A Model of Cognitive Structure: A Preliminary Sketch*

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In response to an event in the environment, a person forms a cognitive field, consisting of one dominant cognitive unit (cognitive theme) and supplementary cognitive units (cognitive elements). Relations between the cognitive theme and cognitive elements may be seen in terms of both compatibility and distance, and salience of such a relation is obtained by dividing the degree of compatibility by the degree of distance. Balance of a cognitive field is based on the sum of the salience of the relation between the cognitive theme and each cognitive element, and various degrees of balance can be thus expressed. Eight hypotheses on imbalance reduction are stated.

There are rather many models and model-like ideas in the area of cognitive structure and attitude change in contemporary social psychology. However, it appears that relatively little attention has been paid to the degree of a positive or negative relation between cognitive units, and in fact, this is one of the weak points in Heider's model (1958) which has been consistently criticized (see, e.g., Kiesler, Collins, & Miller, 1969, p. 189; Shaw & Costanzo, 1970, pp. 192–193). The purpose of this paper is to sketch a model in which the degree of the relation between cognitive units is considered. In addition, the factor of psychological distance between cognitive units is also taken into account. On the whole, the model is within the category of "naive" psychology, in the sense that a person's cognition of his environment is the basis of the model.

Cognitive theme

Through socialization and enculturation, a person acquires a large number of cognitive units. These cognitive units are based on various concepts about his environment. To learn about the environment is to acquire a large number of concepts about it in order to deal with it properly. By utilizing a large number of concepts about the environment, a person acquires a large number of cognitive units, and these cognitive units become the basis of his behavior in response to his environment.

However, the majority of a person's cognitive units is dormant most of the time. In order to deal with his environment at a particular time, a person does not need all of them. The relationship between a person and his environment may be seen as a series of cognitive responses through time. In response to some specific event around him, he utilizes a small number of cognitive units and forms a cognitive structure in order to deal with that particular event. Only a small number of cognitive units are relevant to a particular event in the environment, and only these cognitive units are mobilized for that purpose. This is essentially the problem of what Zajonc (1960) calls "cognitive tuning".

When a person recognizes some particular event in his environment, not all of the cognitive units mobilized in response to it have the same significance and relevance to it. For example, when a person listens to a piece of music on the radio, he may have the following cognitive units: (a) there are a solo violin and an orchestra, (b) the soloist plays well, (c) the conductor is mediocre, (d) the acoustic condition is poor, etc. But above all, he may strongly dislike this particular composition and the cognitive unit

that I do not like it at all may become most salient among the cognitive units and predominate his response toward it. The immediate consequence may be to turn off the radio. Similarly, if a person sees a grizzly bear not in a zoo but in a mountain, his predominant concern may be to run away as fast as he can. Thus, at least in certain forms of cognition, it may be possible to assume that there is the most salient cognitive unit which predominates the cognitive structure. This most salient cognitive unit may be called "cognitive theme".

Definition 1: A cognitive theme is the most salient cognitive unit within the cognitive structure.

It may be mentioned that several psychologists and philosophers have discussed concepts similar to cognitive theme. Some examples are "organization" (Lewin, 1951), "hypothesis" (Postman, 1951, pp. 251–252), "theme" (Gurwitsch, 1966), and "conviction" (Ortega y Gasset, 1958), among others. The concept of cognitive theme is similar to them, but above all, it is characterized by its salience in the cognitive structure.

A cognitive theme may or may not entail a certain form of behavior. In both of the examples above, an overt behavioral consequence resulted from the cognitive theme. But in other cognitive structures, a person may merely maintain the cognitive theme without carrying out its meaning into action in an overt manner.

When the cognitive theme in a given cognitive structure is the most salient cognitive unit and is primary in role, the other cognitive units in the same cognitive structure are secondary in significance. These cognitive units are supplementary in nature and they are somehow subjectively related to the cognitive theme. These cognitive units may be called "cognitive elements".

Definition 2: A cognitive element is a cognitive unit within the cognitive structure which

is not the cognitive theme.

From Definitions 1 and 2, the cognitive field may be defined.

Definition 3: A cognitive field is made up of a cognitive theme and one or more cognitive elements.

A cognitive field is one form of cognitive structure in which the cognitive theme is present. It will become clear shortly that the cognitive field is somewhat analogous to what Abelson and Rosenberg call "conceptual arena" (1958), except that in the present work, a distinction is made between one dominant cognitive unit (cognitive theme) and the other cognitive units in the same cognitive structure (cognitive elements).

An important point to be emphasized is that the cognitive theme is the cognitive unit which is most relevant to the event in the environment toward which a person cognitively responds. Therefore, subjectively, the cognitive theme is the cognitive unit which is most salient to him. Among the cognitive units activated in response to an event, the cognitive theme is the one which he thinks is the most important, meaningful, or significant in that particular cognitive situation. The cognitive theme is basically "adjustive" in nature.

Figure 1 schematically shows a cognitive field, in which a cognitive theme and three cognitive elements are present.

If we use the example of a man seeing a grizzly bear in a mountain, the event in the
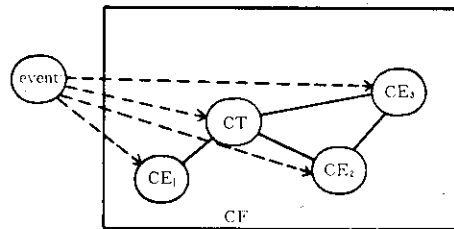
CF Cognitive field
CT Cognitive theme
CE Cognitive element

Fig. 1 An example of cognitive field.

environment is the appearance of a grizzly bear, and the cognitive theme (CT) is that I must run as fast as I can. One cognitive element is that it looks very big (CE_1), a second cognitive element is that it attacks man (CE_2), and a third cognitive element is that it looks hungry (CE_3). In this cognitive field, CE_2 and CE_3 are logically related (It looks hungry, therefore it may attack me), while CE_1 (It looks very big) is not especially related to either CE_2 or CE_3 as conceived by him spontaneously by seeing the grizzly bear. Among these four cognitive units, CT is most salient and he behaves in accordance with it: he runs.

According to the way the model is conceived, the mutual interrelationships between the cognitive theme and the cognitive elements as well as between the cognitive elements can be the most important point of the model. In Heider's model and certain other models influenced by his thought, these relationships are mostly either plus or minus, positive or negative and so on, and if one wishes to improve this aspect of the "balance" model, there may be several ways of doing it. In the present paper, two kinds of relations between cognitive units are recognized, and the gradation of each of these two relations is considered. They are (a) compatibility, and (b) distance.

Compatibility

When a person thinks of two cognitive units in a given cognitive field, he may be able to recognize the degree of compatibility between them. This may deal with two cognitive elements, or the cognitive theme and a cognitive element. A person may think that the relationship between two cognitive units is very compatible, neither compatible nor incompatible, or very incompatible. As long as a person can cognize various relations among the cognitive units in the cognitive field in terms of the degree of compatibility, then, it is theoretically possible for him to rate every pair of cognitive units on a unidimensional scale of, say, seven points,
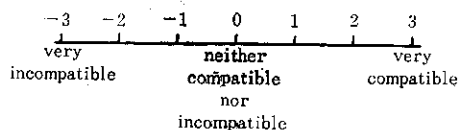

Fig. 2 A scale for compatibility between cognitive units.

ranging from "very compatible" on the one end to "very incompatible" on the other, as shown in Figure 2. The scale values range from 3 to -3 in this example.

Definition 4: Compatibility refers to the extent to which two cognitive units in a person's cognitive field are consistent toward each other as seen by him.

To be a little more specific, two cognitive units can be compatible or incompatible in a variety of ways. From the standpoint of "naive" psychology, the following bases of determining the degree of compatibility may be arbitrarily recognized: (a) emotive, (b) logical, (c) empirical, and (d) cultural. These categorizations are certainly awkward, but in our everyday thinking, these bases may have some meaning. For example, when a person cognizes that two people hate each other very strongly, he may rate this relation as very incompatible. In this case, the emotive factor is the basis of determining the degree of compatibility. A person may rate the relation between communism and capitalism as very incompatible, when he thinks that the ideology of capitalism is logically not compatible with that of communism. Similarly, if a man goes to church every Sunday and talks about his church to people around him, he and his church are likely to be seen as very compatible on the empirical ground. Finally, in societies in which the institutionalized system of brother-sister avoidance is practiced, brother and sister may possibly be seen as incompatible, but in other societies, they are likely to be rated in a compatible way. It should be added that a person may not necessarily think of a relation in terms of one of these bases

consciously, nor all people may cognize the relation between given two cognitive units on the same basis. In our daily lives, we appear to cognize the relation between two cognitive units in terms of one or more of these bases and one of them is more important than the other.

Distance

In a person's cognitive field, not only the degree of compatibility, but also the degree of psychological distance between the cognitive units as perceived by him may be of interest to the psychologist. As in the case of compatibility, distance may be cognized between two cognitive elements or the cognitive theme and a cognitive element. A person may think that two cognitive units are very close or very distant to each other, or he may think that they are neither close nor distant to each other. This factor of psychological distance can also be rated by the subject on a unidimensional scale of seven points, ranging from "very distant" to "very close" with the point of "neither close nor distant" in between, as shown in Figure 3. The scale values range from 1 to 7.

> Definition 5: A distance refers to the extent to which two cognitive units are psychologically located toward each other in a person's cognitive field as seen by him.

As in the case of compatibility, a person may look at the degree of distance between two cognitive units in a variety of ways. It may be possible to recognize the following bases of determining it: (a) spatio-temporal, (b) cultural, and (c) functional. For example, to most people, t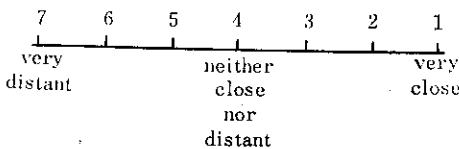he relationship between the ancient Romans and the contemporary Russians is very remote because of distance in time. To the members of a society in which the institutionalized system of avunculate is practiced, the distance between a male child and his mother's brother may be seen as very close because of their culture. To a student, President and Academic Vice-President of his university may appear close in distance because of the similarity in function each of them has in the university as an organization. As in the case of the cognition of compatibility, a person may not necessarily be aware of the basis he is using in judging the degree of distance between a given pair of cognitive units. A cognition of a relation may involve more than one basis of judgment, and one of them may be more important than the other.

Matrix

In this model, it is assumed that a cognitive field is made up of a cognitive theme and one or more cognitive elements, which are in one way or another related to each other. Since it is also assumed that the degrees of compatibility and of distance among these cognitive units can be taken into account, a matrix can be made up from such data. The cognitive theme and the cognitive elements are arranged both vertically and horizontally in such a matrix, and for each combination of two cognitive units,

Fig. 3 A scale for distance between cognitive units.

	CT	CE$_1$	CE$_2$	CE$_3$	CE$_4$
CT		2 / 4	-3 / 3	2 / 6	1 / 5
CE$_1$	2 / 4		1 / 2	0 / 7	2 / 3
CE$_2$	-3 / 3	1 / 2		-1 / 1	-2 / 6
CE$_3$	2 / 6	0 / 7	-1 / 4		0 / 5
CE$_4$	1 / 5	2 / 3	-2 / 6	0 / 5	

CT Cognitive theme
CE Cognitive element

Fig. 4 A hypothetical example of the matrix based on the compatibility and distance between the cognitive units.

two figures (one for compatibility, the other for distance) can be placed. It is assumed that a cognitive unit is very compatible with and very close to itself, and the diagonal cells are ignored for this reason. Figure 4 shows a hypothetical example of such a matrix.

In each cell, the figure on the upper left side represents the degree of compatibility, and the figure on the lower right side, the degree of distance.

It should be noted that, between two cognitive units, a certain degree of compatibility does not necessarily imply a certain degree of distance and vice versa. For example, a man and wife may be rated as very close in distance, but the degree of compatibility may be "very compatible" or "very incompatible", depending probably on the condition of marital adjustment. Similarly, India and Pakistan may be seen as "incompatible", but the rating of distance may be "close". This can vary from person to person.

Propositions

In order to utilize the approach in which the degrees of compatibility and of distance between cognitive units are taken into account, it is possible to examine the implication of these conditions within the same cognitive field. For the sake of a more efficient presentation, this can be achieved by means of a series of propositions. As it will be remembered, cognitive units as discussed in this paper are all in the same cognitive field which is organized as a structure in terms of a cognitive theme. For this reason, they are categorically similar to each other and two cognitive units may be very similar to each other to begin with. The propositions which follow apply to this specific situation, and they are not intended for any three units of cognition.

First, suppose there are two cognitive units, and the degree of compatibility between them is neutral. Since they are two separate cognitive units having a neutral relation with one another, they may or may not have the same re-

lation with a third cognitive unit. One of them may be very compatible with it, while the other may be very incompatible with it. Similarly, it is possible that the distance in one situation is close and in the other, very distant. Suppose, further, that these two cognitive units have become very compatible and finally in a person's mind, they are practically one cognitive unit. At this point, it is reasonable to assume that their relations with a third cognitive unit have become alike. Both the degree of compatibility and of distance in regard to a third cognitive unit are similar for them. For example, in a person's mind, if two politicians of the same political orientation appear to be very much the same in their speech and behavior, he is likely to assume that they would support or reject the same political issue similarly. When two politicians share the same vested interests, this tendency may be very clear. To take another example, if communists and socialists are seen as "the same thing" in a person's mind, these two cognitive units are likely to have the same relations with a third cognitive unit, such as revolution. To him, if communists and socialists are the same thing, both communists and socialists very strongly support revolution ("very compatible") and he may be afraid that they are just about to succeed in a revolution in his country ("very close").

As the degree of compatibility between two cognitive units decreases, however, the relations with a third cognitive unit cannot be expected to be alike. If two politicians do not share the same vested interests, they may be seen to have two different views about the same political issue. Similarly, if a person thinks that communists agitate for revolution and socialists are against extreme radicalism such as revolution, the degree of compatibility is less than in the above example, and the distance between socialists and revolution is seen as greater than between communists and revolution. From these reasonings, Proposition 1 may be presented.

Proposition 1: The more compatible the two cognitive units, the more similar their relations with a third cognitive unit.

Since a relationship between any two cognitive units entails both the degrees of compatibility and of distance, Propositions 1-1 and 1-2 can be presented as the specifications of Proposition 1.

Proposition 1-1: The more compatible the two cognitive units, the more similar their distances toward a third cognitive unit.

Proposition 1-2: The more compatible the two cognitive units, the more similar their compatibilities with a third cognitive unit.

By definition, the cognitive theme is the most salient cognitive unit in the cognitive field. A person responds to a cognition of an event in his environment by activating certain concepts, from which a cognitive theme is formed in order to deal with the event. Some other cognitive units may also be formed supplementarily in connection with the cognitive theme. For this reason, the degree of salience for any cognitive element is based on the nature of relationship with the cognitive theme. When two cognitive elements are very much the same in regard to compatibility and distance toward the cognitive theme in the same cognitive field, it is reasonable to assume that they are also very much alike in regard to the degree of salience. Therefore, Proposition 1-3 may be stated.

Proposition 1-3: The more compatible the two cognitive elements, the more similar they become in salience in reference to the cognitive theme.

The relationship between the cognitive theme and a cognitive element can be seen in terms of the degree of compatibility between them. Since the cognitive theme is the most salient cognitive unit, when there is a cognitive element which is incompatible with it, the cognitive element exists as a disturbance to the validity of the cognitive theme. In a sense, the cognitive theme is an adaptive, economizing means to deal with a cognition of an event in the environment. If a person uses a proper cognitive unit as the cognitive theme, there may be no cognitive element in the cognitive field which is incompatible with it. In this case, the position of the cognitive theme is secure, so to speak, and no disturbance is felt to it. But when the choice of the cognitive theme is inadequate, there may be a disturbing cognitive element which is incompatible with it. Because of the salience of the cognitive theme, any incompatible relationship between the cognitive theme and a cognitive element is likely to become salient as a consequence. It is reasonable to assume that the degree of salience due to the incompatibility of this kind becomes greater as the degree of incompatibility increases. Therefore, Proposition 2 can be stated at this point.

Proposition 2: The more incompatible the cognitive theme and the cognitive element, the more salient the relation between them.

As regards the matter of distance between two cognitive units, the following observation may be made. When two cognitive units are seen to be compatible, and when they are seen to be very close, there is a tendency to look at them as very similar to each other. As the distance between them decreases, this tendency increases. In a person's mind, when there is very little or no distance between the two cognitive units, he may consider that they are practically the same. In such a situation, both the degrees of compatibilty and of distance toward a third cognitive unit are likely to be similar for these cognitive units. For example, if capitalist country A and capitalist country B begin to have very active contacts between them, a person may see this as two compatible countries becoming very close to each other. He may cognize that their attitudes toward a third country or a certain international issue is very much the same, as a consequence. To him, both

countries may show the same degree of involvement and interest in the third cognitive unit (similar distance) and they may also show the same degree of support or rejection toward it (similar degree of compatibilty). From this reasoning, Proposition 3 may be made.

Proposition 3: The closer the two cognitive units of a compatible relation, the more similar their relations with a third cognitive unit.

The specification of Proposition 3 results in Propositions 3–1 and 3–2.

Proposition 3–1: The closer the two cognitive units of a compatible relation, the more similar their distances toward a·third cognitive unit.

Proposition 3–2: The closer the two cognitive units of a compatible relation, the more similar their compatibilities with a third cognitive unit.

As in the case of Proposition 1–3, when two cognitive elements are very much the same in regard to compatibility and distance toward the other cognitive units in the same cognitive field, it is reasonable to assume that they are also similar in salience, which is based on the relationship with the cognitive theme. Proposition 3–3 is a third specification of Proposition 3.

Proposition 3–3: The closer the two cognitive elements of a compatible relation, the more similar they become in salience in reference to the cognitive theme.

Since, by definition, the cognitive theme is the most salient cognitive unit in the cognitive field, when the distance between the cognitive theme and a cognitive element varies, the salience of this relationship may be expected to vary accordingly. That is, if the distance between them is seen to be far apart, the existence of the cognitive element is insignificant to the cognitive theme, and as a consequence, the salience of the relationship is also low. But when these two cognitive units are seen to be very close,

the existence of the cognitive element is very salient to the cognitive theme, and the matter of how they are related to each other becomes very salient. This means that as the distance between the cognitive theme and a cognitive element decreases, the degree of compatibility between them becomes more salient.

For example, suppose that a composer has written a new opera which he thinks is his magnum opus and he is very satisfied with it. But at the première, the audience reacts negatively. His fellow musicians are not impressed by it. The critics write that the opera is a poor work and a failure. In this situation, the cognitive theme is based on his own evaluation of the opera when it was completed. After the première, both the reaction of the audience and the reviews by the critics are two cognitive elements which are incompatible with the cognitive theme. If the degree of compatibility with the cognitive theme is just about the same for these two incompatible cognitive elements, to most composers, the negative reviews by the critics are far more unbearable than the negative reaction of the audience. (Just think of Bizet!) This is because music critics as a category is far more closer to the evaluation of musical compositions than the music lovers as a category.

From Proposition 2, it is expected that this tendency becomes greater as incompatibility becomes greater. But the same principle is also likely to be seen when the cognitive theme and the cognitive element are compatible with each other. For example, when a politician expresses his idea against abortion, he may get reactions from various people in the street. A middle aged man may say that he strongly supports him. A 55-year-old woman may also say that she strongly supports him. A 23-year-old married woman may also say that she strongly supports him. In this case, if these three people express their support for him to an equal degree, the degree of compatibility between the cognitive theme (no abortion) and the three

cognitive elements (three people against abortion) may appear the same to him. But the fact that the 23-year-old married woman supports him may be more salient than that fact that the 55-year-old woman supports him. The degree of compatibility with her support, in turn, may be more salient than the degree of compatibility with the middle aged man's support. If that is the case, the difference in salience can be understood in terms of the difference in the perceived distance between the cognitive theme and the three cognitive elements. Thus, Proposition 4 may be stated from these reasonings.

Proposition 4: The closer the cognitive theme and the cognitive element, the more salient the relation between them.

When a person has a cognitive field in which the cognitive theme exists as the most salient cognitive unit, various situations are conceivable. There is the situation in which all the cognitive elements are compatible with the cognitive theme with different degrees of distance and compatibility. Because of the difference in these two factors, some of the cognitive elements may be more salient than the others. But since all of them are compatible with the cognitive theme, none of them disturbs the status of the cognitive theme as the most important cognitive unit activated in response to an event in the environment. Rather, when the relationship between the cognitive theme and a compatible cognitive element is salient, the existence of such a cognitive element can support the validity of the cognitive theme.

In contrast, however, when some of the cognitive elements are incompatible with the cognitive theme, and when the distance between the cognitive theme and such an incompatible cognitive element is very close, the fact of this incompatibility may become very salient. To a person, this is likely to create tension of some kind. Since the cognitive theme has been chosen by him, so to speak, in order to deal with a

cognition of an event in the environment as the most suitable and adequate cognitive unit, the salience of the relation between the cognitive theme and an incompatible cognitive element tells him that his choice of the cognitive theme was wrong. Probably it is too simplistic to say that an experience of such a relation necessarily creates an uncomfortable feeling in the mind, but it may be reasonable to assume that at least in most cases, a person in such a situation experiences a feeling of tension. When this feeling is reasonably strong and also unpleasant, he may be tempted to reduce it. Here is the familiar and in a sense dubious assumption underlying consistency theory. Probably this assumption can be accepted if this is considered as a tendency rather than the necessary consequence of an inconsistent experience.

Proposition 5: The greater the salience of an incompatible relation between the cognitive theme and the cognitive element, the greater the tendency to reduce it.

Balance and imbalance

The assumption of Proposition 5 almost automatically implies the problems of imbalance and imbalance reduction. First, balance may be defined as follows.

Definition 6: A balance is the degree of salience of one or more incompatible relations between the cognitive theme and one or more cognitive elements in the cognitive field.

The key point in this definition is the word "salience". To put it differently, a given condition of balance is based on the degree of salience of the relations between the cognitive theme and the incompatible cognitive elements. This means that balance is based on the extent of disturbance to the cognitive theme. And this also means that in order to understand the condition of balance, it is not only the degree of compatibility between the cognitive theme and the cognitive elements, but also the degree of

distance between them. Both the degrees of compatibility and of distance between the cognitive theme and the cognitive elements contribute to the degree of salience, which in turn becomes the basis of balance.

The salience of the relation between the cognitive theme and a given cognitive element may be expressed by Formula 1.

$$\text{Salience} = \frac{c}{d} \qquad (1)$$

where c refers to the degree of compatibility and d refers to the degree of distance between them. By using this formula, it is possible to compare various degree of salience. From Propositions 2 and 4, the following stipulation may be made. For any two values for the degree of salience, if they are both greater or both less than 0, their absolute values are taken, and the greater absolute value is considered to indicate more salience. In contrast, if one of them is greater than 0 and the other, less than 0, the latter is considered to indicate more salience. That is;

for S_a and S_b

if $S_a < 0$ and $S_b < 0$ or $S_a > 0$ and $S_b > 0$
and if $|S_a| > |S_b|$, $S_a > S_b$;
if $S_a > 0$ and $S_b < 0$, $S_a < S_b$ $\qquad (2)$

where S_a and S_b signify two conditions of salience. This may deal with the relation between the cognitive theme and a cognitive element at two different points in time, or the relations between the cognitive theme and two different cognitive elements at a particular point in time.

It should be noted that according to this definition of balance, the degrees of compatibility and of distance between the cognitive elements are not taken into account. This is because of the assumption of the cognitive theme. A cognitive theme is the most important cognitive response to an event in the environment, and the subjective validity of the cognitive theme and its verification are the basis of balance. The validity of the cognitive theme is verified or rejected by the cognitive elements in the same

cognitive field. Balance refers to this situation in this paper. Therefore, the relations between cognitive elements without involving the cognitive theme are not relevant to the problem of balance.

Formula 3 is the formal definition of balance.

$$\text{Balance} = \frac{\sum_{i=1}^{m} \frac{c'_i}{d'_i}}{a \cdot m} - \frac{\sum_{i=1}^{(n-m)} \frac{c''_i}{d''_i}}{b(n-m)} \qquad (3)$$

where

n signifies the total number of the cognitive elements;

m signifies the total number of the cognitive elements that are compatible with the cognitive theme;

c' signifies the degree of compatibility between the cognitive theme and a cognitive element compatible with it;

c'' signifies the degree of compatibility between the cognitive theme and a cognitive element incompatible with it;

d' signifies the distance between the cognitive theme and a cognitive element compatible with it;

d'' signifies the distance between the cognitive theme and a cognitive element incompatible with it;

a signifies the maximum value for compatibility; and

b signifies the minimum value for compatibility (i.e., the maximum value of incompatibility).

The first term of Formula 3 indicates the extent to which the compatible cognitive elements are salient in reference to the cognitive theme, and the second term indicates the extent to which the incompatible cognitive elements are salient in reference to the cognitive theme. For each relation between the cognitive theme and the cognitive elements, the degree of compatibility is divided by the degree of distance in order to take both factors into account. This is in accordance with the formula for salience (Formula 1). The denominators of both terms

indicate the maximum value of positive or negative salience, respectively.

Formula 3 can indicate to what extent a given cognitive field is balanced or unbalanced. If the value of 0 for the degree of compatibility and the value of 4 for the degree of distance are chosen as the neutral points (refer Figures 2 and 3), the value of 0 is obtained because both terms vanish by this operation. Therefore:

$$\text{balance} > 0, \text{ and unbalanced} < 0. \qquad (4)$$

Similarly, the range of the values can be known from the two extreme values of balanced and unbalanced conditions. On the one hand, there is the situation in which all of the relations between the cognitive theme and the cognitive elements are very compatible and very close, and on the other, there is the situation in which all of the relations between them are very incompatible and very close. If the values of 3 and 1 for the first situation and -3 and 1 for the second are used for compatibility and distance (refer Figures 2 and 3), the values of 1 and -1 are obtained. Therefore:

$$1 \geq \text{balance} \geq -1. \qquad (5)$$

Imbalance reduction

Since the degree of balance is based on the degree of salience of the relations between the cognitive theme and the cognitive elements, a reduction of imbalance can be achieved by reducing the salience of incompatible relations. According to Proposition 5, the tendency to reduce imbalance is greatest for the relation between the cognitive theme and the most salient incompatible cognitive element. This can be achieved by increasing the degree of compatibility (from Proposition 2) or by increasing the distance between them (from Proposition 4). These reasonings can be expressed as Hypotheses 1 and 2.

Hypothesis 1: Imbalance is reduced if the cognitive theme and the most salient incompatible cognitive element become more compatible with each other (from Propositions 2
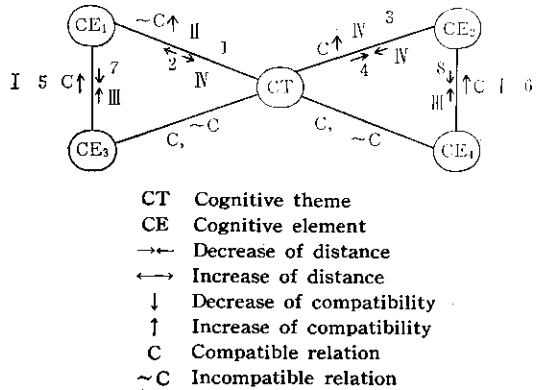

CT   Cognitive theme
CE   Cognitive element
→←   Decrease of distance
←→   Increase of distance
↓   Decrease of compatibility
↑   Increase of compatibility
C   Compatible relation
~C   Incompatible relation

Fig. 5 The modes of imbalance reduction. The roman numerals signify relevant Propositions, and the arabic numerals, relevant Hypotheses.

and 5).

Hypothesis 2: Imbalance is reduced if the cognitive theme and the most salient incompatible cognitive element become more distant toward each other (from Propositions 4, and 5).

Figure 5 schematically shows these possibilities, in which CT and CE_1 signify the cognitive theme and the most salient incompatible cognitive element respectively.

In order to reduce imbalance, furthermore, it is also possible to improve the relation between the cognitive theme and the most salient compatible cognitive element (CE_2 in Figure 5) even further. If the salience of the relation between them is increased, by definition, imbalance is reduced (Formula 3).

Hypothesis 3: Imbalance is reduced if the cognitive theme and the most salient compatible cognitive element become more compatible with each other (from Proposition 4).

Hypothesis 4: Imbalance is reduced if the cognitive theme and the most salient compatible cognitive element become closer to each other (from Proposition 4).

Thus, in order to reduce imbalance, there are four possibilities by changing the relations between the cognitive theme (CT) and the most

salient incompatible cognitive element (CE_1) on the one hand, and the cognitive theme (CT) and the most salient compatible cognitive element (CE_2) on the other.

In addition, it is also possible to reduce imbalance indirectly. According to Proposition 1, if two cognitive units become more compatible with each other, their relations with a third cognitive unit become similar to each other. More specifically, Proposition 1-3 says that the degree of salience for two cognitive elements in such a situation become similar to each other.

In order to reduce imbalance in this case, there are two possibilities, depending on the nature of the relationship between the cognitive theme and one of the two cognitive elements which is more salient. If this relation is incompatible, imbalance is reduced when this cognitive element (CE_1) changes and becomes similar to the other cognitive element (CE_3) which has a less salient incompatible relation or a compatible relation with the cognitive theme. In contrast, if this relation is compatible, imbalance is reduced when this cognitive element (CE_2) remains as it is, and the other cognitive element (CE_4) which has a less salient compatible relation or an incompatible relation with the cognitive theme changes and becomes similar to it. In terms of the effectiveness of imbalance reduction, it is reasonable to assume that the most salient incompatible cognitive element and the most salient compatible cognitive element are to be dealt with in these cases. Therefore, Hypotheses 5 and 6 may be stated.

Hypothesis 5: Imbalance is reduced if the most salient incompatible cognitive element becomes more compatible with and similar to the cognitive element, which is most compatible with it and has a less salient incompatible relation or a compatible relation with the cognitive theme (from Proposition 1).

Hypothesis 6: Imbalance is reduced if the cognitive element, which is most compatible with the most salient compatible cognitive element and has a less salient compatible relation or an incompatible relation with the cognitive theme, becomes more compatible with and similar to the most salient compatible cognitive element (from Proposition 1).

A similar reasoning can be made from Proposition 3. According to this proposition, if two cognitive units of a compatible relation become closer to each other, their relations with a third cognitive unit become similar to each other. More specifically, Proposition 3-3 says that the degrees of salience for two cognitive elements in such a situation become similar to each other.

As in the case of Proposition 1 and Hypotheses 5 and 6 derived from it, there are two possibilities of imbalance reduction, depending on the nature of the relationship between the cognitive theme and one of the two cognitive elements which is more salient. If this relation is incompatible, imbalance is reduced when this cognitive element (CE_1) changes and becomes similar to the other cognitive element (CE_3) which has a less salient incompatible relation or a compatible relation with the cognitive theme. On the other hand, if this relation is compatible, imbalance is reduced when this cognitive element (CE_2) remains as it is, and the other cognitive element (CE_4) which has a less salient compatible relation or an incompatible relation with the cognitive theme changes and becomes similar to it. In terms of the effectiveness of imbalance reduction, it is reasonable to assume that the most salient incompatible cognitive element and the most salient compatible cognitive element are to be dealt with in these cases.

Hypothesis 7: Imbalance is reduced if the most salient incompatible cognitive element becomes closer and similar to the cognitive element, which is compatible with and closest to it and has a less salient incompatible re-

lation or a compatible relation with the cognitive theme (from Proposition 3).

Hypothesis 8: Imbalance is reduced if the cognitive element, which is compatible with and closest to the most salient compatible cognitive element and has a less salient compatible relation or an incompatible relation with the cognitive theme, becomes closer and similar to the most salient compatible cognitive element (from Proposition 3).

The four cognitive elements in the above hypotheses (CE_1, CE_2, CE_3, and CE_4) can be easily located by examining the matrix. The order of imbalance reduction among these means is based on the degree of salience, in which a salience of a negative value precedes a salience of a positive value, and if all the relations between the cognitive theme and the cognitive elements are of the same positive or negative category, the salience of a larger absolute value precedes the other (Formula 2 from Propositions 2 and 4).

Discussion and conclusion

According to Heider's model and certain other models of cognitive structure influenced by his thought, imbalance reduction is achieved by changing the cognition of the relation between cognitive units from a positive to a negative or vice versa. But in reality, it may be often very difficult to change one's cognition in such a drastic manner. Rather, a change of the cognition in the degree of a positive or negative relation is more likely to occur in most cases.

Furthermore, one is sometimes unable to change the cognition of one's environment at all. Yet, after a passage of time, one may feel less unbalanced even when the same unbalanced cognitive structure is reproduced in one's mind. A possible explanation is that, after a passage of time, the psychological distance between the cognitive theme and the incompatible cognitive element is increased, and one feels a smaller amount of disturbance from the same incompatible cognitive element. One also leaves the environment where an unpleasant experience is felt and moves to a distant place and feels better. Thus, at least an increase in space or time may have something to do with a decrease in imbalance.

This phenomenon is reflected in many cultures, including the cultures in Northwestern Europe and North America. For example, in the English language, people say that they want to "get away" from something they dislike. Two people may become "close" friends when they like each other. The technique of utilizing space and distance properly in interhuman relations is a highly important art in many cultures (see, e.g., Fast, 1970). These considerations imply that the factor of psychological distance may be culturally recognized and utilized, and that imbalance reduction is highly relevant to it.

Needless to say, the problem of psychological distance is familiar in social psychology and psychology. William James discussed various degrees of distance from the pure ego to different parts of the self (1890, Ch. 10). G. H. Mead discussed the distance to various objects in explaining his concept of "manipulatory area" (1932, pp. 124 ff.). Alfred Schutz emphasized the importance of distance in the "social world" in terms of the past, the present, and the future (1964). It appears quite reasonable, then, to utilize the concept of distance in understanding a person's cognitive structure.

In this paper, only the problem of balance has been discussed. But other important problems of cognitive structure such as unity, organization, differentiation, and complexity (cf. e.g., Lewin, 1951; Zajonc, 1960) can be examined similarly by considering the degree of psychological distance as well as the degree of compatibility between cognitive units. It may also be possible to use the same approach in studying interhuman relations, in which people, instead of cognitive units, make up the structure.

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