Determinants of Feature Centrality in Clinicians' Concepts of Mental Disorders

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Abstract

What determines which features are more central in concepts? Sloman, Love, and Ahn (1998) examined laypeople's concepts about everyday objects (e.g., chairs and apples) and found that lay theories of these concepts determined feature centrally as much as category validity judgments (i.e., how prevalent features are in a given category) did. The current study examined determinants of feature centrality in 35 clinical psychologists, psychiatrists, and clinical social workers' concepts of Major Depressive Disorder (MDD) and Dysthymic disorder (Dysthymia). Unlike previous findings, we found that category validities were by far the strongest predictor of conceptual centrality in clinicians' concepts of these mental disorders and their theories about these disorders were only a weak, albeit significant, predictor. We discuss possible reasons for this discrepancy.

Keywords: categorization; reasoning; clinical diagnosis; theory-use; causal reasoning.

Introduction

Features in concepts vary in their importance. In the concept of cats that most educated people hold, for instance, the genetic structure of a cat would be judged to be much more important than the fact that they meow. That is, we can easily imagine a cat that does not meow, but it is extremely difficult to imagine a cat that does not have "cat DNA".

The current study examines why some features in clinicians' concepts of mental disorders are more crucial than others. The domain of mental disorders is particularly interesting because the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association [APA], 1994), the official guidelines that clinicians must follow for diagnostic and insurance purposes, explicitly specifies that all symptoms of a given disorder be weighted equally (with only a few exceptions). For instance, there are four symptoms listed as the diagnostic criteria for anorexia nervosa, all of which have to be present in order to be diagnosed with the disorder. Yet, Kim and Ahn (2002) found that clinical psychologists assign significantly different ratings of importance among symptoms that are supposed to be equally weighted according to the DSM-IV. For instance, "*refusal to maintain body weight at or above minimal levels*" in anorexia nervosa was judged to be significantly more central than "*absence of the period (in women) for more than 3 months of menstrual cycles*." What would be the bases of clinicians' weightings of these symptoms?

The implications for the current study are two-fold. First, there are clinical implications. If clinicians' perception of feature centrality deviates from a certain norm (e.g., DSM-IV), we can develop better training programs that address the basis of these misperceptions. Second, there are implications for basic cognitive psychology. Previous studies have demonstrated strong influences of people's theories about concepts in determining feature centrality (e.g., Ahn, 1998; Rehder & Hastie, 2001; Sloman, Love, & Ahn, 1998). Examining this phenomenon in the domain of mental disorders offers an interesting test-bed because the theories that clinicians hold about mental disorders appear to be rather fragile. For one thing, it is a well-known fact that there rarely is any consensus on or clear understanding of the etiology of mental disorders. Furthermore, the DSM-IV (APA, 1994) discourages users from applying their own theories by forcing them to go through a checklist of isolated symptoms regardless of any potential causal structures underlying these symptoms. Given that the major guideline for mental disorder diagnosis pushes for such an atheoretical stance, it is interesting to examine whether the influence of theory would be as robust as in other domains.

In the current study, we examined clincians' concepts of MDD and Dysthymia. These two mental disorders are good candidates for studying clincians' theories because they are highly prevalent, and most clinicians are familiar with them (Flanagan & Ahn, 2005). Thus, clinicians' judgments on these disorders could not be simply attributed to their lack of experiences with these disorders. In what follows, we will first describe how we measured feature centrality in these disorders. Then, we will discuss three potential determinants for feature centrality.

Measure of Feature Centrality

To measure the centrality of features in a concept, we first asked clinicians to generate features of MDD and Dysthymia, and then to give a rating on the ease of changing a feature (i.e., how easy it is to imagine removing a feature in a concept, such as how easy it is to imagine a patient with MDD that does not display *sleep disturbances*.) Henceforth, this measure will be referred to as mutability (Sloman et al., 1998). A feature that is easy to transform in one's mental representation would be less central in the concept. For instance, it is easier to imagine an apple that is not sweet than to imagine an apple that does not grow from an apple tree; therefore growing from an apple tree is more central to the concept of apples.

One way of understanding mutability as a measure of conceptual centrality in clinical settings is to imagine a typical diagnosis session where a clinician is confronted with a patient who displays a full set of symptoms for a certain disorder except for one symptom. A clinician's assessment of the likelihood that the person has the target disorder would be a function of how much weight the clinician assigns to that missing symptom. Thus, the mutability task would approximate importance of a symptom in a clinician's conceptualization of a disorder.

Potential Determinants of Feature Centrality

In addition to simply discovering which features or symptoms of mental disorders clinicians weight more, it is also crucial to understand why some features are perceived to be more important than others. In the current study, we examined three potential determinants.

The first determinant was category validity (i.e., how common the feature is among those with the disorder, or the likelihood that a person displays a certain symptom given that the person has a disorder). A feature may be central to a disorder because it is common in the disorder. Note, however, that a highly prevalent feature does not have to be conceptually central. For instance, all tires are black, but it is easy to imagine a tire that is not black.

The second potential determinant was diagnosticity (i.e., how predictive the feature is of the disorder, or the likelihood that a person has a certain disorder given that the person has a symptom). A feature may be central to a disorder because it is highly diagnostic. Again, note that this does not necessarily have to be the case. For instance, *grows on a tree* might be highly central in our concept of apples, but it is not necessarily diagnostic: Knowing that an object has grown on a tree does not tell us that the object is highly likely to be an apple.

The third potential determinant was causal centrality. In Kim and Ahn's study (2002), it was found that causal centrality predicted centrality of a feature in a concept such that the more causal a symptom was in a clinician's theory, the more important it was in their diagnoses. For instance, if a clinician believed that symptom A causes symptom B, which in turn causes symptom C, patients presenting more causally central symptoms (e.g., symptom A) were more likely to be diagnosed with that mental disorder than patients presenting more causally peripheral symptoms (e.g., symptom C).

The possible reason behind this is the following (Sloman et al., 1998). By definition, a feature that causes other features determines the fate of many other features. It would be difficult to imagine an item missing a causal feature because deleting that feature requires adjusting all the other features that depend on it. For instance, if a cat does not have cat DNA, that would require changes to all other biological properties of the cat. As a result, a causally central feature should be immutable, or conceptually central. In contrast, a feature that is causally peripheral in one's theory would be easy to remove without having to change many features in one's mental representation. For instance, a cat's claws are caused by a cat's DNA make-up, and it would be easy to imagine removing a cat's claws without having to change other biological properties of the cat, such as shape or size.

However, to the extent that changing an effect feature also requires change in a cause feature, causal centrality might not fully predict mutability. For instance, suppose one believes that the only way an animal can look like a cat is to be born from another cat, and all animals that were born from a cat must look like a cat. Then upon seeing an animal that does not look like a cat (i.e., absence of an effect feature), the person would also conjecture that the animal was not born from another cat (i.e., absence of a cause feature). That is, if a cause is a necessary and sufficient condition for an effect, changing an effect must entail changing a cause, making cause and effect features almost equally immutable.

Another possible reason why causal centrality might not fully predict mutability is that a person may not be fully confident in his/her own causal theories, in which case the person might easily mutate a cause feature while leaving other features intact. For example, if a person is not confident that s/he has correctly identified the true cause of a cat's coloration, the person may be willing to change the feature playing this causal role without changing the effects represented in his/her causal theory.

The main goal of the current study is to examine which – category validity, diagnosticity, or causal centrality – predicts mutability of features in clinicians' concepts of MDD and Dysthymia. Each of these factors is a potential determinant for mutability, but there are also reasons why they might not necessarily determine mutability. Thus, it is an empirical question to ask which one of these factors would significantly influence weightings of symptoms or features of a mental disorder in clinicians' minds.

Sloman et al. (1998) found that for everyday objects (e.g., apples, guitars, etc.), both the centrality in one's theories about the objects and the category validity strongly correlated with mutability of features (rank correlation of 0.72 for the former and Pearson correlation of 0.66 for the latter), whereas diagnosticity did not correlate (Pearson correlation of 0.04). In the domain of mental disorders, Kim and Ahn (2002, Experiment 2) found the rank-order correlation between causal centrality and mutability of features to be 0.43,

but they did not examine other potential determinants of feature centrality, making it difficult to conclude about relative contributions of clinicians' theories. The current study offers such an occasion. Given that clinicians' theories about mental disorders might be rather fragile as discussed earlier, clinicians' weightings on features might be based more on statistical factors (e.g., category validity or diagnosticity). In contrast, theory-based reasoning might be so robust that clinicians would be cognitively driven to apply their theories, ignoring other statistically based determinants.

Methods

Participants

Thirty-five participants were recruited using lists of licensed psychiatrics, clinical psychologists, and clinical social workers obtained from the Tennessee Department of Public Health and the Connecticut Department of Public Health. Recruitment letters were sent to psychiatrists and social workers in Tennessee in the spring of 2003, to all eligible psychiatrists and social workers in New Haven, CT in the summer of 2003, and to all eligible psychologists in New Haven in the fall of 2003. Eligible clinicians were licensed for at least 10 years and for no more than 30 years[1]. Participants were paid for participating in the study at a rate that would roughly correspond to their normal pay scale ($100 per hour for psychiatrists, $85 per hour for clinical psychologists, and $70 per hour for social workers).

Procedure

To give an overview of the procedure, participants performed a set of tasks for both MDD and Dysthymia. They first generated lists of features. Various tasks were then performed to obtain different measures of each feature, including diagnosticity, category validity, and mutability. Participants were also asked to draw relationships between features in order to examine their theories. All of these tasks were completed for one disorder and then for the other disorder in a counterbalanced fashion. The experiment was self-paced and the entire task took about 2 hours on average (ranging from 1 hour to 5 hours). Below each of these tasks are explained in detail.

In the first task, participants were asked to list features of a disorder. In order to prevent the demand characteristics of listing the DSM diagnostic criteria, the instructions specified that it was the participant's own concept that was of interest and that we were not testing their knowledge of the DSM. The instructions provided examples of types of features that participants could list (i.e., "1) symptoms that are *often* seen in people with this disorder, 2) symptoms that are *rarely* seen in people with this disorder, 3) symptoms that are often *associated* with this disorder, 4) demographic characteristics, 5) precipitating conditions, 6) accompanying features, 7) physical features, 8) possible genetic, physiological, biological, psychological, and environmental causes/correlates of the disorder, etc.").

For the feature listing task, participants entered their features on a Microsoft® Excel spreadsheet. They were instructed, "Please separate out each feature in any way that is meaningful to you and enter each feature into an individual cell in the Excel spreadsheet in front of you"; therefore, participants determined for themselves what counted as separate features. Once the feature list was generated for one disorder, the experimenter ran a pre-set macro program on Excel to generate stimulus lists for the category validity, diagnosticity, mutability questions, and the theory drawing task on separate worksheets of the Excel file. The macro program randomized the order of the features for each task. The first three tasks were then carried out by entering responses on the Excel spreadsheet. For the theory drawing task, the experimenter printed out the participant generated features, cut out separate slips for each feature, and presented them to the participant. The order of the rating tasks and the theory drawing task was counterbalanced.

For the rating tasks, each individual was asked to rate each of the features he or she had generated (indicated as X below) in terms of three questions:

- Category Validity question: "Of all people who have [Major Depressive Disorder / Dysthymia], what percentage have X?"
- Diagnosticity question: "Of all people who have X, what percentage have [Major Depressive Disorder / Dysthymia]?
- Mutability question: "Imagine a typical [Major Depressive Disorder / Dysthymia] patient. How easy is it for you now to change your image of this person such that this person does NOT have X?" (0=very easy and 100=very difficult)

Participants completed one type of rating question for all of their self-generated features before moving on to the other types of rating questions. The order of the three types of rating questions was counterbalanced.

Participants were also given the theory drawing task. Participants were provided with slips of paper for each feature they listed and asked to "arrange them on the sheet in such a way that will facilitate the drawing process" and to tape them in place. Then for every feature X that is related to a feature Y, they were asked to draw "a line between the two features and label the line with the kind of relation that links them." They were told to "draw an arrowhead on the line to denote the direction of the relationship." Participants were provided with a list of possible relationships they might consider (but to which they were not limited). They were told to not include an arrowhead if there is no direction in a relationship and told to draw bidirectional arrows if they believe that the two features influence each other in a bidirectional way. Finally, they were asked to rate the strength of each relationship from 1 (weak) to 3 (strong).

[1] One clinical psychologist was licensed for 7 years, but no noticeable difference was found between this participant and others.

Results

To reiterate, we asked participants to rate mutability, which served as a measure of conceptual centrality of features. We also asked about three potential determinants of conceptual centrality: category validity, diagnosticity, and causal centrality. Causal centrality was calculated from the participants' theory drawings as in Kim and Ahn (2002) and Sloman et al. (1998)[2]. Tables 1 and 2 show mean ratings on these measures for MDD and Dysthymia for features listed by more than 50% of participants[3].

First, it is interesting to note that participants' weightings of symptoms, as indicated by their ratings on the mutability task, deviated from the DSM-IV criteria. For MDD, *depressed mood* and *anhedonia* should be equally weighted, but estimates for *depressed mood* (M = 82.3) were significantly higher than those for *anhedonia* (M = 71.1, $p < 0.05$ for a one-sample t-test for subjects who listed both features). In addition, *low energy, poor concentration, sleep disturbances, suicide,* and *appetite disturbance* in MDD should be equally weighted according to the DSM-IV. However, the mutability ratings of these features ranged from 32.1 to 60.9. A one-way ANOVA with these five features as a factor showed a significant difference in these ratings, $F(4, 169) = 5.11$, $p < .01$. For Dysthymia, *sleep disturbance* (M = 27.0) received significantly lower ratings than *low energy* (M = 54.8), $t(49) = 4.25$, $p < .01$, although these two symptoms should be equally weighted according to the DSM-IV. This indicates that *sleep disturbance* was thought to have greater causal centrality than *low energy*, despite their equal criterial weighting in the DSM.

Table 1: Ratings on MDD Features Listed by More than 50% of Clinicians

Features	Mutability Ratings	Causal Ranks	Diagnosticity Ratings	Category Validity Ratings
depressed mood	82.3	1	46.2	89.0
anhedonia	71.1	8	54.7	81.6
hopelessness	69.5	8	62.1	76.3
low energy	60.9	3	23.2	76.3
impaired functioning	55.8	8	29.7	68.8
poor concentration	49.5	5	26.0	69.4
sleep disturbances	42.1	2	35.3	65.9
suicide	35.6	4	68.7	48.5
appetite disturbance	32.1	6	21.0	56.3

Table 2: Ratings on Dysthymia Features Listed by More than 50% of Clinicians

Features	Mutability Ratings	Causal Ranks	Diagnosticity Ratings	Category validity Ratings
chronicity	78.3	4	47.8	89.0
depressed mood	73.3	1	37.6	85.9
low energy	54.8	3	20.5	65.7
sleep disturbances	27.0	2	22.9	51.8

Second, various correlations were calculated in order to determine which factor correlates with the conceptual centrality of features. For each participant, correlations between the scores from three rating tasks were calculated and Spearman rank correlations were calculated between each of the three ratings and the causal centrality rankings. Correlations were averaged across participants by taking the average of the Fisher transformation of each correlation and taking the inverse Fisher of the resulting average. These correlations for MDD and Dysthymia are shown in Tables 3 and 4, respectively. The average correlations were compared to a correlation of zero using a one-sample t-test. In Tables 3 and 4, * indicates $p < .05$ and ** indicates $p < .01$ from these tests.

Table 3: Correlations among four measures of features for MDD

	Mutability Rating	Diagnosticity Rating	Category Validity Rating	Causal Centrality Rank
Mutability Rating	1.00	0.24 **	0.74 **	0.20 **
Diagnosticity Rating		1.00	0.20 **	0.05
Category Validity Rating			1.00	0.22 **
Causal Centrality Rank				1.00

[2] From the theory drawings of participants, a causal centrality ranking was calculated using an iterative process (Sloman et al., 1998). In this process, the causal centrality rank of a given feature increases as a function of both the number of features it causes and the causal centrality of the features it causes. The equation is given by $c_{i,t} = \sum_j d_{ij} c_{j,t-1}$ where $c_{i,t}$ is the centrality of feature i at iteration t and d_{ij} is the number representing the extent to which feature j depends on feature i. We performed 10 iterations.

[3] All reported analyses were carried out over all features generated by each participant. For simplicity, Tables 1 and 2 present only the ones that are generated by more than 50% of participants.

Table 4: Correlations among four measures of features for Dysthymia

	Mutability Rating	Diagnosticity Rating	Category Validity Rating	Causal Centrality Rank
Mutability Rating	1.0	0.45 **	0.69 **	0.17 *
Diagnosticity Rating		1.00	0.34 **	0.29 **
Category Validity Rating			1.00	0.16 *
Causal Centrality Rank				1.00

As before, we obtained the effect of causal theories on feature centrality as indicated by significantly positive correlations between causal centrality rank and mutability. The correlation between mutability and causal centrality was consistent – out of 35 clinicians, the correlation was positive in 26 clinicians for MDD, and in 22 clinicians for Dysthymia – but not large (correlations of 0.20 and 0.17 for MDD and Dysthymia, respectively). In addition, the current results showed that diagnosticity significantly predicted mutability in both MDD and Dysthymia.

However, the strongest predictor of the mutability rating was category validity (correlation coefficient of 0.74 and 0.69 for MDD and Dysthymia, respectively)[4]. The correlation between mutability and category validity was statistically higher than the correlation between mutability and causal centrality for both disorders (MDD: $t(31) = 3.87$, $p < 0.001$; Dysthymia: $t(31) = 3.32$, $p < .005$). Likewise, for MDD the correlation between mutability and category validity was significantly higher than the correlation between mutability and diagnosticity, $t(31) = 3.56$, $p < 0.002$. For Dysthymia this correlation of mutability and category validity was marginally higher than the correlation between mutability and diagnosticity, $t(31) = 1.94$, $p = .061$.

Discussion

We measured conceptual centrality of features by asking clinicians to judge ease of imagining removal of a feature in the concept of a mental disorder (e.g., Ahn et al., 2000; Medin & Shoben, 1988). Using this task, we found that features that clinicians spontaneously generated vary a great deal in terms of conceptual centrality. Even among the features that the DSM-IV explicitly gives equal weight, significant differences in conceptual centrality were found. Three potential determinants for feature centrality were considered: causal centrality, diagnosticity, and category validity.

Effect of Causal Theories

To examine the role of causal theories, we measured clinicians' causal theories about these disorders and derived the centrality of a feature within their own theories. It was hypothesized that a feature that many features depend on would be more conceptually central than a feature that only a few or no features depend on. As in previous studies (e.g., Kim & Ahn, 2002; Sloman et al., 1998), the current study found positive correlations between causal centrality and mutability, which although statistically different from 0, were fairly low: 0.20 for MDD and 0.17 for Dysthymia. These correlations appear to be weaker than those found in previous studies. We will discuss the reasons below.

The effect of causal centrality on mutability found in the current study appears weaker than that found in Kim and Ahn (2002), who measured similar kinds of correlations in clinicians' concepts of MDD. In their study, they used 26 features for Major Depressive Episode that were taken from the DSM-IV (both criterion and texts), rather than generated by clinicians. For MDD, they found correlations much higher than what was obtained in the current study (e.g., $r = 0.43$ in their Experiment 2). One critical difference between Kim and Ahn and our current study is that the current study utilized only the features that clinicians spontaneously recalled. The general consensus is that recalling a feature is more difficult than recognizing a feature (e.g., it is easier to agree that bears have a pancreas than to spontaneously recall "having a pancreas" as a feature of the category "bear"). Thus, our clinicians might have failed to report many less central features that are part of their concepts and theories. If so, the current study suffers from a truncated range problem where most of the features used were fairly salient and central ones to begin with.

Aside from the methodological details, both of these studies on mental disorders confirm that the effect of theories in the domain of mental disorders seems only moderate. For instance, the correlations between causal centrality and mutability found in the current study (0.20 and 0.17) markedly contrast with the correlation of 0.72 found in Sloman et al. (1998) for lay people on everyday objects. Why is the effect of causal centrality more prominent in laypeople's concepts of everyday objects than in clinicians' concepts of mental disorders?

One possible reason is that clinicians might be less confident in their theories about mental disorders than lay people are about everyday objects. For instance, laypeople's theories include such straightforward knowledge as, people eat apples because they are sweet, or chairs are comfortable because they have backs. For mental disorders, theories might not be as definite. It is the current ambiguity in the theoretical relations between features of mental disorders that is the very reason why the DSM-IV avoids utilizing theories. Indeed, Kim and Ahn (2002) also found that clinicians' self-ratings of familiarity with disorders correlated with the extent to which their causal theories influenced feature centrality. Thus, although clinicians' theories somewhat influence feature centrality, the extent of influence

[4] All of the following correlation t-tests were completed utilizing Hotelling's t-test for correlated correlations within a population.

might be limited by clinicians' lack of confidence in their own causal theories.

Another possibility is that the levels of categories used in the current study might not be as basic as in Sloman et al.'s (1998) study. That is, although MDD and Dysthymia are diagnostic categories in the DSM-IV, they might not be basic level concepts to clinicians; instead, they might believe in sub-types of MDD or Dysthymia. This is consistent with an anecdotal observation from Kim and Ahn's (2002) study where a clinician complained that drawing these theories is not that feasible because there are too many different kinds of a given disorder, each varying in how the symptoms are related. For instance, there might be different types of Borderline Personality Disorder depending on different causal mechanisms. Thus, the theories that are measured in the current study might have been at a level too abstract to have any strong or specific influence. What count as basic level categories in the domain of mental disorders deserve further research.

Effect of Category Validity

The most notable results of the current study are the findings that category validity of features predicted feature centrality more than any other determinants. The correlation found (0.74) is comparable to Sloman et al.'s (1998) results (0.66) on a similar measure for laypeople's concepts of everyday objects.

As discussed in the introduction, a prevalent feature does not have to be immutable. Tires are black but we can easily mutate this feature and imagine a tire that is not black. Watermelons are round or oval, but we can conceive that one might develop an oddly shaped watermelon without having to change other aspects of a watermelon -- indeed Japanese farmers have produced cube watermelons (to maximize space efficiency in refrigerators). As indicated by these examples, a prevalent feature can be mutable presumably because it does not play a central role in our theory about that object; for instance, there are reasons why tires have to be round but there is no specific reason why tires have to be black beyond conventional reasons.

Although category validity generally does not have to be correlated with immutability, our results show that they are closely related in clinician's conceptions of MDD and Dysthymia. What this suggests is that clinicians may have more statistical, and less theoretical, concepts of mental disorders. If one were uncertain that his/her causal theory of a mental disorder is valid, it probably would be a more suitable strategy to rely on base rates of features within a target patient population in order to determine importance of features.

Given such a strong influence of category validity, it would be imperative to further examine whether clinicians' estimates of category validity of features are accurate. If, as our findings suggest, clinicians draw heavily on their sense of category validity in weighing information for the purpose of diagnosis, any misconceptions about category validity will have important clinical applications.

Conclusion

The two most notable results of the current study are that the effect of causal theories is weaker with mental disorders than with everyday objects, and that category validity influenced feature centrality most in clinicians' concepts of mental disorders. These results demonstrate boundary conditions for the effect of causal theories and prompt future research to specifically target the underlying mechanisms of theory influence. They also provide useful data for improving clinical training.

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