You can't play 20 questions with nature and win
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I. The problem: After reviewing many papers for a symposium, Allan Newell concludes that while significant progress has been made in experimental (cognitive) psychology, there were/are some fundamental flaws with the scientific approach that psychologists tend to use, and this approach leads to no real progress toward a unified theory of behavior.
   a. Psychologists generally use two methods that dominate experimental style in the field
      i. Phenomenon are discovered and follow-up experiments must ensue to explore the new phenomenon. (fig 1)
      ii. Next, the phenomenon must be explained and these explanations are usually set forth in terms of oppositions that are usually binary and then questions are formulated to try to resolve these oppositions (fig 2, i.e. nature vs. nurture, single vs. dual system)
   b. Problems with these methods
      i. We can always come up with more and more phenomenon to explore, and new oppositions, but when will it be enough? When can we begin answering the big question of behavior?
      ii. The accumulation of more and more evidence in this manner does not seem to lead to clarity or a unified theory but to more an more issues.
      iii. (Wingfiled and Byrnes example) We can continue to explore a phenomenon and do follow-up experiments for decade but the questions still linger out there and are never really resolved.

II. **Newell's diagnosis**: There are certain problems that are present in this manner of research that must be resolved in order to start unifying theory
   a. First injuction of Psychological Experimentation: Know the method your subject is using to perform the experimental task
      i. In order to predict a behavior outcome certain information must be known about what methods are available
         1. What are the person's goals?
         2. What are the variables in the task environment?
         3. What are the possible ways in which the participant could complete the task given the underlying processing mechanisms?
      ii. Psychology seems to be wrapped up in discovery and verification of methods oat this stage
   b. **Second injuction of psychological experimentation: Never average over methods**
      i. Cooper-Shepard example-rotation and RT are non-linear but angle shows to be linear with time therefore averaging across different starting points lead to misinterpretation of data
      ii. Klahr separated out methods but this eventually leads to the question of when do we know if methods are pure?
         1. The problem lies in not knowing all of the methods available to the subject to complete the task given the goal and environment.

iii. Rather than understanding the entire set of methods that could be used, scientists are verifying and determining methods post-hoc and in this framework there are limitless possibilities for new methods to be proposed. A tighter framework is needed.
iv. A cognitive control structure needs to be modeled so we know what methods or operations are available to man.
1. Flow charts are not constrained enough

c. Another related problem lies in the ability of being able to link findings together to create a more cohesive story, and this problem arises from the binary oppositions created for explanations.
i. Only certain information in a given experiment is highlighted in order to support one side of the opposition, but other information is not highlighted
1. This leads to a problem of not truly understanding how research may be linked
2. And it leads to a cycle of reinterpretation and uncertainty
3. Wingfiled example- one result challenges a large body of work

III. **Newell's Prognosis**

a. Complete Processing models- should be able to complete the task
i. Flow diagrams are not sufficient models- they cannot perform the task
ii. Without a complete control model, how can we know the subset of methods?
iii. Proposal for a way to create detailed control structures
1. Operationally, there may be several ways to complete a task, and we can only observe the output
2. But we should be able to deduce what method is being used by looking at differences in encoding, processing time, and memory load.

b. Analyze a complete task- accept a single complex task and do all of it
i. Much experimentation just looks at small experiments to answer small questions
ii. Instead do a lot of small experiments that combine in order to create a bigger picture
1. Dansereau example- mental multiplication
a. Constructed information processing model that could simulate the task and predict results
i. He estimated parameters in the model by doing mini-experiments

c. One program for many tasks
i. Model the whole human information processor

IV. Conclusion

a. We need to find a way to progress toward being able to unify experiments together and start creating a cohesive picture.
b. These suggestions are one way to approach that