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Yes -- Neural Network Learning Theory Can Resolve the Behavioral Cognitive Controversy

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programs themselves to organize their own formal continuing education offerings. By appraising themselves in terms of this or similar models, programs can discover gaps that can be filled by coursework and experiences contained in their continuing education program. By organizing continuing education in ways that are consistent with their basic training model, departments have a logic that can guide the selection of potential offerings. Once established, the continuing education program can have a steady source of participants recruited from program graduates and others seeking additional specialized training offered in ways consistent with the logic and values underlying the base program itself. Moreover, the formal training program can concentrate on providing a firm foundation in behavior principles, methodology, and the process of continual self-improvement, rather than focusing on the specific tests or treatments du jour.

Summary

Behavioral training programs must reengineer themselves to remain viable in the face of dramatic changes in health care, the workplace, and society, generally. The industrialization of mental health, the conversion of health services to managed care, the availability of increasing numbers of empirically validated intervention procedures, the trend toward the provision of basic service by less expensive personnel, the need for specialists to supervise and assist these personnel, the outsourcing by organizations of noncore activities, and the need for practitioners to have multiple specialties and to reinvent themselves continuously are some of the trends affecting us. We propose a model or a process for clinical programs to use in organizing their training activities. By simultaneously considering what is taught, the level of analysis (individual, group, system), and the level of competence students must acquire, a 3-dimensional scheme is produced. It provides a "specialty layer" undergirded by instruction in basic psychological processes and the methods or tools of the field. Program outcomes can easily be classified using the model, thereby creating an evaluative mechanism. Finally, individual students can use the model to organize and rationalize their own formal training and a program of continued inquiry and professional development in the years after graduation.

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Clinical Round Table

Yes -- Neural Network Learning Theory Can Resolve the Behavioral Cognitive Controversy

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The positive comments and constructive tone with which Forsyth, Hawkins and Hutchison (1996) begin their response to Tryon's (1993b, 1995a, 1995b) thesis that Neural Network Learning Theory (NNLT) can resolve the behavioral cognitive controversy identifies consistencies between Radical Behaviorism (RB) and connectionistic Neural Network Learning Theory (NNLT). The questions they raise in subsequent sections are important to achieving rapprochement of the cognitive behavioral schism and are therefore addressed here. The primary task of unification is to combine the positive contributions of both the behavioral and cognitive perspectives without rejecting or compromising important values of either orientation. For reasons presented below, I conclude that NNLT, which is completely compatible with cognitive psychology, is also theoretically compatible with behavior analysis and will broaden the appeal of behavioral analysis within the scientific community.

Issues and Answers Explanation

Under the heading "NNLT Findings as Explanatory," Forsyth, Hawkins, and Hutchison (1996, p. 5), ask "How does the neural network account explain human behavior?" (p. 5). Many connectionistic neural networks (CNNs) mediate stimulus inputs and behavioral outputs with a learning mechanism consisting of one or more "neural" layers sandwiched between, and having synaptic connections with, both input and output layers. Experience alters these synaptic weights through a learning mechanism implemented via a mathematical equation. Several fundamentally correct neuroscience principles characterize the operation of these networks. That some biologically plausible processes, such as alternation of synaptic weights in response to experience, are computer simulated using biologically implausible methods does not diminish their conceptual value. Many CNNs model biological function rather than the exact biological method found in nature. Forsyth et al.'s preference for explanations grounded in the "adaptive network behavioral research (ANBR)" (p. 6) approach

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neither lessens the explanatory value of CNNs nor negates Tryon's unification thesis.

Forsyth et al. (1996) criticize computer modeling of CNNs as follows: "It seems to us that making a computer model perform similarly to a human does not explain the human's behavior but rather mimics it" (p. 5). However, in their section on Adaptive Network Behavioral Research they praise computer modeling of behavioral principles: "Once the quantitative relationships are in the computer, they can be subjected to many complex manipulations under well controlled conditions to produce 'behavior' " (p. 7). Forsyth et al. place behavior in quotations because they recognize that they also mimic rather than produce real behavior. *Simulation*, the preferred term, is probative for both NNLT and ANBR modeling in that correspondence between observed and simulated behavior does not occur frequently by chance but requires knowledge and understanding of the subject matter to accomplish.

Forsyth et al. (1996) criticize CNN models as follows: "The study of computer models of environment-behavior relations cannot substitute for the study of such relations in living organisms, although we agree that it can be suggestive" (p. 6). Yet they endorse computer modeling in their section on Adaptive Network Behavioral Research. Tryon (1993a, 1993b, 1995a, 1995b) never recommended studying CNNs in isolation from data on living subjects. CNN modelers consistently constrain their models with empirical data. CNNs are environmentally driven in that they develop their functional properties through learning; they are taught rather than programmed. This point is consistent with Forsyth et al.'s quote from Skinner that "... we cannot account for the behavior of any system while staying wholly inside it" (p. 7). The dependence of CNN status on experience exemplifies Skinner's point and is a unifying property because it equally acknowledges the role of cumulative organism change and current contingencies in explaining behavior.

The subsection entitled Hypothetical constructs as explanation (Forsyth et al., 1996, p. 6) criticizes hypothetical constructs but connectionistic neural networks are not hypothetical. Neurons actually exist and they actually are interconnected via synapses whose properties really do change as a function of learning. While CNNs are certainly crude first approximations to biological networks they are not hypothetical.

Behavioral Values

The section entitled Clarification of Behavioral Values and Characteristics (Forsyth et al., 1996) dismisses the question of why a reinforcer is reinforcing with the following sentence: "However, the behavior analyst does not feel impelled to provide such an explanation, because it is analogous to explaining why a cow is a cow" (p. 6). Describing the selection of behavior as a noun reifies it as an object whose existence we are asked to accept rather than as a process to be explained. Converting verbs into nouns is something cognitive psychologists have been criticized for doing. Such reasoning is no more compelling when Radical Behaviorists do it than when cognitive psychologists do it. Some behavior analysts may not value knowledge about learning mechanisms but the Basic Behavior Analysis section of *PsycSCAN: Behavior Analysis & Therapy* regularly reviews articles on learning processes demonstrating their relevance to the field.

The subsection entitled Control (Influence) as a Primary Goal (Forsyth et al., 1996) underscores that behavior modification is an important scientific and clinical value for behavior analysts. NNLT will probably not assist in the identification of new environmental variables of which behavior is a function because it was not developed to do so. Rather, NNLT offers behavior analysts explanatory benefits. It will help behaviorists, cognitive behaviorists, and cognitivists explain their phenomena using the same vocabulary and fundamental concepts thereby unifying the cognitive behavioral schism.

The recommended Adaptive Network Behavioral Research (ANBR) approach is valuable and completely consistent with NNLT. ANBR interrelates behavioral principles and empirical relationships but does not address the mechanisms giving rise to the existence of these relationships. This is the contribution CNNs make.

In the subsection entitled Parsimony and Theoretical Consistency, Forsyth et al. (1996) indicate that "Behaviorists insist that explanations of behavior be as consistent across species and phenomena as the data will permit not adding new concepts when speaking of human behavior..." (p. 8). NNLT embodies the required parsimony and species generality. The neural network concepts used to describe complex human behavior are the same as those used to describe simple conditioning in primitive marine creatures. This feature makes CNNs very different from symbol-oriented cognitive explanations and highly compatible with behavioral explanations. NNLT does not treat humans as "demigods" (p. 8).

In the subsection entitled What Is the Promise of NNLT for Behavior Therapy and Behavioral Science? Forsyth et al. (1996) criticize the role of memory in NNLT by stating: " although we can erase files on a computer, we cannot erase an organism's history, short of direct lesions to the brain" (p. 8). While CNNs are modeled on computers, just as ANBR simulations are, they do not store experience in serial memory locations as symbolic cognitive models do. Nor does forgetting entail erasing computer files or making brain lesions. CNNs form memories and many of their interesting properties are memory related. Under some conditions, new experiences alter existing memories; a finding consistent with empirical research. The study of memory is an active area of experimental psychology, and Bouton (1994) explains how remembering and forgetting play fundamental roles in conditioning. The ability of CNNs to simulate important human and animal memory phenomena is a strength and not a weakness.

Why Behavior Analysts Need NNLT

Darwin's functional theory of evolution was not widely endorsed for more than 75 years (Mayr, 1982). Although Darwin provided an ultimate functional explanation for the origin of species, he could not account for how selection works. The lack of a proximal causal mechanism precluded widespread interest by the scientific community (Bowler, 1983; Catania, 1978, 1987). The modern synthesis with population genetics provided the missing proximal causal mechanism and moved evolutionary theory from relative obscurity to a cornerstone of biologic science.

Skinner's explanation of behavior and behavior change entails Darwin's functional arguments of variation and selection--reinforcement--(Smith, 1983; Tryon, 1993b) and is currently met with the same scientific disregard by most psychologists as Darwin originally experienced by most biologists and for precisely the same reason; lack of a plausible proximal explanatory mechanism (Rosenberg, 1984). No explanation is provided for how reinforcers select behaviors and/or how experience with the environment alters the organism. Critics did not question Darwin's facts just as contemporary critics do not question the facts demonstrated experimentally by behavior analysts.

The historical parallels and lesson seem unusually clear: The valuable contributions of behavior analysis will not be widely received within the scientific community until issues of proximal causation are satisfactorily addressed. Connectionistic neural networks (NNLT) provide a class of biologically inspired proximal causal mechanisms that are compatible with behavioral values and capable of mediating the functional relationships articulated by ANBR and other repositories of behavioral analytic phenomenon. NNLT may do for behavioral analysis what population genetics did for evolution. Efforts to avoid proximal causal mechanisms may seem to advance and preserve behavioral analysis but the effect of such behavior is to isolate behavioral analysis from main stream science to the detriment of this discipline.

Mechanism issues have been avoided by behavior analysts on several grounds. One objection is that mechanism explanations are incompatible with behavioral analytic explanations. Donahoe and Palmer (1989) discuss substantive similarities between behavioral analysis and CNNs thereby demonstrating that this criticism does not pertain to NNLT. A second objection is that mechanism explanations detract from identifying environment behavioral relationships because they look exclusively inside the organism. The environmental driven nature of CNNs viti-

ates this criticism. A third reason is that the popularity of mechanism questions does not make them valuable questions for psychologists to ask implying that these inquiries are better left to neuroscientists who have the proper tools for such studies. This argument presumes that psychologists are more willing to leave mechanism questions to another discipline than were biologists. This assumption is falsified by the empirical fact that the vast majority of psychologists are not behaviorists, and most behaviorists are cognitive behaviorists, paradigmatic (psychological) behaviorists (Tryon, 1990), etc., and not Radical Behaviorists. Forsyth et al. (1996) correctly reason that "... the popularity of an approach does not prove its value" (p. 7), and I add that the unpopularity of a position does not vitiate its content. Darwin's theory was as correct when first published as it was 75 years later when it became widely accepted by the scientific community. While popularity has nothing necessarily to do with correctness, it has everything to do with participation in organized science. Unpopular positions generally do not have the same access to human and financial resources as do popular ones. Given that behavioral analytic objections to proximal causal mechanisms to not pertain to CNNs there is no longer reason to avoid mechanism questions. That CNN explanations are completely compatible with cognitive explanations and therefore are capable of resolving the cognitive behavioral schism, NNLT provides behavioral and cognitive psychologists with the necessary common ground for mutual acceptance, respect, and full participation of behavior analysis within the broader scientific community.

The theoretical synthesis of which I speak does not require large changes in current practices by behavior analysts or cognitive psychologists. Behavior analysts can, and should, retain their search for environment behavior relationships because these findings result in clinically useful interventions. Cognitive psychologists can, and should, continue their focus on mediational issues. The main point is that both behavioral and cognitive psychologists can conduct their inquiries from a common connectionistic NNLT perspective thereby resolving the cognitive behavioral schism.

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The International Scene

The Australian Association for Cognitive and Behaviour Therapy (AACBT)

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A number of scholars have carefully documented the emergence of *behaviour therapy* or *behaviour modification* in Australia (see Birnbraurer, 1994; Lovibond, 1993; Winkler & Krasner, 1987). During the 1960s and 70s a number of interest groups were formed in various parts of the country (typically University-based). Moves to establish a communication network and possibly a national organisation were voiced at a meeting that took place at the University of Western Australia in August, 1974, during the 9th Annual Conference of the Australian Psychological Society (APS). This resulted in the publication of a Directory of Persons Interested in Behaviour Modification. A decision was made at the 1975 meeting of APS to organise more formally as a national body.

In 1978, the first national conference, held in Sydney, attracted approximately 400 delegates. At about this time, the Australian Behaviour Modification Association (ABMA) was adopted as the official name of the Association. Keith Jonson was the first National President. In 1984, the first issue of the Association's journal, *Behaviour Change*, was published. After wide consultation, a national constitution was adopted in 1986. Following a national ballot of the membership, the Association recently adopted the new name Australian Association for Cognitive and Therapy (AACBT). The aim of this article is to inform readers briefly about the Association.

Aims of the Association

The AACBT is a multidisciplinary professional society. The aims of the Association are:

1. To organise continuing education and training in the principles and practice of cognitive and behaviour therapy;
2. To publish and disseminate information to members about developments in cognitive and behaviour therapy in Australia and other countries;
3. To educate the community in the principles and ethical practice of cognitive and behaviour therapy;
4. To liaise and consult with other persons or organisations in the teaching and practice of cognitive and behaviour therapy;
5. To promote the ethical practice of cognitive and behaviour therapy by members;
6. To organise or assist in the organisation of an annual National Conference on Cognitive and Behaviour Therapy.

Organisational Structure and Membership

The Association has a President-Elect, President and Past President. The President-Elect is nominated by the State Branch hosting the national conference

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