Information-Gathering Strategies in Behavioral Assessment

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Summary: In behavioral assessment, the strategy theoretically most coherent for case formulation is to carry out a functional analysis aimed at discovering, among other factors, functionally relevant stimuli acting upon the problem-behavior. However, little is known about the decision-making processes involved in this task. Although many authors have suggested prescriptive models for this process, the strategies used by clinicians when gathering information seem to be left to experience and common sense. The present research is an attempt to increase the knowledge about this process of information gathering. The study was carried out with psychology students in their final year who already had enough theoretical knowledge to gather this kind of information, but still lacked practical experience. Subjects were asked to gather information aimed at checking a hypothesis about the functional role on a given behavior of either an antecedent or a subsequent (i.e., reinforcing) stimulus. The results show that information gathered to test a reinforcing stimulus hypothesis is more homogeneous than information to test a hypothesis about a functionally relevant antecedent stimulus. The strategies used to test both types of hypotheses are different. In both instances, however, subjects more frequently gathered information useful to refute or refine the hypothesis than information useful to verify it.

In the behavioral conceptualization of a clinical case, one of the most important tasks clinicians carry out is to establish the functional relationships between behaviors and the stimuli triggering them (Evans, 1993; Fernández-Ballesteros, 1993; Haynes, 1998; Schulte, 1989; Silva, 1993). Finding out whether a given stimulus is acting either as a functionally relevant antecedent stimulus or as a reinforcing stimulus is such a task.

It is assumed that, while carrying out these tasks, clinicians are making use of reasoning strategies as well as psychological knowledge to decide on the information that should be gathered in order to find out the functional role of a given stimulus (Godoy, 2001; Haynes et al., 1993).

The present research is an attempt to increase our knowledge about how this process of information gathering takes place. Nevertheless, the results obtained in this study cannot be compared to previous works because there is very little empirical research regarding the way behavioral psychologists perform these kinds of tasks (Hayes & Nelson, 1986; Haynes & O’Brien, 2000; Vervaeke & Emmelkamp, 1998; Westmeyer, 2001).

On the contrary, outside the field of behavioral assessment, there is a lot of empirical work about hypothesis generation and hypothesis testing in the clinical field (Elstein, Shulman, & Sprafka, 1978; Patel & Groen, 1986; Boshuizen & Schmidt, 1992; DeBruyn, 1992; Adarraga & Zaccagnini, 1992). For example, some of the more well-known models of clinical judgment assert that clinicians first gather a great amount of information, which they then combine and integrate according to some empirical or methodological knowledge (e.g., actuarial tables, regression equation, Bayes Theorem), or alternatively, according to some theoretical or nosological system (e.g., DSM-IV).

However, after the pioneering work of Elstein, Shulman, and Sprafka (1978), we know that the models proposing a distinction between the two stages (i.e., infor-
mation gathering in the first place and, after it, information integration) are used by very few clinicians. In fact, the majority of clinicians generate hypotheses very early in the process, normally after gathering the first items of information (Godoy, 1996; Dowie & Elstein, 1983). The role of these early hypotheses is precisely to guide the collection of further information.

The present study, then, utilizes the model of Elstein, Shulman, and Sprafka (1978) and several other models of case formulation (Eells, 1997; Fernandez-Ballesteros et al., 2001; Weerasekera, 1996) to empirically investigate the process of gathering information useful to test hypotheses referring to functional relations between stimuli and behaviors.

Method

Subjects

The subjects were 163 university students in their last year (fifth year) of a psychology degree. Their participation took place within the clinical practices they carried out in one of the optional subjects in the course.

Tasks

The task given to the subjects was to read a text with a short description of a clinical case. Then, based on the description, the text suggested a hypothesis regarding the functional role (whether antecedent or reinforcing) a given stimulus had with regard to a given behavior. Finally, subjects were asked what type of information they would gather in order to test the functional hypothesis.

Sixty-one subjects participated in the task of gathering information to test a hypothesis about a functionally relevant antecedent stimulus. One hundred and two subjects participated in the task of collecting information to test a hypothesis about a reinforcing stimulus.

Dependent Variables

The dependent variables used were: kind of information gathered and type of search strategy employed. These variables were evaluated using a category system designed ad hoc. The categories established were as follows:

Kind of information gathered: To assess this variable, subjects’ replies were classified according to some categories reflected in the cells of a contingency table similar to the one shown in Table 1.

In this way, subjects’ replies were classified as information belonging to cells \(a\), \(b\), \(c\), \(d\), \(a + b\), \(a + c\), \(a + d\), \(b + c\), \(b + d\), \(a + b + c\), \(a + b + c + d\) or as information not classifiable in any of the contingency table cells.

The type of information collected allows inference of the type of strategies that can be logically applied to test the hypothesis in each case. Two well-known strategies for hypothesis testing are verification and refutation. In this context, “verification” is used to mean any reasoning strategy that concludes a probable functional relationship between a stimulus and a behavior based on their frequently conjoint presence (via the event-conjunction fallacy: if two or more events happen simultaneously with high frequency, then these events are functionally related). Refutation refers to any reasoning strategy that concludes (via the rules of the logic of conditionals) either (1) the probable nonexistence of any functional relationship between an antecedent stimulus and a subsequent behavior from the frequent absence of the behavior when the stimulus is present (or it has been present just before), or (2) the probable nonexistence of a reinforcement functional relationship between a stimulus and a behavior from the frequent absence of the stimulus when the behavior is present (or it has been present just before).

This refuting information is given by data in cells \(c\) and \(d\) of the contingency table, respectively. In this way, for example, when collecting information to test a hypothesis about a functionally relevant antecedent stimulus, if the information collected belongs to cell \(c\), it is possible, in principle, to refute the hypothesis, whereas gathering information about cell \(a\) does not permit refutation of it.

Type of Search Strategy Used to Collect Information

The second objective of this study is to find out what search strategy the subjects used. Strategies were classified as follows:

- **Behavior-oriented strategy.** Subjects focus their attention on what happens when a given behavior is present. With this strategy, information belonging to cells \(a\) and \(b\) is gathered, but it does not allow knowing what happens to the stimulus when the behavior is not present (information in cells \(c\) and \(d\)).
- **Stimulus-oriented strategy.** Subjects focus their attention on what happens when a given stimulus is present. This strategy allows the observation of information

<table>
<thead>
<tr>
<th>Kind of information gathered</th>
<th>Stimulus present</th>
<th>Stimulus absent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavior present</td>
<td>Cell (a)</td>
<td>Cell (b)</td>
</tr>
<tr>
<td>Behavior absent</td>
<td>Cell (c)</td>
<td>Cell (d)</td>
</tr>
</tbody>
</table>

**Table 1. Contingency table.**
belonging to cells $a$ and $c$, but does not allow knowing what happens to the behavior when the stimulus is not present (information from cells $b$ and $d$).

- **Complex strategy.** Behavior-oriented and stimulus-oriented strategies are used simultaneously. Therefore, the complex strategy allows the observation of what happens with the stimulus when the behavior is present and similarly what happens to the behavior when the stimulus is present (cells $a$, $b$, and $c$).

- **Strategy oriented toward the conjoint presence of stimulus and behavior.** Subjects focus their attention on those occasions where both behavior and stimulus are present (cell $a$), ignoring the information provided by other cells.

- **Strategy oriented toward cases of conjoint presence of stimulus and behavior as well as cases of conjoint absence of stimulus and behavior.** Subjects focus their attention on those occasions where behavior and stimulus are both either present (cell $a$) or absent (cell $d$). This strategy allows the observation of those cases where both the stimulus and the behavior are present (cell $a$), as well as the cases in which none of them are present (cell $d$).

Despite having used the contingency table cells to make reference to both the type of information gathered as well as the search strategy employed, these are two different variables. For example, the behavior-oriented strategy allows gathering information in cells $a$ and $b$. Subjects using this strategy can – but do not have to – pay attention to information in both cells. On the other hand, information belonging to cell $a$ becomes available when using both behavior- and stimulus-oriented strategies.

### Results

#### Kind of Information Gathered

**Hypothesis About a Functionally Relevant Antecedent Stimulus**

A third of the subjects (33%, see Table 2) exclusively collected information belonging to cell $a$. This only allowed them to use a verificationist-like strategy to test the hypothesis (via the event-conjunction fallacy).

About another third of the subjects (31%) searched for information belonging to cells $a$ and $c$, which in principle, would allow them to verify or refute the hypothesis, depending on whether most of the observations belong to cells $a$ or $c$, respectively.

About 18% of the subjects collected information belonging to cells $a$ and $b$. This strategy enables hypothesis verification – if all observations belong to cell $a$ – as well as fine-tuning it, if the observations belong to both cells, which could be interpreted as a cue of additional conditional stimuli.

No subject gathered information for both cells $a$ and $d$ in conjunction, which would have allowed the use of a reasoning strategy similar to biconditionals (behavior is present if, and only if, the stimulus is present).

Finally, only 8% of subjects collected comprehensive information for more than two cells. Furthermore, only one subject collected information for the four cells. This allowed the use of multiple reasoning strategies, including similar reasoning to that underlying the statistics that can be calculated in the contingency table (i.e., $\chi^2$ statistic, Fisher’s exact probability test, Bayes’ theorem, etc.).

**Hypothesis about a Reinforcing Stimulus**

Most subjects (81%) collected information belonging to cells $a$ and $b$, which, in this instance, enables the use of verificationist or refuting strategies to test the hypothesis.

Contrary to the antecedent stimulus hypothesis, a very small number of participants (3%) collected information for just cell $a$ (stimulus and behavior conjunction), which only allowed them to verify the hypothesis, by using the event-conjunction fallacy.

Although 16% of subjects collected information for three cells, no subject collected information for the four cells, which permitted the use of a hypothesis testing strategy similar to the reasoning strategies used in the statistics applicable to the contingency table.

As in the other experimental condition, no subject collected joint information for cells $a$ and $d$.

Finally, cells $b$, $c$, and $d$ never exclusively contained

### Table 2: Frequency and percentage of the various types of information searched by subjects.

<table>
<thead>
<tr>
<th>(a) Hypothesis about a functionally relevant antecedent stimulus</th>
<th>Cells</th>
<th>$a$</th>
<th>$b$</th>
<th>$c$</th>
<th>$d$</th>
<th>$ab$</th>
<th>$ac$</th>
<th>$ad$</th>
<th>$bc$</th>
<th>$bd$</th>
<th>$abc$</th>
<th>$abcd$</th>
<th>None</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>20</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>11</td>
<td>19</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>61</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>33</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>55</td>
<td>95</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>1</td>
<td>5</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>(b) Hypothesis about a reinforcing stimulus</td>
<td>Cells</td>
<td>$a$</td>
<td>$b$</td>
<td>$c$</td>
<td>$d$</td>
<td>$ab$</td>
<td>$ac$</td>
<td>$ad$</td>
<td>$bc$</td>
<td>$bd$</td>
<td>$abc$</td>
<td>$abcd$</td>
<td>None</td>
<td>Total</td>
</tr>
<tr>
<td>N</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>83</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td>102</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

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observations. The only information independently observed was the one corresponding to cell \( a \).

**Type of Search Strategy Used to Gather Information**

**Hypothesis about a Functionally Relevant Antecedent Stimulus**

The most widely used strategy to collect information to test an antecedent stimulus hypothesis was the stimulus-oriented strategy, i.e., trying to find out what happens to the behavior when the stimulus is present (42%, see Table 3). This strategy enables subjects to find out whether the behavior tends to occur when the stimulus is present. However, subjects cannot know whether the behavior will be present (or absent) in the absence of the stimulus.

Almost a third of the subjects (28%) used a behavior-oriented strategy. With this strategy, subjects can find out what happens to the stimulus in the presence of the behavior. However, it is not possible to find out whether the stimulus is also present in the absence of the behavior.

There is also a significant percentage of subjects (21%) making use of the complex strategy, that is, observing what occurs to the behavior when the stimulus is present, and what happens to the stimulus when the behavior is present. This strategy is the only one that provides full information about the co-occurrence of stimulus-behavior and behavior-stimulus.

One of the subjects gathered information to find out whether the given behavior was indeed frequent. We called this strategy – which was not considered a priori in our category system – strategy exclusively based on the presence of behavior. No subject used a similar strategy based on the stimulus.

Finally, the responses of four subjects (7%) were not specific enough to classify them in an unequivocal way in any of the categories.

**Hypothesis about a Reinforcing Stimulus**

The most widely used strategy (93%) to gather information for testing a reinforcing stimulus hypothesis was the behavior-oriented strategy, i.e., attempting to find out what happens to the stimulus when a given behavior is present.

This strategy does not permit knowing whether the stimulus is present or not in the absence of the behavior. In this way, it is not possible to find out whether, for example, the stimulus is frequently present in the subject’s environment, and thus it would be present at times when the behavior is not present.

Only a small percentage of subjects (5%) used the complex strategy, which permits finding out all relevant information in both instances: presence of the stimulus and presence of behavior.

Finally, two subjects in this experimental condition focused their attention on finding out the frequency of the behavior without paying attention to what happens to the stimulus (strategy exclusively based on the occurrence of behavior).

**Conclusions**

**Information Gathered**

Except in the case of cell \( a \), whose information is useful to verify the hypothesis via the event-conjunction fallacy –, practically no subject collected information for a single cell (i.e., cells \( b, c, \) or \( d \)). This tendency was more extreme in the reinforcing stimulus condition.

In a similar way, no subject collected information for \( a \) and \( d \) jointly. This would have allowed subjects to apply biconditional logic.

In both experimental conditions, and especially in the condition with a hypothesis about a functionally relevant

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**Table 3. Frequency and percentage of subjects who adopt each information-search strategy.**

<table>
<thead>
<tr>
<th>Information-search strategy</th>
<th>Hypothesis about an antecedent stimulus Frequency</th>
<th>Hypothesis about a reinforcing stimulus Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavior-oriented strategy</td>
<td>17</td>
<td>95</td>
</tr>
<tr>
<td>Frequency %</td>
<td>28%</td>
<td>93%</td>
</tr>
<tr>
<td>Stimulus-oriented strategy</td>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td>Complex strategy</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>Complex strategy</td>
<td>21%</td>
<td>5%</td>
</tr>
<tr>
<td>Strategy oriented toward the conjoint presence of stimulus and behavior</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Strategy oriented toward cases of conjoint presence as well as cases of conjoint absence of stimulus and behavior</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Strategy exclusively based on the presence of behavior</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Strategy exclusively based on the presence of stimulus</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Unclassified</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Unclassified</td>
<td>7%</td>
<td>0%</td>
</tr>
<tr>
<td>Total number of subjects</td>
<td>61</td>
<td>102</td>
</tr>
<tr>
<td>Frequency %</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

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antecedent stimulus, the number of subjects that collected information belonging to more than two cells was very low. Furthermore, only one subject paid attention to information of the four cells. It seems that subjects take the observation of cases with a conjoint absence of stimulus and behavior (cell \(d\)) as a senseless observation that would gather useless data.

Thus, it could be inferred that most subjects do not use reasoning strategies similar to the ones underlying the statistics calculated in the contingency tables.

In addition, and independently of the search strategy used, most subjects tended to collect information belonging to cell \(a\) — whether exclusively or in conjunction with information belonging to cells \(b\) or \(c\). This kind of information allows refutation as well as fine-tuning of the hypothesis.

Relationship Between Search Strategy and Type of Information gathered

In general terms, it could be asserted that, as expected, there is a close relationship between the search strategy employed and the type of information gathered. For example, in the reinforcing stimulus condition, most subjects use a behavior-oriented strategy, that provides information in cells \(a\) and \(b\), which in fact is the kind of information subjects tend to collect in this experimental condition.

However, the strategy adopted does not fully determine the type of information gathered. For instance, subjects collected information belonging to more than two cells more often when testing a reinforcing stimulus hypothesis than when testing an antecedent stimulus hypothesis (16% versus 8%; see Table 2). Paradoxically, this more comprehensive information gathering takes place in the experimental condition where fewer subjects follow a complex strategy to search for information (5% versus 21%; see Table 3).

In short, the search strategy employed strongly influences the type of information gathered. However, given that many subjects end up gathering information which is not accessible via the search strategy employed, or do not gather all the information such a strategy permits, it can be hypothesized that factors others than those explored in this study also have an effect on the type of information gathered.

Similarities in Subjects’ Behavior

Subjects differed greatly in the way they tested the antecedent stimulus hypothesis in both variables: the search strategy used and the information gathered. On the contrary, when testing the reinforcing stimulus hypothesis, nearly all subjects acted in the same way: They used a behavior-oriented strategy and collected all the information that such a strategy gives access to (cells \(a\) and \(b\)). In other words, the experimental condition of testing a reinforcing stimulus hypothesis led to quite homogeneous behavior among subjects, both in the search strategy used as well as in the information collected, while testing a hypothesis about a functionally relevant antecedent stimulus provided more variability.

Information Gathering to Refute the Hypothesis

When testing the antecedent stimulus hypothesis, there were many subjects who collected information that only enabled them to verify it. These results match those found by previous authors, who have reported about the high frequency of verificationist strategies (Godoy, 1996; Klayman & Ha, 1987). In fact, none of the most well known psychological models that have been proposed to explain the process of clinical assessment give much relevance to the refuting processes. Thus, Elstein, Shulman, and Sprafka (1978), Patel and Groen (1986), Lemieux and Bordage (1986), Boshuizen and Schmidt (1992), and Berrios and Chen (1993) did not report that their experimental subjects (medical doctors) refuted their hypotheses.

However, some philosophers of science (e.g., Popper, 1972) propose that the scientific method consists of gathering information in order to refute a given hypothesis. Clinicians should also use this approach and, according to this study, many subjects seemed to do so, since in both variables and in both experimental conditions, many subjects tended to collect information that was useful for refuting the hypothesis. This approach is present in both experimental conditions, but it is more frequent when testing the reinforcing stimulus hypothesis: 81% for the variable “information gathered,” and 93% for the variable “search strategy.”

Thus, the results of this study state that although a verificationist strategy may be frequent under certain conditions, under others a refutationist strategy prevails.

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