Q Methodology and Control Theory: II. General Considerations

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ABSTRACT: The principles of control theory are presented, and their connection to Q methodology is described. The perceptual prerequisites of the Q-sorting task are considered, and the perceptual levels of control theory are related to the selection of Q statements and conditions of instruction, and to the interpretation of factors. The conclusion is reached that control theory has advantages over the quantum and interbehavior theories often associated with Q methodology.

I use Q methodology and control theory in my practice of psychology. In the past, I have presented a case study, the case of Tom (Goldstein, 1989), which illustrated the way these two approaches can work together. The purpose of the present article is to follow-up on the case study in order to emphasize some general points.

Following a brief introduction of control theory for those who may be unfamiliar with it, attention will turn to the ways

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in which control theory can contribute to Q methodology during the research process. Finally, research method and theory style comparisons between the creators of control theory and Q methodology will be discussed.

Introduction to Control Theory

General Concepts

Control theory (Powers, 1973; Powers, 1989; Robertson & Powers, 1990) is a complete theory of human beings. The general theme is that persons in all situations, including the Q-sort task, can be understood as functioning to control selected perceptions by means of adjusting actions.

What does the following statement mean? *Person X is perceiving a stimulus.* In control theory, this means that person X is having physical energy inputs into his/her nervous system which are transformed into nervous system activity in sensory pathways (perceptual signals). Note that whether a person is aware of the perceptual signals or not is irrelevant to this definition of perception. In control theory, the meaning of the term "perception" is much broader than in other theories, and, as will be seen later, includes the meaning of the more traditional concepts of sensation, perception, and cognition.

All perceptual signals which result from a stimulus constitute the person's perceptions of the stimulus. It is one of the novel features of control theory to point out that these perceptual signals are not independent of the person's own actions: For every perception, there is a contribution from the person's actions as well as from the environment. For example, the perception of a food might change depending on how a person chews the food; the perception of a book might change with the way a person reads it. The objective stimulus stays the same, but the perception changes because a person's actions on the stimulus change.

At any given moment, some of the perceptual signals occurring within a person are being controlled and some are not. To control a perception means that the perception will

be stabilized at some preferred value, called the reference signal, which is stored in memory. A reference signal is the way the person wants the perceptual signal to be. When a perception is under control, it is matching the reference signal exactly. That is what "under control" means.

The environment changes in unexpected ways which disturbs the perception, namely, makes it deviate from the preferred value. When the perceptual and reference signal are not the same, an error signal is said to exist. In order to keep the perception stabilized, an action change is produced by the person which counteracts the perceptual impact of the distrubance and reduces the error signal to zero.

Perception Concepts

The control theory view is that any particular perception is part of a hierarchy of perceptions. Any particular perception is a combination of several lower level perceptions and is qualitatively different in kind from the lower level perceptions. There is a many-to-one relationship between a perception and the lower level perceptions which comprise it. Any particular perception can be a building block for a higher level perception; it is the means by which a higher level perception forms. Given this hierarchy, the time required to form a perception is a direct function of the level of perception. Asking *how* any particular perception is achieved requires reference to lower level perceptions. Asking *why* one wants to achieve a particular perception demands reference to higher level perceptions.

The current version of control theory includes 11 hierarchical levels of perception. It is necessary to go over the meanings of these levels in order to set the stage for understanding what perceptual abilities are involved in Q-sorting tasks from a control theory view. To illustrate: Imagine that you are taking a walk in your neighborhood. If you chose to become aware at the configuration level of perception (3rd level), then you would see objects of different kinds as you walked -- a specific car, tree, dog, house, sound, smell, etc. If

you paid attention to the sensation level (2nd level), then you would notice the properties which make up the objects such as color, shape, size, texture. If you paid attention at the intensity level (1st level), you would note that some stimuli seemed stronger than others and that you often would attend to the strongest source of stimulation. Tuning into the transition level (4th level), you become aware of small changes over time. For example, you may note that the illumination changes, the leaves move, etc. At the event level (5th level), you start to perceive familiar happenings, such as a person *walking*, a bird *chirping*, the wind *blowing*. At the 6th level of relationships, you see connections between two lower level perceptions, such as a car *on* the street, people *in* a car. When you let yourself notice the category level (7th level), groupings of perceptions occur: a flock of birds, General Motors cars, pine trees, etc. Going up to the sequence (8th) level, you note things such as the sequence of left, right, left, right; the sequence of the streets that you follow during the walk. At the program level (9th level), you become aware of if/then perceptions, such as: If it rains, then I take an umbrella on the walk; if it is Wednesday or Saturday, then people put out their garbage. At the 10th level of principles, you note the reasons for your taking the walk: to be physically healthy, to meditate, to be social. At the 11th level of systems one notes: taking a walk is consistent with my self image; taking a walk is consistent with my family tradition.

A person is not aware of all of the levels of perception at a given moment. The "law of awareness" in control theory refers to the idea that a person is not aware of levels of perception at or above the level from which the person is choosing reference signals. A person's awareness is typically drawn to those control systems which deviate from the preferred value.

Communication and Language Concepts

The meaning of a verbal statement is defined as the set of nonverbal perceptions evoked from memory by the verbal statement (Powers, 1977). Nonverbal perceptions can occur

at various perceptual levels, and meaning exists at each perceptual level, not just at the higher ones. Powers hypothesizes that any perception can become the meaning of any other perception of equal or lower level. Thus, to determine the meaning of a perception, one looks upward or at the same level in the perceptual hierarchy, not down.

When communicating with another person, the communicator compares the meaning suggested by his/her verbal statement to the intended meaning. A mismatch in the suggested and intended meaning results in the communicator changing something about the verbal statement. If the communicator becomes aware that the other person does not understand, he or she may paraphrase. For example, consider the statements: (1) The dog is to the left of the cat. (2) The cat is to the right of the dog. Statements (1) and (2) are the same at the level of relationships. However, they are different at the level of transitions.

Control Theory Applications in Q Methodology

Task Analysis of Q Sorting

Stephenson has not provided us with a task analysis of Q sorting; in this discussion, therefore, I will provide a partial analysis from the viewpoint of control theory. I will try to identify the perceptual and memory abilities needed to do the Q-sort task, but will not actually propose a full model of it. Other than Stephenson (1953), the major reference for Q methodology which I use is Brown (1980).

What are the minimum perceptual abilities a person must have in order to perform a Q sort? The person must be able to perceive each of the items, the general task instructions and the specific conditions of instructions.

The perceptual abilities required to perceive an item vary depending on the item. In the simplest possible case, the items might vary at the intensity level; e.g., sounds of different loudnesses. If a person could not reliably discriminate the sound items then that person could not do the Q sorting.

Thus, the nature of the items can be reduced to the lowest levels of perception. One could imagine a young child being able to meet this requirement; thus, this does not seem to be a major obstacle to performing a Q sort.

The general task in Q sorting involves rank ordering the items, which requires that a person be able to operate at the sequence level of perception. In English, we have grammatical signals to suggest sequence concepts; for example, big boy, bigger boy, biggest boy. When these signals are understood, the Q sorter probably has the necessary sequence concept. Even before these grammatical signals are acquired, children have the idea of more of/less of something and evidence of these concepts appears in the words they use. Most normal developing two and three year olds have the necessary ability to function at the sequence level of perception demanded by the general task instructions; thus, this is not a major obstacle to doing a Q-sort.

The condition of instruction specifies the way in which a person is supposed to rank order the items, and the perceptual abilities required will vary depending on the level of perception on which the person is asked to operate. One can imagine the conditions of instruction varying from system level to sensation level perceptions.

From the above considerations of the simplest possible Q-sorting task, it seems that the task instruction is the major perceptual ability limitation and places the minimum ability at the sequence level of perception. The other requirements can be reduced to lower levels, but the general task requirement cannot. Thus, the youngest person who can be expected to be able to Q sort is one who can function at the sequence level of perception, typically normal two and three year olds. Stephenson (1980, pp. 24-26) has already provided a brief study of a four year old (using a Q sample of 18 postcard portraits of children as drawn by children) and nowhere indicates that this age represents a lower threshold.

The condition of instruction can be thought of as the reference signal which is stored in memory, and each item can be thought of as the perceptual signal. A person compares the

two signals and an error signal is calculated. The error signals associated with the items can be ordered from large-negative through zero to large-positive. Large-negative or large-positive error signals mean dissimilarity. Error signals closer to zero mean similarity.

Feeling states will be related to the error signals depending on the nature of the reference signal. If the reference signal is associated with a negative feeling, then zero error signal items will be maximally negative and deviations from it will be decreasingly negative, then no feeling, then increasingly positive in feeling.

If the reference signal is associated with a positive feeling, then zero error signals will be maximally positive, and deviations from it will be decreasingly positive, then no feeling, then increasingly negative in feeling.

When a person is Q sorting a set of items, the error signals are calculated and remembered, and then the person rank-orders the items according to the error signals. The ability of the person to remember is obviously involved in Q sorting, but not often discussed. The short-term memory literature yields the generalization that the largest sequence of unrelated items a person can remember after a single exposure varies with chronological age: 3-4 year olds, for example, can recall a two-item sequence, 5-6 year olds a three-item sequence; by age 13-14, a seven-item sequence (the adult capacity) can be recalled.

These kinds of considerations have implications for Q sorting. One is that a normal child of age 3 or 4 is at the lower end of the age scale of people who could do Q sorts. Memory factors seem to play a more limiting role than perceptual factors in suggesting this conclusion. Secondly, it would be wise to come up with a rank-ordering procedure which takes into account the importance of memory factors. Fortunately, this has already been accomplished by the procedure of conceptual ranking (Chignell & Patty, 1987; Chignell & Goldstein, 1990).

Selection of Items and Conditions of Instruction

The items in a Q-methodology study are typically selected after the topic of conversation is chosen. In control theory terms, the topic is at the category level of perception. All the items are things that someone might possibly say about the selected topic.

The selection of items is on the same topic, and this is necessarily so since it would not be terribly interesting to discover that the different factors which emerged were related to the fact that they represented different topics. The aim of Q methodology is to study higher level perceptions than the category level. In order to do this, the items are kept the same with respect to the topic category.

In the analysis of the Q-sort task, as noted previously, the items can be thought of as perceptual signals and the condition of instruction as a reference signal, and this statement has several implications for the selection of items and conditions of instruction.

Recall that in control theory, combinations of perceptual signals from a lower level result in a new perceptual signal at the next higher level. What does this imply for a Q-methodological study? One implication is that factors may be related to linear combinations of items in the Q sample as a higher level perception is related to combinations of the next lower level perception. If the level of the items in the Q sample were at the principle level, for example, one would be expecting the factors to be at the systems level. If the level of the items in the Q sample were at the program level, one would be expecting the factors to be at the principle level. This implication is testable.

A second implication has to do with the condition of instruction, which should be at the same or higher level of perception than the items. If the items are at the program level, then the condition of instruction should be at least at the program level. If the items are at the principle level, then the conditions of instruction should be at least at the principle

level. Why should one select conditions of instruction in this way? Recall that the meaning of any perception in control theory must be at the same or higher level. Q methodologists know this intuitively.

In Q methodology, the condition of instruction is the way that the researcher can introduce theory-based hypotheses. In the case study of Tom (Goldstein, 1989), I could have introduced the following conditions of instruction which have a control theory flavor to them: (a) Show me, via the Q sort, which personal characteristics individual X would try to maintain if they started to change. (b) Show me which characteristics person X would have to change in order to reach goal Y. (c) If person X engaged in action Z, what personal characteristics would come into prominence?

The condition of instruction provides a context within which a person is to rank-order the items. If a person cannot take the point of view specified by the condition of instruction, then the rank-ordering cannot be done. If the condition of instruction is a perception which the person has experienced, then this experience has to be remembered. If the condition of instruction is a perception which the person has not experienced, then this requires the perception to be imagined -- i.e., created through the synthesis of stored perceptions. In control theory, remembering or imagining is called *operating in the imagination mode.* The person seems to possess the capacity for if/then thinking which is at the program level of perception. Most normal developing preschoolers display this kind of mental activity when they engage in imaginary or role play.

One of the laws of Q methodology is James' Law (Stephenson, 1980, pp. 22-23): some of the factors are *me,* the others are *mine.* In control theory, the system level is where a person's self-image has been theorized to exist (Robertson et al., 1987). There are other system level concepts: the family image, the country image, the image of the world as seen in physics, the image of the way our economy works, the image of control theory as well as other theories, etc. Perhaps when the self image is involved in Q sorting, that is the *me* factor.

When the other system concepts are involved in the Q sort, that is the *mine* factor. The difference is that the self image is unique to the person and is the way that the person discriminates inside-me from outside-me activities. If a voice comes from the self system, then the voice is me; if a voice comes from a non-self system, then it appears to be a different person. People with multiple-self systems (multiple personality disorder) perceive voices as being inside their head, whereas people with schizophrenia hear voices as coming from outside them.

The other system level concepts are not tied to the self system concept and therefore seem to be "objective" and to come from outside the person; however, both are perceptions which a person has at the system level.

Interpretation of Factors

In Q methodology, interpretation is typically based on examining the specific Q sorts which load on a factor, and by examining the ordering of the items from the most extreme to the middle to the other extreme. The person who produces the Q sorts is often shown the results, and reactions or commentary are obtained.

The ideas associated with control theory can be related to the interpretation of factors. The ordering of items in the theoretical Q sort (factor array) works as a verbal statement: memories are evoked in the researcher by the theoretical Q sort which suggests what the factor might be for the Q sorter. Each of the Q sorts loading on a factor can be thought of as a paraphrase for its meaning. The factor is a higher level perception created by ordering the items in a particular way.

In control theory, one has the techniques of how/why (Goldstein, 1985) and the method of relative levels (Goldstein, 1988) to explore a perception. If a factor is a higher order perception of the items, then these techniques can be used to explore the factor. One presents the theoretical Q sort and asks the person to examine it. The method of relative levels invites the person to describe what it is like to have this per-

ception so that the researcher can experience it in the same or similar way. The how/why method asks how this perception is achieved, and why the person would want to achieve it.

It is sometimes helpful to ask the person to give a running commentary during the course of the Q sorting. By comparing the commentary associated with the Q sorts which load on the same factor, hints can often be gained about the nature of the higher order perception suggested by the factor. It is possible that this information may be useful in helping the researcher decide on the best way to rotate during judgmental rotation. Some people perform Q sorts in silence and some want to talk and interact with the researcher. For those who prefer to Q sort in silence (introverts perhaps), it might be a good idea to use a tape recorder and leave the room. For those who like to talk out loud (extraverts), the use of a tape recorder and the presence of a silent researcher might be the best arrangement.

How well does one person understand the position of another person on a particular issue, say abortion? One measure is how closely the person can anticipate the Q sort which the other person will produce. A second measure is how closely the person can anticipate the commentary the other person will make when producing the Q sort. The commentaries of both persons can be converted into statements and combined into a single Q sample. Each person could then Q sort the statements according to the condition of instruction *most like* to *most unlike* the comments which would likely occur when the target person was Q sorting the items.

Research Method and Theory Style Comparisons

The creator of control theory, William T. Powers, and the creator of Q methodology, William Stephenson, reject the traditional ways of using statistics. Stephenson (1953) has focused attention on the differences between R and Q approaches. Powers (1990) has shown how statistical correlations based on a group of individuals can lead to in-

correct conclusions about what is going on within a single individual.

These two theorists have high regard for single case studies, and their attitude seems to be that any person is a legitimate sample from the human species population: if one can understand a single person, then a big step will have been taken towards the goal of understanding people in general.

Powers goes further than Stephenson in this direction and argues that if the goal is to understand the way that a person works inside, then the single case study is a necessary first step. It is necessary because one cannot go from finding a relationship between two variables in the typical research designs to the conclusion that these two variables are related in the same way within a person.

Powers and Stephenson are oriented towards giving theory a major role in research, but in different ways. Powers advocates a modeling approach. A model consists of a mathematical system which spells out all the variables and their relationships in a particular situation. Using a Powers approach for the Q-sort task, one would want to create a model which would show how the person creates the Q sort from the condition of instruction and the items. The model would be allowed to "run" and generate data. The results obtained would be compared to the ones a person provides. If the model-generated results and the actual results do not closely match, the model is modified. This would be done on a single case study first, and once the model became adequate for the single case, the same model would then be tried on other individuals. The model's parameters would have to be adjusted for each individual, but the same model would be used.

For Stephenson, theory enters via the choice of conditions of instruction, the judgmental rotation process, and the thinking about the relationships among the factors which emerge. While Stephenson often alludes to Kantor's interbehavioral approach and to quantum theory in physics (e.g., Stephenson, 1982), it seems safe to say that these theories play a minor role in the actual conduct and understanding of a Q study by most users of Q methodology.

I suggest that control theory is a much richer theoretical framework for Q methodologists. To take one example: consider the relationships among factors. By analogy to quantum theory, Stephenson liked to think that the factors were quantum states of feeling which showed (sometimes? always?) the property of complementarity. From a control theory perspective, we have seen how the factors are higher order perceptions. These perceptions will sometimes be conflicting ways of understanding the items which are lower level perceptions. Control theory ideas about conflict can be applied in this case. Not all higher order perceptions are in conflict. Therefore, there is no theoretical reason to expect factors always to have a relationship of complementarity to each other.

A second major advantage of using a control theory framework is that it provides some guidance about what to do with the factors obtained, as illustrated by Goldstein (1989). They are possible higher order perceptions uncovered by Q methodology. The researcher can determine whether they are controlled perceptions, and can then apply the methods of how/why and relative levels to explore the perceptions in order to discover the way in which higher order perceptions link up to others in the perceptual hierarchy.

Conclusions

Control theory is a theory about the way people work psychologically in all situations, including the Q-sort task. People control their perceptions. Q methodology is a way to study higher level perceptions. The Q sort that a person provides is a controlled perception in which the higher order perception being controlled is the meaning which the condition of instruction has for the person. Q sorts which load on the same factor are paraphrases of the same higher order perception.

References

Brown, S.R. (1980) *Political subjectivity.* New Haven, CT: Yale University Press.

Chignell, M.H. & B.W. Patty (1987) Unidimensional scaling with efficient ranking methods. *Psychological Bulletin, 101,* 304-311.

Chignell, M. & D.M. Goldstein (1990) *Q-rank: Q-sorting, and ranking on the computer.* Working paper, Department of Industrial and Systems Engineering, University of Southern California.

Goldstein, D.M. (1985, September) *The how and why technique in psychotherapy.* First Annual Control Theory Conference, Haimowoods Center, Kenosha, WI.

Goldstein, D.M. (1988, October) *The method of relative levels in therapy.* Annual Control Systems Group Conference, Haimowoods Center, Kenosha, WI.

Goldstein, D.M. (1989) Q methodology and control systems theory. *Operant Subjectivity, 13,* 8-14.

Powers, W.T. (1973) *Behavior: The control of perception.* Chicago: Aldine.

Powers, W.T. (1977) Private correspondence.

Powers, W.T. (1989) *Living control systems: Selected papers of William T. Powers.* Gravel Switch, KY: Control Systems Group.

Powers, W.T. (1990) Control theory and statistical generalizations. *American Behavioral Scientist, 34,* 24-31.

Robertson, R.J., D.M. Goldstein, M. Marmel, & M. Musgrave (1987, October) *Testing the self as a control system.* Third Annual Control Theory Conference, Haimowoods Center, Kenosha, WI.

Robertson, R.J. & W.T. Powers (1990) *Introduction to modern psychology: The control-theory view.* Gravel Switch, KY: Control Systems Group.

Stephenson, W. (1953) *The study of behavior.* Chicago: University of Chicago Press.

Stephenson, W. (1980) Consciring: A general theory for subjective communicability. In D Nimmo (Ed.), *Communication yearbook 4* (pp. 7-36). New Brunswick, NJ: Transaction Books.

Stephenson, W. (1982) Q-methodology, interbehavioral psychology, and quantum theory. *Psychological Record, 32,* 235-248.