related two self-aspects are, the more likely thoughts and feelings about one are to spill over to color thoughts and feelings about the other.

Because greater self-complexity involves having self-aspects that are more distinct from one another, people greater in self-complexity are likely to be less subject to such spillover effects. For those high in self-complexity, thoughts and feelings evoked by events are likely to be confined to immediately salient self-aspects. Thus, with greater self-complexity, fewer self-aspects are affected by events, and a greater number of self-aspects remain unaffected.

Self-Complexity and Affective Extremity

The self-complexity model assumes that current affect is a function of the affect associated with recently activated self-aspects. These recently activated self-aspects include not only those activated by recent events, but also those activated by the spillover process or by other cognitive processes such as recalling past experiences.

Thus, the model leads to the *self-complexity–affective extremity hypothesis:* People lower in self-complexity will experience greater swings in affect and self-appraisal in response to life events (Linville, 1985). That is, those lower in self-complexity will experience a more negative *change* in affect and self-appraisal following a negative event and a more positive *change* in affect and self-appraisal following a positive event.

Why does high self-complexity lead to less affective extremity? The greater a person's self-complexity, the smaller the proportion of self-aspects that are likely to be affected by an emotionally salient event. This is true for two reasons. First, the greater a person's self-complexity, the more self-aspects the person is likely to have. Thus, if an event directly affects only one self-aspect, this one self-aspect will be a smaller proportion of the total self-representation for a person high in self-complexity. Second, because greater self-complexity implies less spillover, the impact of emotionally salient events is less likely to spread from the immediately affected self-aspect to other self-aspects.

Why does the proportion of self-aspects affected influence affective extremity? Because emotionally salient events affect a smaller proportion of the self-aspects of those high in self-complexity, the direct impact of the event will tend to be relatively small. In addition, those high in self-complexity will tend to have a greater proportion of self-aspects that were unaffected by the event. Thus, if these unaffected self-aspects are activated by other events or cognitions, they may serve to moderate the impact of the original event.[1]

The self-complexity–affective extremity prediction has been supported in two past experiments. In the first, Linville (1985) examined reactions to success and failure in a bogus performance feedback experiment. As predicted by the self-complexity model, those lower in self-complexity showed both a greater increase in affect and self-appraisal following a success experience and a greater decrease in affect and self-appraisal following a failure experience. Thus, low self-complexity was associated with more extreme affective reactions.

The second experiment tested a related prediction. Assuming that people tend to experience both positive and negative self-relevant events over time, the self-complexity model predicts that those lower in self-complexity will experience greater mood swings over time. Their mood will go up more after positive events and down more after negative events, which results in greater mood variability over time. Linville (1985) tested this hypothesis in a mood diary study in which subjects filled out a set of mood scales each day over a 2-week period. As predicted, those lower in self-complexity displayed greater mood variability. Self-complexity was related to the variance but not to the mean of subjects' mood scores over the 2-week period. Thus subjects lower in self-complexity were not more positive or more negative in their mood, they were simply more variable.

Self-Complexity as a Buffer Against Stress-Related Illness and Depression

The goal of the current research is to extend the self-complexity model to physical and mental health consequences of stressful life events. One plausible sequence is as follows. Experiencing negative stressful events triggers negative thoughts and feelings associated with various self-aspects. These, in turn, contribute to negative affect, low self-appraisal, depression, and other stress reactions including physiological responses. These may ultimately influence physical health outcomes through neuroendocrine or immune system functioning, maladaptive health-related behaviors (e.g., smoking, alcohol and drug use, poor diet), and failure to seek medical care (see Jemmott & Locke, 1984; Krantz, Grunberg, & Baum, 1985).

For people high in self-complexity, the impact of a stressful event will tend to be confined to immediately relevant self-aspects, thus affecting a relatively small part of their self-representation and leaving many other self-aspects to serve as buffers against the stressful event. In this way, greater self-complexity moderates negative thoughts and feelings about self-aspects and, hence, the extremity of negative affect and self-appraisal. Assuming that these negative thoughts and feelings contribute to stress reactions and their physical and mental health consequences, it follows that greater self-complexity also moderates these adverse consequences of stress.

This logic leads to the *self-complexity buffering hypothesis:* Greater self-complexity moderates the adverse impact of stressful events on physical and mental health outcomes.

The study that follows tests this prediction.

Method

Overview

The self-complexity buffering hypothesis was tested in a prospective study that examined the relation between accumulated stresses and subsequent depression and illness in a college population. In Session 1, subjects completed a self-complexity task, then completed questionnaires that assessed their life events, illnesses, and physical and depressive symptoms occurring during the preceding 2 weeks. In Session 2, conducted 2 weeks later, subjects again reported on their life events, illnesses, and physical and depressive symptoms that had occurred during the preceding 2 weeks. The self-complexity model predicts that those greater in self-complexity are less prone to depression and illness following high levels of stress.

Subjects

A total of 106 undergraduates (43 men and 63 women; 58 freshmen and 48 upperclassmen) participated in this study as part of their research participation requirement.[2] Subjects were tested in small groups composed of 1 to 5 subjects.

Measures

Subjects attended two sessions, 2 weeks apart. (A 2-week time interval was chosen because the outcomes studied have short developmental periods.) At each session, they completed the following measures.

Self-complexity measure. Recall that in the present model, self-com-

[1] This is a probabilistic argument. On the average, the affect associated with unaffected self-aspects will be more moderate than that associated with self-aspects that have just been affected by emotionally salient events. For example, there is no guarantee that a person will feel good about a self-aspect unaffected by a negative event. But the more unaffected self-aspects a person has, the greater the chance that the person will have positive feelings about some of them.

[2] Three of the initial 109 subjects could not be scheduled for the second session. Because inclusion of sex as a variable did not alter any results that tested self-complexity as a buffer against depression and illness, male and female subjects were combined in the present data analyses.

plexity is conceptually defined in terms of the number and distinctiveness of self-aspects a person uses to think about himself or herself. To measure self-complexity defined in this way, I used the self-complexity sorting task developed in studies of mood variability and reactions to success and failure (Linville, 1985).

Subjects were given a packet of 33 randomly ordered index cards, 10 blank cards, and two recording sheets (each consisting of a legal-size sheet with 14 columns). Each index card contained the name of one feature and a number in the corner.[3] The features were chosen from a pretest, open-ended self-description task. They were chosen to represent a wide range of dimensions that students use to think about themselves and included both positive and negative features. The experimenter gave the following instructions aloud:

> In this study we are interested in how you describe yourself. In front of you are 33 cards and two recording sheets. I'll let you look through the cards when I finish giving the instructions. Each card contains the name of a trait or characteristic. Your task is to form groups of traits that go together, where each group of traits describes an aspect of you or your life. You may sort the traits into groups on any meaningful basis—but remember to think about yourself while doing this. Each group of traits might represent a different aspect of yourself. Form as many or as few groups as you desire. Continue forming groups until you feel that you have formed the important ones. I realize that this task could be endless, but we want only what you feel is meaningful to you. When you feel that you are straining to form more groups, it is probably a good time to stop.
>
> Each group may contain as few or as many traits as you wish. You do *not* have to use every trait, only those that you feel are descriptive of you. Also, each trait may be used in more than one group; so you may keep *reusing* traits as many times as you like. For example, you may find that you want to use the trait *relaxed* in several groups. If you wish to use a trait in more than one group, you may use one of these blank cards on your desk. Simply write the trait and its number on a blank card and then proceed to use it as you would the other cards.
>
> The sheet with the columns is your recording sheet. Use the recording sheet to indicate which traits you have put together. Each column will correspond to one of your groups. Notice the number in the corner of each card. Write only the trait's number in the column, not the name of the trait. In each column, place the numbers of the traits that form a group. A natural way to perform this task is to form one or several groups and record them, then mix up the cards and see if there are other groups that you wish to form and then record them. Repeat this procedure until you feel that you have formed the groups that are important to you. Remember to use the blank cards if you wish to use the same trait in more than one group. You have an extra recording sheet if you need it. The order in which you record the groups is not important, nor is the order of the traits within a group. We are only interested in which traits you put together. It is not necessary to label the groups unless you wish to. Do not put your name on the recording sheet. Your responses are strictly anonymous and confidential. So be as honest as you can.
>
> As you are doing the task, I'd like you to keep a few things in mind. Remember that you are describing yourself in this task, not people in general. You do *not* have to use all of the traits, and you may *reuse* a trait in several groups. Take as much time as you like on the task. Different people will finish at different times, so take as much time as you need even if others finish. Do you have any questions about the task? Now look at each of the traits and let me know if you need a clarification on the meaning of any trait. When you are finished, please turn over your recording sheet.

If subjects did not complete the task in 25 min, they were asked to do so within the next 5 min. Because some subjects tend to stop when others complete the task, no more than 5 subjects were tested at one time, and subjects were tested in individual cubicles.

In general, subjects found the self-complexity sorting task meaningful and interesting. All formed at least several groups, often reusing the same feature in several different groups. Table 1 displays the actual feature sorts created by 2 subjects. These subjects spontaneously labeled their feature groupings. An informal examination of these feature sorts, as well as those of other subjects who labeled their feature sorts, supported several of our earlier speculations about the self. The self is multifaceted. It includes categories related to roles (student, friend), relationships (listener), activities (sports, parties), superordinate traits (tense, creative), and evaluatively organized aspects (my best qualities).

To assign each subject a self-complexity score, I used a measure of dimensionality based on the H statistic, an index of dispersion derived from information theory (Attneave, 1959; Scott, 1969). The measure represents the number of independent attributes implicit in a subject's feature sort. In the present context, the objects in question were features that described different aspects of the self, so I will refer to this measure as the *self-complexity score* and denote it by the letters *SC*. It is defined by

$$SC = \log_2 n - (\Sigma_i\, n_i \log_2 n_i)/n, \tag{1}$$

where n is the total number of features (here 33), and n_i is the number of features that appear in a particular group combination.[4] The *SC* score can be interpreted as the minimal number of independent binary attributes underlying a person's feature sort about the self.[5] The greater the number of self-aspects created and the less redundant the features used in creating these self-aspects, the greater the *SC* score. Thus, high self-complexity results from having a large number of self-aspects that are nonredundant in terms of the features that describe them. Low self-complexity results either from having few self-aspects or from having many self-aspects that are highly redundant in terms of the features that describe them.

Activities. Subjects listed "the basic activities that you engage in during the school year" (e.g., studying, a job, sports, campus groups, dates, relationships with others, artistic or musical activities, hobbies). Subjects listed each activity on a separate line. A simple count of the number of separate activities was later made. This count excluded such basic activities as sleeping or eating.

Life stresses. Subjects completed a modified version of the College Student Life Events Scale (CSLES; Levine & Perkins, 1980). The 102 items of the CSLES represent stressful events that fall into 14 categories (social and academic life, living arrangements, finances, drugs, religious activities, political activities, sexual activities, family, friends, male–female relationships, employment, legal problems, accidents, and extracurricular activities). The scale was chosen because it includes a wide variety of minor and major stressful events characteristic of a college-

[3] The features and details of the measurement procedure are available from the author.

[4] To define a *group combination,* consider a feature that is sorted in Group 1 and Group 2 but no others. This feature is said to fall into the group combination 1–2. More generally, if a person forms two groups, a given feature may fall into one of four possible group combinations: 1, 2, 1–2, or no group. The n_i in the formula would be interpreted as follows in this example: n_1 = number of features sorted only into Group 1; n_2 = number of features sorted only into Group 2; n_3 = number of features sorted only into both Group 1 and Group 2; and n_4 = number of features not sorted into any group. Note that if the i-th group combination has no members (i.e., $n_i = 0$), it is excluded from the summation.

[5] The measure does not require the assumption that people think about themselves in terms of independent binary attributes. It is simply a useful statistical measure of the complexity of a feature sort.

Table 1
Examples of Two Subjects' Feature Sorts

Subject 1					
Relationship with men	Relationship with friends	Relationship with family	Studies	Physically	At parties
Outgoing	Humorous	Emotional	Quiet	Individualistic	Humorous
Playful	Relaxed	Playful	Studious	Affectionate	Playful
Reflective	Assertive	Reflective	Organized	Industrious	Outgoing
Mature	Outgoing	Mature	Mature	Quiet	Sophisticated
Emotional	Mature	Assertive	Reserved	Organized	Affectionate
Assertive	Emotional	Humorous	Industrious		Competitive
Competitive	Reflective	Outgoing	Individualistic		Imaginative
Relaxed	Soft-hearted	Individualistic			Impulsive
Humorous	Not studious	Unconventional			Mature
Affectionate	Affectionate				
Soft-hearted	Individualistic				
Individualistic					
Sophisticated					

Subject 2					
Dorm life	Home life	School	Social life	Work (dining hall worker)	Activities
Playful	Lazy	Reflective	Outgoing	Industrious	Imaginative
Relaxed	Emotional	Reserved	Humorous	Rebellious	Relaxed
Outgoing	Relaxed	Unorganized	Quiet	Playful	Quiet
Assertive	Humorous	Lazy	Relaxed	Outgoing	Outgoing
Competitive	Playful	Insecure	Playful	Assertive	Assertive
Affectionate	Affectionate		Insecure	Relaxed	Unorganized
Humorous	Unorganized		Impulsive		Affectionate
Soft-hearted	Soft-hearted		Not studious		Soft-hearted
Unorganized	Not studious		Conformist		
Lazy	Irresponsible				
Imaginative					
Individualistic					

age population. Because several of our outcome variables were illness related, we omitted 7 health-related items from all analyses.[6]

For each item, subjects indicated whether the event in question had happened to them during the past 2 weeks, during the past 6 months (excluding the past 2 weeks), or not at all. For those events that had occurred, subjects rated whether the impact of the event was *negative, none*, or *positive*, then whether the event was *caused by you* or *not caused by you*. (The causal question and several life events were added to the scale for this study.)

Preliminary analyses were performed to select a stress index. In these analyses, various stress indices at Time 1 were used to predict outcome variables at Time 2. (These regression models did not include self-complexity as a predictor of Time 2 outcomes.) On the basis of these results, the primary analyses reported here were based on a stress index computed for each subject using the number of negative events occurring during the past 2 weeks.[7]

Subjects completed the following outcome measures at each of the two sessions.

Depression. The Center for Epidemiologic Studies Depression Scale (CES-D) consists of 20 items constructed to measure current level of depressive symptomatology, especially depressive affect. Each symptom on the CES-D was rated on a 4-point scale indicating the degree of occurrence during the previous week. The scale ranged from *rarely or none of the time* to *most all of the time* (Radloff, 1977).[8]

Physical symptoms. The Cohen–Hoberman Inventory of Physical Symptoms (CHIPS; Cohen & Hoberman, 1983) lists 39 common physical symptoms that reflect the health problems of college students (e.g., a cold, cough, pulled muscle, stuffy head or nose, stomach pains, nausea, and headache). The scale excludes symptoms obviously psychological in nature. Subjects rated how much each physical symptom both-

[6] Additional analyses revealed that inclusion of the health items did not alter any results.

[7] These analyses indicated that stresses during the past 2 weeks were more strongly related to all subsequent depression and illness outcome variables than stresses during the past 6 months. Similarly, an index of events whose impact was perceived to be negative was more strongly related to most outcome variables than an index of all events. Comparisons between a stress index based on all negative events during the past 2 weeks and one based on negative events during the past 2 weeks perceived to be "caused by you" showed no clear pattern of superiority in predicting outcome variables. Because results for these two indices were very similar, and because most stress research has used indices of all negative events regardless of perceived causality, the primary analyses reported here used a stress index based on all negative events during the past 2 weeks.

[8] Because many subjects failed to notice that half of the items on a Beck Depression Inventory were on the back side of the form, this variable was not included in the analyses.

ered them during the past 2 weeks. Physical symptoms were rated on a 5-point scale (*not at all, a little bit, moderately, quite a bit, extremely*).

Illness. Subjects also listed, on a separate sheet, all illnesses that had occurred in the past 2 weeks. The list of illnesses was later coded for the occurrence of the following: (a) respiratory flu, (b) abdominal problems, (c) headache or backache, (d) allergy-related problems, (e) physical injury or muscle problems, (f) menstrual cramps, and (g) yeast infection. All listed illnesses fell into one of these categories. Those categories relevant only to women (menstrual cramps and yeast infection) were analyzed for women only.

Perceived stress. Subjects completed the Perceived Stress Scale (PSS), a 14-item instrument designed to measure the degree to which situations in one's life are appraised as stressful (Cohen, Kamarck, & Mermelstein, 1983). For each item, subjects rated how often during the past 2 weeks they thought or felt a certain way. For example, "In the last two weeks, how often have you felt difficulties were piling up so high that you could not overcome them?" Subjects responded on a 5-point scale (*never, almost never, sometimes, fairly often, very often*).

Procedure

The study involved two sessions. Subjects were tested in individual cubicles in groups of 1 to 5 persons. At the beginning of the first session, the experimenter stressed the confidentiality and anonymity of their responses. Subjects gave no identifying information but created a code to be put on each scale. At the first session, subjects completed the self-complexity sorting task. They then completed a packet containing the following instruments in the following order: the CSLES, the CES-D, the CHIPS, the PSS, and a sheet requesting a list of all illnesses occurring during the past 2 weeks. Exactly 2 weeks later, subjects returned for the second session. Subjects completed the same self-complexity sorting task and the same packet of instruments. In addition, subjects listed their school-year activities. Thus, in this prospective design, subjects reported life stresses, depression, and illnesses for the past 2 weeks at both Time 1 and again at Time 2 (2 weeks later).

Statistical Model and Predictions

Recall that the model predicts a stress-buffering effect of self-complexity. The impact of stress on depression and illness is reduced as the level of self-complexity increases. Because self-complexity was conceptualized and measured here and in prior studies as a continuous variable, I tested this prediction by using a multiple regression model that included the multiplicative interaction of stress and self-complexity:

$$Y_2 = b_0 + b_1 Y_1 + b_2 Stress_1 + b_3 SC_1 + b_4 SC_1 \times Stress_1. \quad (2)$$

Here, Y_2 is the value of the outcome variable (e.g., depression, illness) at Time 2; Y_1 is the value of the outcome variable at Time 1; $Stress_1$ is the number of negative events during the past two weeks at Time 1;[9] SC_1 is the self-complexity score at Time 1; and $SC_1 \times Stress_1$ is the multiplicative interaction term that provides the basis for testing the self-complexity buffering hypothesis.

Because all outcome variables are scaled so that higher scores indicate greater depression or illness, the specific predictions of the analysis are as follows:

1. $b_1 > 0$: Because physical and mental health symptoms tend to persist, values of the outcome variables should be positively related over time. This term controls for initial individual differences in illness and depression.

2. $b_2 > 0$: Higher stresses at Time 1 will increase depression and illness at Time 2.

3. $b_3 >, =,$ or < 0: The model being tested makes no prediction concerning any direct association between self-complexity and level of depression and illness over time.

4. $b_4 < 0$: This is the key hypothesis of the self-complexity model. The predicted multiplicative interaction provides a direct test of the self-complexity buffering hypothesis. If higher self-complexity moderates the impact of recent stresses on subsequent depression and illness, then the coefficient for the Self-Complexity × Stress interaction term will be negative. That is, as self-complexity increases, the impact of stress on illness and depression decreases.

Note that this is a prospective prediction model. By measuring outcome variables at both Time 1 and Time 2, I was able to control for initial levels of depression and illness. This prospective design also permits an examination of the temporal relation between life events and depression and illness and avoids the contamination of measures that occurs with retrospective studies. Thus, this prospective design provides a strong test of the self-complexity model.

Results

Self-Complexity Scores

As a first step in the analyses, each subject received a *SC* score based on his or her feature sort at Time 1 (see Equation 1). A higher *SC* score indicates higher self-complexity. The maximum value of *SC* is $\log_2 n$ (where n is the number of features to be sorted). In the present study, $n = 33$, so the maximum *SC* score is $\log_2 33 = 5.04$. The actual range of scores was between .994 and 4.802 ($M = 3.089$, $SD = .693$).[10] Self-complexity scores for male and female subjects did not significantly differ ($t_{104} = 1.25$, $p > .2$). Self-complexity was relatively stable from Time 1 to Time 2 ($r = .7$, $p < .001$). Also, a simple regression analysis indicated that changes in self-complexity from Time 1 to Time 2 were not a function of life events ($p = .9$).

The number of feature groups created in the self-complexity sorting task ranged from 3 to 12 ($M = 6.57$, $SD = 2.156$). Self-complexity scores were positively correlated with number of feature groups created ($r = .72$, $p < .001$). The number of activities listed ranged from 4 to 22 ($M = 10.48$, $SD = 3.95$). Both self-complexity scores and number of feature groups created had a near-zero correlation with number of activities.

Frequency of Stressful Events, Depression, and Illness

At Time 1, 96% of the subjects reported at least one negative event during the preceding 2 weeks. The number of negative events ranged from 0 to 17 ($M = 4.89$, $SD = 3.56$). At Time 2, 67% of the subjects reported at least one type of illness during the preceding 2 weeks (57% had respiratory flu, 19% had headaches or backaches, 13% had abdominal problems, 11% had injuries, 3% had allergies, 11% of the women had menstrual cramps, and 3% of the women had yeast infections). At Time 2, depression (CES-D) scores ranged from 2 to 45 ($M = 16.08$),

[9] Additional regression analyses revealed that using a stress index based on negative events during the past 2 weeks perceived to be "caused by you" did not alter any of the results regarding the buffering effect of self-complexity.

[10] In prior studies that also used 33 traits, the mean self-complexity scores for this sorting task were 2.857 and 3.555 (Linville, 1985).

Table 2
Correlations Between Stresses, Self-Complexity, Physical Symptoms, Depression, and Perceived Stress

Variable	Stress (T1)	Self-Complexity (T1)
Self-complexity (T1)	.12	—
Physical symptoms (T1)	.30**	.17
Depression (T1)	.28**	.10
Perceived stress (T1)	.31**	.09
Self-complexity (T2)	.07	.70***
Physical symptoms (T2)	.25**	.28**
Depression (T2)	.22*	.18
Perceived stress (T2)	.31**	.15

Note. Stress = number of negative events. T1 = Time 1. T2 = Time 2.
* $p \leq .05$. ** $p \leq .01$. *** $p \leq .001$.

physical symptoms (CHIPS) scores ranged from 0 to 81 (M = 18.45), and perceived stress (PSS) scores ranged from 8 to 45 (M = 22.75).

Correlations

Correlations between key continuous variables are presented in Table 2. Note first that self-complexity was not associated with number of negative events. Second, number of negative events at Time 1 was only moderately associated with depression, physical symptoms, and perceived stress at Time 2. This weak association when moderators were not considered is consistent with previous research. Third, self-complexity at Time 1 was not significantly associated with level of depression, physical symptoms, or perceived stress at Time 1, although it was moderately associated with physical symptoms at Time 2. Fourth, although not shown, the Time 1 to Time 2 correlations were .82 for physical symptoms, .56 for depression, and .75 for perceived stress. Finally, although not shown in Table 2, depression, physical symptoms, and perceived stress were significantly correlated with one another at both Time 1 and Time 2. These correlations ranged from .45 to .80.

Regression Models of Physical Symptoms, Depression, and Perceived Stress

Because of the complex and interactive nature of the model posited in this article, the simple correlations discussed earlier do not provide an adequate basis for testing the hypotheses of interest. In this section, we will consider regression results obtained by estimating the coefficients of Equation 2 for each of the three continuous outcome variables: physical symptoms, depression, and perceived stress. Predictions regarding the signs of the coefficients of these regression models were explained in the previous discussion of Equation 2. The regression results are summarized in Table 3, which presents standardized regression coefficients for each outcome variable.[11] These regression models explained between 35% and 71% of the variance in Time 2 outcomes for the three continuous dependent variables.[12]

Additive effects of previous symptoms and stressful events. As predicted, there was a strong positive relation between symptoms at Time 1 and symptoms at Time 2 for all three outcome variables. The standardized b_1 coefficients for the three outcome variables ranged in size from .53 to .78, and each was highly significant ($p < .001$). Even after adjusting for the effects of stress and self-complexity, there was a large and statistically significant tendency for physical symptoms, depression, and perceived stress to persist over time.

Also as predicted, negative events at Time 1 were positively and significantly related to physical symptoms, depression, and perceived stress at Time 2. The standardized b_2 coefficients, which reflect the additive effect of stressful events, ranged in size from .59 to .81. Thus, even after adjusting for prior symptom levels and the effect of self-complexity, subjects who reported a higher number of negative events at Time 1 displayed higher levels of physical symptoms, depression, and perceived stress at Time 2.

Additive and interactive effects of self-complexity. The critical prediction of the present theory is that the impact of negative events on physical and depressive symptoms is reduced as level of self-complexity increases. Therefore, b_4, the coefficient for the multiplicative interaction of self-complexity and negative events, should be negative. This prediction was supported for all three outcome variables, physical symptoms ($p < .01$), depression ($p < .03$), and perceived stress ($p < .06$), with standardized regression coefficients ranging from −.56 to −.82. It is noteworthy that the standardized regression coefficients for this predicted interaction effect were as large as the additive effects of negative events per se. Thus, these results strongly support the main buffering prediction of the self-complexity model; namely, the higher the level of self-complexity, the less adverse the impact of stressful events on physical and depressive symptoms.

Recall that the self-complexity model makes no prediction about the value of b_3, the coefficient that reflects the additive impact of level of self-complexity. As Table 3 reveals, this effect was positive, with coefficient values ranging from .23 to .35. To understand this additive main effect, we must consider it in the context of Equation 2. Considered together, the estimated values of b_2, b_3, and b_4 imply that there was a crossover interaction between stress and self-complexity.[13] Our regression estimates imply that at low levels of stressful events, subjects low in self-complexity were less likely to experience physical symptoms, depression, or perceived stress. But at high levels of stressful events, subjects high in self-complexity were less likely to experience physical symptoms, depression, or perceived stress.

[11] Because the self-complexity model makes a clear a priori directional prediction for b_1, b_2, and b_4, one-tailed tests are most appropriate for testing hypotheses regarding these coefficients; for b_3, where no a priori prediction is made, two-tailed tests are appropriate (Winer, 1971).

[12] Differences in variance explained were due mainly to differences on how much change occurred between Time 1 and Time 2. High R^2 values occurred for dependent variables that changed very little because the covariate at Time 1 accounted for most of the variance at Time 2.

[13] When the estimated regression relation was plotted, a crossover occurred in the range of the observed values of stress and self-complexity.

Thus, higher self-complexity acted as a buffer against the adverse physical and mental health consequences of high levels of stressful events. But in the absence of stressful events, low self-complexity subjects experienced fewer symptoms. As I argue in the Discussion section, although such a crossover interaction is not necessarily predicted by the self-complexity model, it is not inconsistent with it.

Logit Models of Probability of Illness

Our measures of the occurrence or nonoccurrence of specific illnesses (e.g., flu or no flu) were dichotomous. This section reports the results of logit analyses for the five types of illnesses that occurred in 10% or more of our sample at Time 2. These were respiratory flu, backaches and headaches, menstrual cramps, abdominal problems, and injuries.[14] In addition, I created a dichotomous overall measure (*illness*) for the presence or absence of any type of illness. Ordinary least squares regression analysis is inappropriate for these dichotomous outcome variables. Instead, for each illness, the coefficients of the following logit regression model were estimated:

$$\log[p_{ij}/(1 - p_{ij})] = b_0 + b_1 Y_1 + b_2 Stress_1 + b_3 SC_1 + b_4 SC_1 \times Stress_1. \quad (3)$$

Here p_{ij} denotes the conditional probability that subject i will have illness j at Time 2, given the observed values of the independent variables for subject i (see Bishop, Fienberg, & Holland, 1975). Thus, the dependent variable in this model is the "log odds" that subject i will get illness j. Predictions from the self-complexity model regarding the signs of the coefficients in Equation 3 are exactly the same as for Equation 2.

The coefficients of Equation 3 were estimated by using the logistic regression procedure in the BMDP package. A separate logit model was estimated for each illness as well as for the overall illness measure. To facilitate comparisons of the relative sizes of coefficients for Table 4, the continuous independent variables (stress, self-complexity, and the Self-Complexity × Stress interaction) were standardized by converting them to Z scores. But the values of the illness outcome variables at Time 1 and Time 2 were left in their naturally dichotomous form. Logit results for each illness measure are presented in Table 4.

Table 3
Standardized Regressions of Physical Symptoms, Depression, and Perceived Stress

Outcome variable	Outcome (T1) (b_1)	Stress (T1) (b_2)	SC (T1) (b_3)	SC (T1) × Stress (T1) (b_4)	R^2
Physical symptoms (T2)	.78***	.61**	.34***	−.68***	.71
Depression (T2)	.53***	.81**	.35**	−.82**	.35
Perceived stress (T2)	.71***	.59**	.23**	−.56*	.58

Note. T1 = Time 1. T2 = Time 2. SC = self-complexity. N = 106. The SC × Stress interaction term provides the basis for testing the buffering hypothesis.
* $p \leq .06$. ** $p \leq .05$. *** $p \leq .01$.

Table 4
Logit Models of Illness

Outcome variable	Outcome (T1) (b_1)	Stress (T1) (b_2)	SC (T1) (b_3)	SC (T1) × Stress (T1) (b_4)
Illness (T2)	0.53*	2.95**	1.26*	−3.34**
Flu (T2)	0.60**	2.64**	1.19**	−3.21**
Aches (T2)	0.87**	2.74*	1.08*	−2.43*
Cramps (T2)	−4.26	5.52*	1.98*	−6.12*
Abdominal (T2)	1.02**	1.46	0.49	−1.31
Injury (T2)	1.39**	1.09	0.91	−1.11

Note. T1 = Time 1. T2 = Time 2. SC = self-complexity. N = 106 for all illness variables except cramps (women only) where N = 63. The Stress, SC, and SC × Stress variables have been converted to standardized scores. The binary illness, flu, aches, cramps, abdominal, and injury variables have been left in binary form.
* $p \leq .05$. ** $p \leq .01$.

Additive effects of previous symptoms and stress. For all types of illnesses except menstrual cramps, the presence of the illness at Time 1 was positively and significantly related to the presence of that illness at Time 2. Thus, except for menstrual cramps, the presence or absence of these illnesses tended to persist over a 2-week period of time. Of greater interest is the fact that the b_2 coefficients were also positive and statistically significant for four of the six illness measures. Even after controlling for the presence of illness at Time 1, negative events at Time 1 were positively associated with the presence of illness at Time 2 for the *illness, flu, aches,* and *cramps* measures. Negative events at Time 1 were not significantly associated with the *abdominal* or *injury* measures at Time 2 (see Table 4).

Additive and interactive effects of self-complexity. Here the critical prediction of the self-complexity model is that b_4, the coefficient for the Self-Complexity × Stress interaction, is negative. In discussing the results of this prediction, it is useful to distinguish between those illness outcome measures at Time 2 that were significantly associated with stress at Time 1 and those that were not. If a specific illness is unrelated to prior stress, then moderating the stress should not reduce the likelihood of the illness. Thus, the types of illnesses for which we expect a significant Self-Complexity × Stress interaction are those whose occurrence is associated with prior stress.

For all four illness outcome variables for which there was a significant stress main effect, the coefficient for the Self-Complexity × Stress interaction was negative and statistically sig-

[14] Allergies and yeast infections occurred too infrequently (3%) to permit us to meaningfully estimate the coefficients in Equation 3.

nificant as predicted (*illness*, $p < .004$; *flu*, $p < .005$; *aches*, $p < .05$; and *cramps*, $p < .03$). Moreover, comparison of the b_2 and b_4 coefficients revealed that the interaction effect was of roughly the same magnitude as the adverse effect of stress per se (see Table 4). So here, too, we find support for the self-complexity buffering prediction that those high in self-complexity are less prone to stress-related illness following a period of high stress.

For the two illness outcome variables for which there was no significant stress main effect (i.e., *abdominal* and *injury*), the coefficient for the Self-Complexity × Stress interaction was not significant. However, these symptom categories occurred for relatively few subjects in our experiment (13% had abdominal problems and 11% had injuries), so these tests of the self-complexity buffering hypothesis had low statistical power. Moreover, even for these two variables, the coefficients for the stress main effect were positive, and the coefficients for the Self-Complexity × Stress interaction were negative as predicted by the model. Therefore, even for these variables, the results were consistent with the self-complexity model (although not statistically significant).

Finally, as was the case for the continuous outcome variables, the b_3 coefficients for the additive effect of self-complexity were positive for all six illness measures and statistically significant for four. Again, this indicates a crossover interaction between stress and self-complexity. Our logit results imply that at low levels of stress, subjects lower in self-complexity were less likely to become ill. But at high levels of stress, subjects higher in self-complexity were less likely to become ill.

In summary, greater self-complexity acted as a protective buffer against the adverse physical and mental health consequences of stressful events. Subjects higher in self-complexity were less prone to depression, perceived stress, physical symptoms, and occurrence of the flu and other illnesses following high levels of stressful events.

Other Measures of Self-Complexity

To see whether two relatively crude measures of self-complexity would also serve as predictors of differences in reactions to stress, two additional sets of regression analyses were run that paralleled those already reported. In the first set of analyses, a simple count of the number of feature groups created by each subject in the self-complexity sorting task was used as a self-complexity measure in Equations 2 and 3. Results for this measure revealed the same buffering pattern as those based on the *SC* score used in the main analyses, but the interaction effect was weaker and nonsignificant. Number of feature groups created is an inferior measure of self-complexity because unlike the self-complexity statistic defined earlier, it fails to adjust for the redundancy of the categories created.

In the second set of analyses, the number of activities listed by each subject was used as a self-complexity measure. Results for this measure showed no buffering effect of number of activities on physical or mental health outcomes of stress. In fact, there was a nonsignificant tendency in the opposite direction: A greater number of activities tended to exacerbate the relation between stress and subsequent depression and illness.

Discussion

The proposed model predicts that people who have complex self-representations are less vulnerable to the adverse physical and mental health consequences of stressful events. The model maintains that self-knowledge is cognitively represented in terms of multiple self-aspects that vary in terms of their relatedness. As defined in this model, greater self-complexity involves having more self-aspects and perceiving greater distinctions among self-aspects. When people experience negative events, they experience negative thoughts and feelings associated with particular self-aspects. These negative thoughts and feelings then spill over and color thoughts and feelings about associated self-aspects. Because people high in self-complexity tend to have more self-aspects, and because they are less likely to experience spillover effects, the impact of a negative event is likely to be confined to a smaller proportion of their self-representation. Thus, those high in self-complexity will have more unaffected self-aspects that can serve as buffers to moderate negative thoughts and feelings resulting from negative events. If one assumes that such negative thoughts and feelings about various self-aspects contribute to stress reactions and their physical and mental health consequences, those higher in self-complexity should be less prone to these adverse consequences of stress.

The results of this prospective study support the self-complexity buffering hypothesis and suggest the following conclusions. First, greater self-complexity acts as a moderator of depression and illness when people are under high stress. Second, greater self-complexity buffers against those types of health outcomes that are related to stress in the current sample (respiratory flu, backaches and headaches, and menstrual cramps). Third, self-complexity is a stronger moderator of stress-related depression and illness than a simple count of number of self-aspects or number of activities.

The analyses tested whether self-complexity is related to well-being through a main effect model (i.e., self-complexity has a beneficial effect regardless of whether people are under stress) or a buffering model (i.e., self-complexity moderates the adverse effect of stressful events and, therefore, is beneficial primarily for those under stress). The self-complexity model does *not* imply that those higher in self-complexity will generally display higher levels of physical and mental health but, rather, that self-complexity interacts with level of stress so that those higher in self-complexity will be less adversely affected by negative events when they occur. Thus, the model predicts a buffering interaction but makes no predictions regarding either a positive or negative main effect of self-complexity. The current data supported this buffering prediction. High self-complexity was mainly beneficial to those under high stress. Similarly, many studies have shown that social support is beneficial primarily to those under high levels of stress (see Cohen & Wills, 1985; Gentry & Kobasa, 1984, for reviews). In past studies, self-complexity moderated mood and self-appraisal but had no main effect on mood or self-appraisal (Linville, 1985).

In fact, estimation results from the regression analysis revealed a crossover interaction between stress and self-complexity. At low levels of stress, subjects lower in self-complexity showed fewer physical and mental health symptoms than did those higher in self-complexity. At higher levels of stress, subjects higher in self-complexity showed fewer adverse symptoms. Although such a crossover interaction is not necessarily predicted by the self-complexity model, it is not inconsistent with it.

Why might low self-complexity be advantageous at low levels of stressful events? One possibility is that the absence of negative events may be interpreted or experienced as a positive state of affairs. If so, then the crossover interaction observed here could be another instance of the self-complexity–affective extremity effect reported in Linville's previous research on the effects of positive and negative performance feedback (Linville, 1985).[15] In this work, Linville found that subjects lower in self-complexity showed greater decline in affect and self-appraisal following negative performance feedback, but they also showed greater rise in affect and self-appraisal following positive feedback. If one assumes that the absence of negative events is experienced as a positive state of affairs, then the self-complexity–affective extremity hypothesis suggests that in the absence of stressful events, those low in self-complexity may experience more positive affect than those high in self-complexity. If positive affect protects against depression and illness, then those low in self-complexity may experience fewer mental and physical health problems during periods of low stress.

A second possible explanation of the crossover interaction is that high self-complexity per se might be associated with types of stress not captured by measures of the number of negative events. For instance, maintaining multiple distinct self-aspects may be a source of chronic, low-level stress, perhaps because of role conflicts or multiple demands on time and attention. Such chronic stress may go unreported in events scales either because it is a constant feature of the subject's life, or because it does not fit into the framework of the events scales. Unfortunately, we lack a direct measure of low-level stress resulting from role strain. However, if one assumes that such stress is captured by the PSS, then we can indirectly test this hypothesis by estimating the coefficients of the regression equation

$$PSS = b_0 + b_1\text{Stress} + b_2SC. \tag{4}$$

If this speculation is correct, and if the PSS measure does capture role strain effects, then b_2 should be greater than zero. That is, after we partial out the effects of specific stressful events, there should be some residual perceived stress that is attributable to self-complexity per se. The estimation results for this regression indicated that b_2 was positive, but it was small and fell far short of traditional significance levels ($p > .5$). Nevertheless, this hypothesis is worthy of further study because the perceived stress measure may not capture the kinds of low-level role strains that may accompany having a large number of distinct self-aspects.

It is noteworthy that other buffering studies have found crossover interactions (see Cohen & Wills, 1985, for a review). For example, Cohen and Hoberman (1983) found a similar crossover interaction in their study of the protective effects of social support. At low levels of stress, subjects high in social support reported more physical symptoms than did those low in social support, but at high levels of stress, subjects high in social support reported fewer symptoms than did those low in social support. Cohen and Hoberman speculated that the relationships that provide social support may also be a source of low-level background stress. Similarly, at low levels of stress, Cohen and Hoberman found a slight tendency for subjects with more positive events to experience more physical symptoms; however, at high levels of stress, more positive events acted as a buffer.

Alternative Explanations for the Buffering Effect of Self-Complexity

The prospective nature of the present design allows us to rule out reverse causation arguments. For instance, it is possible that the presence of physical or depressive symptoms might cause both high reported levels of stressful events and low self-complexity. Thus, people with high symptom levels would also have high stress scores and low self-complexity scores, as predicted by our model. This is a plausible hypothesis that would be hard to rule out in a cross-sectional study. But the present prospective design directly controlled for symptoms at Time 1, which removed any effects of prior symptoms on the relation between self-complexity and stress at Time 1 and symptoms at Time 2.

We can also rule out three response-bias explanations for the observed buffering effect of self-complexity. The first is that people higher in self-complexity simply report more of everything (including more self-aspects), but under conditions of high stress, they encounter a ceiling effect on the symptom scales. That is, because they displayed more symptoms under low stress, subjects were unable to report many more symptoms under high stress because they had already exhausted the scale range. This would create the appearance of a moderating interaction like the one observed. However, examination of the actual distribution of responses on the physical symptoms, perceived stress, and depression scales revealed that even the most extreme subjects could have gone much higher on each scale.[16] Thus, the ceiling hypothesis is ruled out. Moreover, those higher in self-complexity did not report significantly more negative events, and under stressful conditions, they actually reported less depression, perceived stress, and illness than did those lower in self-complexity. Thus, this first response-bias hypothesis is refuted by the data.

A second response-bias hypothesis is that people higher in self-complexity simply give more socially desirable responses. Inconsistent with this explanation is the fact that under low stress, subjects higher in self-complexity actually experienced more physical and depressive symptoms—a tendency that does not appear to be socially desirable. If one argues that those higher in self-complexity tried to please the experimenter by

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[15] The complexity–extremity effect has also been demonstrated in studies of how people perceive and evaluate members of various social groups based on age, race, and sex (Linville, 1982; Linville & Jones, 1980).

[16] Although the possible range of scores on the physical symptoms scale was 0 to 140, the actual range was 0 to 81. The possible range for the CES-D was 0 to 60, and the actual range was 2 to 45. The possible range for the PSS was 0 to 56, and the actual range was 8 to 45.

reporting symptoms even in the absence of stress, they should also have reported more symptoms under high stress, which they did not.

A third response-bias hypothesis is that the results reflect only a general propensity to use or avoid extreme values on a rating scale, possibly because people adopt different anchors for the endpoints of scales. Contrary to this hypothesis, the self-complexity measure itself was based on a feature-sorting task, not on a rating task. Thus, the measure of self-complexity could not have been affected by such a response bias. Moreover, the outcome variables *illness, flu, aches,* and *cramps* were generated by listing illnesses, not by rating scales. The supportive results for these discrete outcome variables cannot be accounted for by a tendency to use extreme values on a rating scale.

A final type of alternative explanation for the buffering effect of self-complexity involves differential interpretation of life events by those high in self-complexity or high in depression or illness. To test this hypothesis, the coefficients of the following regression model were estimated:

$$PNEG = b_0 + b_1 SC + b_2 Y_i + b_3 SC \times Y_i, \qquad (5)$$

where *PNEG* is the proportion of reported events judged by the subject to have had a negative impact, *SC* is the subject's self-complexity score, Y_i is the subject's score on the *i*-th illness or depression measure (either CES-D, CHIPS, or PSS), and $SC \times Y_i$ is the product interaction of self-complexity and the *i*-th illness or depression measure. If either self-complexity, level of illness or depression, or their interaction influenced whether subjects interpreted events negatively, then one or more of the coefficients in this regression equation should be statistically significant. Three versions of this model were estimated, one for each of the three continuous outcome measures. In all three analyses, the coefficients of all independent variables were very small and far from statistically significant ($p > .7$). Thus, there is no support for the hypothesis that the findings were due to differential interpretation of events by those high in self-complexity, depression, illness, or perceived stress.

Limitations of the Present Study

Because this research deals with potentially important theoretical and clinical issues, it is essential to recognize possible limitations of the work. First, the reported test of the model was limited to an undergraduate population. Current work is testing the model in nonstudent populations. Second, the study reported here used a stress measure based on the accumulation of a variety of types of events judged to have a negative impact. To see whether these results generalize across different ways of measuring stress, current work is examining the response of a population of respondents, all of whom have been exposed to the same stressful event. A third note of caution concerns the status of the assumptions underlying the self-complexity model developed in this article. The approach has been to present one set of assumptions that leads to the present hypotheses. The assumptions are plausible and, as noted in the discussion of them, most are based on previous research findings. But the assumptions themselves were not tested in the present research, only the hypotheses to which they lead. Other sets of assumptions could be devised that would lead to the same hypotheses. Current work is testing and refining these assumptions regarding the mechanisms that underlie the self-complexity model.

Implications for Testing the Self-Complexity Model

The results have several implications for the measurement of self-complexity. First, the *SC* score used in the primary analyses was a better predictor of illness and depression than was a simple count of the number of feature groups created by the subject in the self-complexity sorting task. This finding supports an important element of the theoretical interpretation of the self-complexity concept, namely that self-complexity depends not only on the number of self-aspects but also on the extent to which these self-aspects are related to one another. The *SC* score reflects both components of self-complexity, whereas a simple count of feature groups created reflects only number of self-aspects.

Second, the *SC* score was a better predictor of illness and depression than was a simple count of the number of activities reported by subjects. Sociological research suggests that multiple roles can have a protective effect against the adverse effects of stress. Thoits (1983b) has shown that the greater the number of actual social identities possessed (e.g., spouse, parent, friend, church member), the lower the reported level of psychological distress. In addition, people who hold fewer social roles—the unmarried, the unemployed, the retired, housewives, those who live alone—experience more psychological distress than their counterparts who hold more roles (e.g., Gove & Hughes, 1980; Gove & Tudor, 1973; Gurin, Veroff, & Feld, 1960; Radloff, 1975). Verbrugge (1983) has shown that employment, marriage, and parenthood are associated with good health for both men and women. Employed married parents had the best health, and people with none of these roles had the worst health. The present results suggest that a simple count of number of social roles may not completely account for stress reactions, and that the concerns of classic role theory may be expanded by considering two additional questions: First, how are roles cognitively represented? Second, how are they cognitively related to one another? The cognitive relatedness of roles may be as closely related to health as the number or kind of roles.

Third, the research suggests that self-complexity is best conceived of as a continuous variable, a matter of degree, rather than an all-or-nothing factor. Treating self-complexity as a dichotomous (high vs. low) measure provides a less powerful test of the model. In the present study, treating the *SC* score as a dichotomous variable supported the buffering hypothesis, but the effect was weaker.

Fourth, the present approach to measuring self-complexity, via the self-complexity sorting task and the *SC* score, is closely linked to the conceptual definition of self-complexity in the model developed here. To test the present self-complexity model, it is important to use a self-complexity measure that satisfies this conceptual definition of self-complexity. Other intuitively plausible definitions or measures of self-complexity will not necessarily show the same relation to the extremity of affective reactions or to the likelihood of physical and mental health symptoms following stressful events.

The theoretical model and results also have two implications for the design of tests of the self-complexity model. First, the results underscore the advantages of using a prospective design to test buffering hypotheses. As noted earlier, the prospective design rules out several alternative explanations of the findings. In addition, a prospective design provides a more powerful statistical test of the buffering hypothesis. When b_2, b_3, and b_4 in Equation 2 were estimated using only cross-sectional data at Time 1, the results were generally consistent with the self-complexity buffering hypothesis, but they were weaker than the prospective results and statistically significant in only a few cases. The greater power of the prospective design results from using the Time 1 score for the outcome variable as a covariate to factor out individual differences and thus increase the precision with which other effects are estimated.

Second, the discussion of the predictions regarding the coefficients of Equation 2, particularly b_4, the coefficient for the multiplicative interaction of stress and self-complexity, underscores the importance of including a measure of stressful events in tests of the self-complexity buffering hypothesis. Simply correlating self-complexity with symptom levels does not test the buffering hypothesis. Rather, one needs to examine the interaction effect of stress and self-complexity to determine whether greater self-complexity buffers those under high stress.

Implications for the Concept of Self

Although the notion of self-concept has long been of interest to psychologists, most earlier work focused on the content rather than the structural properties of the self. The present model is consistent with the growing interest in how information about the self is cognitively represented and processed (e.g., Bower & Gilligan, 1979; Carver & Scheier, 1981; Greenwald & Pratkanis, 1984; Higgins et al., 1985; Kihlstrom & Cantor, 1983; Markus, 1977; Rogers, 1981). The present view is that representations of self are best conceived of in terms of multiple self-aspects, or multiple cognitive structures, each with its own set of associations among features, propositions, affects, and evaluations. Some self-aspects are highly interconnected to other self-aspects, whereas others are not. In the present model, events do not activate all self-aspects or the self-concept as a whole. Rather, only a subset of self-aspects is activated at any given time. Specific self-aspects are activated, depending on the context, the thoughts involved, their relation to currently activated self-aspects, their recency and frequency of activation, their chronic accessibility (Higgins et al., 1982), and motivation. This is consistent with McGuire's work showing that different features of the self are salient at different times. People tend to focus on their features that are most distinctive in a particular social environment (e.g., McGuire, McGuire, Child, & Fujioka, 1978; McGuire & Padawer-Singer, 1976). Thus, how we feel or think about ourselves is dependent on which self-aspects are currently salient or activated. This multifaceted view of the self is in contrast to theories that implicitly assume that the self is represented and activated as a unitary cognitive structure.

How do self-representations develop over time into more differentiated structures? First, increased experience in varied roles, relationships, and situations increases the opportunity for self-differentiation. This argument is consistent with theories of cognitive development that imply that cognitive differentiation increases with experience (Lewin, 1951; Piaget, 1960; Werner, 1957), and self-concept and self-evaluations become more differentiated and more abstract with increasing age (Montemayor & Eisen, 1977; Mullener & Laird, 1971). The self becomes increasingly differentiated through the same basic cognitive processes of generalization and discrimination that lead to increasing differentiation of other social knowledge structures (e.g., Linville, Salovey, & Fischer, 1986). Second, an increasing range of experiences relevant to the self (e.g., family, professional, social, aesthetic, physical) also creates functional incentives for self-differentiation. Increased self-differentiation provides a highly efficient way of accessing self-relevant information in a variety of areas of life, and of discriminating and responding to the varied demands of an increasing number of roles and interpersonal situations. Thus, greater self-complexity is likely to be a function of both greater and more varied experiences and greater demands to differentiate among aspects of one's life. For instance, number of cognitive self-aspects may depend, in part, on the number of actual roles and relationships in one's life. Thus, people involved in multiple personal and professional roles may exhibit greater self-complexity than those whose lives center on only a few roles. Third, intellectual and personality tendencies may contribute to the tendency to cognitively differentiate the self (Linville, Barnes, & Bersoff, 1986). Thus, holding the number of actual roles or relationships constant, people may differ in their tendency to differentiate self-representations.

Finally, note that the factors that contribute to greater self-complexity will not necessarily have any impact on the complexity of cognitive representations of other domains (e.g., cognitive representations of political figures or social psychologists). Thus, those high in self-complexity need not necessarily be high in complexity with respect to other domains.

Clinical Implications

This initial work suggests several broader and potentially significant clinical implications of the self-complexity construct and model. First, the self-complexity model developed here provides theoretical insight into the cognitive and affective responses to stress that result in adverse psychological and physical symptoms. Responses to life events are a consequence not only of the cognitions and affect associated with the event-relevant self-aspect, but also of the cognitions and affect associated with related self-aspects in the self-representation. Second, this research suggests that the self-complexity sorting task and *SC* score provide potentially useful diagnostic tools for identifying those individuals who are more vulnerable to depression or illness under high stress. Third, the self-complexity model may prove useful in understanding the negative thought patterns characteristic of clinically depressed individuals. As argued in an earlier article, the cycle of negative thoughts characteristic of depression may derive from an automatic spreading activation process in which negative thoughts about one self-aspect activate associated negative thoughts in related self-aspects (Linville, 1985). Finally, the self-complexity model suggests therapeutic interventions that simultaneously encourage people to develop distinctions among self-aspects and to focus on those self-aspects about which they have positive thoughts and feelings. For instance, people might be encouraged to focus on feeling good about themselves in certain respects despite problems concerning other areas of their lives, for example, "Despite my marital problems, I am a good parent."

References

Attneave, F. (1959). *Applications of information theory to psychology.* New York: Holt-Dryden.

Beck, A. T. (1976). *Cognitive therapy and the emotional disorders.* New York: International Universities Press.

Bishop, Y. M. M., Fienberg, S. E., & Holland, P. W. (1975). *Discrete multivariate analysis: Theory and practice.* Cambridge: MIT Press.

Bower, G. H., & Gilligan, S. G. (1979). Remembering information related to one's self. *Journal of Research in Personality, 13,* 420–461.

Cantor, N., & Kihlstrom, J. (1986). *Personality and social intelligence.* Englewood Cliffs, NJ: Prentice-Hall.

Carver, C. S., & Scheier, M. F. (1981). *Attention and self-regulation: A control theory approach to human behavior.* New York: Springer-Verlag.

Cassel, J. C. (1976). The contribution of the social environment to host resistance. *American Journal of Epidemiology, 104,* 107–123.

Cobb, S. (1976). Social support as a moderator of life stress. *Psychosomatic Medicine, 38,* 300–314.

Cohen, S., & Hoberman, H. M. (1983). Positive events and social supports as buffers of life change stress. *Journal of Applied Social Psychology, 13,* 99–125.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24,* 385–396.

Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin, 98,* 310–357.

Dean, A., & Lin, N. (1977). The stress-buffering role of social support. *Journal of Nervous and Mental Health, 169,* 403–417.

Dohrenwend, B. S., & Dohrenwend, B. P. (1978). Some issues in research on stressful life events. *Journal of Nervous and Mental Disease, 166,* 7–15.

Gentry, W. D., & Kobasa, S. C. (1984). Social and psychological resources mediating stress–illness relationships in humans. In W. D. Gentry (Ed.), *Handbook of behavioral medicine* (pp. 87–116). New York: Guilford Press.

Gergen, K. J. (1971). *The concept of self.* New York: Holt, Rinehart & Winston.

Gove, W. S., & Hughes, M. (1980). Reexamining the ecological fallacy: A study in which aggregate data are critical in investigating the pathological effects of living alone. *Social Forces, 58,* 1157–1177.

Gove, W. S., & Tudor, J. F. (1973). Adult sex roles and mental illness. *American Journal of Sociology, 78,* 50–73.

Greenwald, A. G., & Pratkanis, A. R. (1984). The self. In R. S. Wyer & T. K. Srull (Eds.), *Handbook of social cognition* (Vol. 3, pp. 129–178). Hillsdale, NJ: Erlbaum.

Gurin, G., Veroff, J., & Feld, S. (1960). *Americans view their mental health.* New York: Basic Books.

Higgins, E. T., King, G. A., & Mavin, G. H. (1982). Individual construct accessibility and subjective impressions and recall. *Journal of Personality and Social Psychology, 43,* 35–47.

Higgins, E. T., Klein, R., & Strauman, T. (1985). Self-concept discrepancy theory: A psychological model for distinguishing among different aspects of depression and anxiety. *Social Cognition, 3,* 51–76.

James, W. (1892). *Psychology: The briefer course.* New York: Holt, Rinehart & Winston.

Jemmott, J. B., & Locke, S. E. (1984). Psychosocial factors, immunologic mediation, and human susceptibility to infectious diseases: How much do we know? *Psychological Bulletin, 95,* 78–108.

Johnson, J. H., & Sarason, I. G. (1978). Life stress, depression, and anxiety: Internal–external control as a moderator variable. *Journal of Psychosomatic Research, 22,* 205–208.

Kanner, A. D., Coyne, J. C., Shaefer, C., & Lazarus, R. S. (1980). Comparison of two modes of stress measurement: Daily hassles and uplifts versus major life events. *Journal of Behavioral Medicine, 4,* 1–39.

Kaplan, B. H., Cassel, J. C., & Gore, S. (1977). Social support and health. *Medical Care, 15,* 47–58.

Kihlstrom, J. F., & Cantor, N. (1983). Mental representations of the self. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 17, pp. 1–47). New York: Academic Press.

Kobasa, S. C. (1979). Stressful life events, personality, and health: An inquiry into hardiness. *Journal of Personality and Social Psychology, 37,* 1–11.

Krantz, D. S., Grunberg, N. E., & Baum, A. (1985). Health psychology. *Annual Review of Psychology, 36,* 349–383.

Kuiper, N. A., & Derry, P. A. (1981). The self as a cognitive prototype: An application to person perception and depression. In N. Cantor & J. F. Kihlstrom (Eds.), *Personality, cognition, and social interaction* (pp. 215–232). Hillsdale, NJ: Erlbaum.

LaRocco, J. M., House, J. S., & French, J. R. P., Jr. (1980). Social support, occupational stress, and health. *Journal of Health and Social Behavior, 21,* 202–218.

Lazarus, R. S., & Launier, R. (1978). Stress-related transactions between persons and environment. In L. A. Pervin & M. Lewis (Eds.), *Perspectives in interactional psychology* (pp. 287–327). New York: Plenum Press.

Lefcourt, H. M. (1981). Locus of control and stressful life events. In B. S. Dohrenwend & B. P. Dohrenwend (Eds.), *Stressful life events and their contexts.* New York: Prodist.

Levine, M., & Perkins, D. V. (1980, August). *Tailor making life events scale.* Paper presented at the meeting of the American Psychological Association, Montreal.

Lewin, K. (1951). *Field theory in social sciences.* New York: Harper.

Linville, P. W. (1982). The complexity–extremity effect and age-based stereotyping. *Journal of Personality and Social Psychology, 42,* 193–211.

Linville, P. W. (1985). Self-complexity and affective extremity: Don't put all of your eggs in one cognitive basket. *Social Cognition, 3,* 94–120.

Linville, P. W., Barnes, M., & Bersoff, D. M. (1986). *Self-complexity: A measure of multiple self-aspects.* Unpublished manuscript, Yale University, New Haven, CT.

Linville, P. W., & Jones, E. E. (1980). Polarized appraisals of outgroup members. *Journal of Personality and Social Psychology, 38,* 689–703.

Linville, P. W., Salovey, P., & Fischer, G. W. (1986). Stereotyping and perceived distributions of social characteristics. In J. Dovidio & S. L. Gaertner (Eds.), *Prejudice, discrimination, and racism* (pp. 165–208). New York: Academic Press.

Markus, H. (1977). Self-schemata and processing information about the self. *Journal of Personality and Social Psychology, 35,* 63–78.

Markus, H., & Nurius, P. (1986). Possible selves. *American Psychologist, 41,* 954–969.

McGuire, W. J., McGuire, C. W., Child, P., & Fujioka, T. (1978). Salience of ethnicity in the spontaneous self-concept as a function of

one's ethnic distinctiveness in the social environment. *Journal of Personality and Social Psychology, 36,* 511–520.
McGuire, W. J., & Padawer-Singer, A. (1976). Trait salience in the spontaneous self-concept. *Journal of Personality and Social Psychology, 33,* 743–754.
Montemayor, R., & Eisen, M. (1977). The development of self-conceptions from childhood to adolescence. *Journal of Personality and Social Psychology, 34,* 314–319.
Mullen, B., & Suls, J. (1982). "Know thyself": Stressful life changes and the ameliorative effect of private self-consciousness. *Journal of Experimental Social Psychology, 18,* 43–55.
Mullener, N., & Laird, J. D. (1971). Some developmental changes in the organization of self-evaluations. *Developmental Psychology, 5,* 233–236.
Pearlin, L. I., & Schooler, C. (1978). The structure of coping. *Journal of Health and Social Behavior, 19,* 2–21.
Piaget, J. (1960). *The psychology of intelligence.* New York: Harcourt, Brace.
Radloff, L. (1975). Sex differences in depression. *Sex Roles, 1,* 249–265.
Radloff, L. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychosocial Measurement, 1,* 385–401.
Rogers, T. B. (1981). A model of the self as an aspect of the human information processing system. In N. Cantor & J. F. Kihlstrom (Eds.), *Personality, cognition, and social interaction* (pp. 193–214). Hillsdale, NJ: Erlbaum.
Rosenberg, S., & Gala, M. A. (1985). The multiplicity of personal identity. In P. Shaver (Ed.), *Review of personality and social psychology* (Vol. 6, pp. 87–113). Beverly Hills, CA: Sage.
Scott, W. A. (1969). Structure of natural cognitions. *Journal of Personality and Social Psychology, 12,* 261–278.
Silver, R. L., & Wortman, C. B. (1980). Coping with undesirable life events. In J. Garber & M. E. P. Seligman (Eds.), *Human helplessness* (pp. 279–375). New York: Academic Press.
Taylor, S. E. (1983). Adjustment to threatening events: A theory of cognitive adaptation. *American Psychologist, 38,* 1161–1173.
Thoits, P. A. (1983a). Dimensions of life events that influence psychological distress: An evaluation and synthesis of the literature. In H. B. Kaplan (Ed.), *Psychosocial stress* (pp. 33–103). New York: Academic Press.
Thoits, P. A. (1983b). Multiple identities and psychological well-being. A reformulation and test of the social isolation hypothesis. *American Sociological Review, 48,* 174–187.
Verbrugge, L. M. (1983). Multiple roles and physical health of women and men. *Journal of Health and Social Behavior, 24,* 16–30.
Werner, H. (1957). *Comparative psychology of mental development* (3rd ed.). New York: International Universities Press.
Winer, B. J. (1971). *Statistical principles in experimental design.* New York: McGraw-Hill.

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Models of Addiction: Call for Papers

A special issue of the *Journal of Abnormal Psychology* is being planned that will comprise both empirical research and review papers relevant to major models or conceptualizations of addiction. Solicited manuscripts should review empirical literatures, advance theory, or present major empirical data sets relevant to models or theories of addiction; namely, Pavlovian, opponent-process, operant, genetic, incentive, biopharmacological, social learning, stress/coping models, and so on. Manuscripts that have clear relevance to motivational processes in addiction are especially welcome. Thus, papers that address specific addiction phenomena (e.g., dispositional tolerance) should make clear the relevance of such phenomena to addiction theory and drug motivation.

Contributions intended for the special issue should be sent to the guest editor:

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W. J. Brogden Psychology Building
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The deadline for initial submission of manuscripts is May 10, 1987. If authors desire feedback regarding the general appropriateness of manuscripts in the preparation stage, they should submit a 200–300 word abstract to the guest editor.