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# Order of Hierarchical Complexity ("Stage") of Items Used to Measure Forensic Experts' Perceptions of Expert Bias Predicts the Amount of Bias

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This article will show that developmental stage will account for the biasing value of items used to test expert witness bias. Bias is usually thought of as a dependent variable to be described and predicted. In the simplest sense, bias represents a deviation from having a neutral value ascribed to a choice. It therefore represents value. In psychology and economics it is a choice-outcome–related dependent variable that alters the rating or probability of an action. Hence it belongs to the Behavioral Economics "value/reinforcement" paradigm. In behavioral economics, all bias reflects the probability of making a response (or the tendency to make a response) based on perceived value of the outcome. The more often one does something that has a positive outcome, the higher the value of doing it. This is true whether an expert is aware of this effect or not. Stage of development is usually thought of as also a dependent variable, but here it will be used as an independent variable to predict bias.

*Keywords:* bias, expert witness, hierarchical complexity, stage, value



In studies of forensic experts (those who testify in legal proceedings), Commons and colleagues (Commons, Miller, & Gutheil, 2004; Commons, Miller, Li, & Gutheil, 2012) have shown that there are a number of factors that experts themselves see as potentially biasing an expert's opinion. These included cases that evoked personal discomfort, or cases in which it was known that certain expert witnesses testified consistently for only one side (e.g., either the defense or the prosecution). On the other hand, factors such as whether an expert was the same ethnicity as the person they were testifying about were not seen as causing much bias in an expert. Bias is usually thought of just as a simple dependent variable, because it represents a deviation from having a neutral value ascribed to a choice. But it is also a type of value that can affect behavior (Luce, 1959).

As shown in several of the other articles in this issue, sometimes the value of an event is influenced or determined by stage. This article will examine whether different statements about bias fall into categories that can be differentiated by the stage of the statement being made.

## Difficulty of Items as Measured by Model of Hierarchical Complexity

To determine the required stage of performance needed to successfully understand an item (Commons, 2008; Commons & Miller, 1998; Commons, Gane-McCalla, Barker, & Li, 2014) this article will use the Model of Hierarchical Complexity (MHC), a measure of the a priori difficulty of tasks. Adults vary greatly in how detailed a task they understand and successfully complete. Because less complex tasks must be completed and practiced before more complex tasks can be acquired, the Model argues that this accounts for the developmental changes seen in individual persons' performance on tasks. For example, persons cannot perform arithmetic until they can truly and cor-

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rectly count. For difficulty to be precisely measured, the Model proposes a metric. That is, that Task A is considered to be hierarchically more difficult or complex than Task B if Task A is (a) made up of two or more next simpler actions (such as Task B and a third task, C), (b) these simpler task actions are organized, and (c) in a nonarbitrary way. If Task A consists of a combination of Task B and Task C (and Tasks B and C satisfy the requirement of being from the next order below A), then Task A would be what is called one Order of Complexity higher than Tasks B and C. The Model specifies that there are 17 Orders of Hierarchical Complexity (Commons, Trudeau, Stein, Richards, & Krause, 1998), starting with tasks that are completed by the simplest animals and infants, and progressing to tasks that only some adults complete. These Orders are shown in Table 1.

An individuals' development stage, or their observed or measured performance, is based on the Order of Hierarchical Complexity of the task that they correctly complete. Because of that, Stage is given the same name and number as the Order of Hierarchical Complexity of the task. For example, if an individual completes a task that is at Order 11 (Formal), performance on that task is also considered to be at the Formal Stage 11. The Model of Hierarchical Complexity (MHC) has been shown to account for performances in a variety of different domains (Commons, 1999; Giri, Commons, & Harrigan, 2014).

Table 1
*The 17 Known Orders of Hierarchical Complexity*

| Order number | Order name |
|---|---|
| 0 | Computational |
| 1 | Automatic |
| 2 | Sensory or Motor |
| 3 | Circular Sensory Motor |
| 4 | Sensory-Motor |
| 5 | Nominal |
| 6 | Sentential |
| 7 | Preoperational |
| 8 | Primary |
| 9 | Concrete |
| 10 | Abstract |
| 11 | Formal |
| 12 | Systematic |
| 13 | Metasystematic |
| 14 | Paradigmatic |
| 15 | Crossparadigmatic |
| 16 | Meta-Crossparadigmatic |

The Order of Hierarchical Complexity of the task is determined through analyzing the demands of each task, that is, by breaking a task down into its constituent parts. The discussion that follows in the next few paragraphs is a description of tasks people typically complete at the Orders of Hierarchical Complexity from 9 to 13. At each Order, key features are described and examples of tasks at that Order are given. They should be understood as only examples not an exhaustive list. Tasks of all domains can theoretically be mapped to this scale.

At the Concrete Order 9, two or more Primary Stage 8 actions may be coordinated. Coordinating two perspectives becomes possible and deals can be made. People respond to threats by making a deal. For example, the insurance company lawyer says to an expert, "If you do not say what I want you to say, you will never work again in this town." Giving in to such a threat creates bias. However, negotiations are specific to the person that one is dealing with and based on concrete (actual) experiences.

At the Abstract Order 10, two or more Concrete Order 9 actions may be coordinated. It becomes possible to coordinate concrete instances and form abstractions. A common abstraction is the notion of a variable, along with the values of the variable. For example, concrete interactions with people may lead to the understanding of social norms for how best to interact. People may figure out what their responsibilities are on a job, based on what the socially accepted role of the position is. For example, an expert witness may know that the social norm of this position is to be bias-free. People performing at this stage have an idea of a variable, such as acting as a consultant or acting as an expert. However, they have no logical or empirical way of deciding whether some activity meets the criteria for each role.

At the Formal Order 11, simple relationships between two variables can be formed, leading to simple deductive logic and simple univariate tests of empirical truths. One understands by using deduction; for example, respondents can logically test whether something meets a set of regulations. If experts know their legal role, they know that part of that role is to testify in an unbiased fashion. But some prosecutors and attorneys want experts to testify in a biased fash-

ion as we have shown previously (Dattilio, Commons, Adams, Gutheil, & Sadoff, 2006). If an expert works for only one side of cases (e.g., only for plaintiffs), one outcome is that attorneys for this side will hire that person in the future. The increase chance of future work has a high value. Working for one side is a value of the variable, which is working for one side versus working for both sides. The value of that variable predicts the perceived amount of bias, another variable; this is an example of a formal relationship in which two variables are related. How working for one side creates bias is straightforward. It is called the presentation effect (Bar-Ilan, Keenoy, Levene, & Yaari, 2009). Prior history alters response bias in the same way as variations in signal probability or payoff. The roles are demarcated by regulations, where the regulations are stated or implied. This result allows for roles being clearly defined.

At the Systematic Order 12, multiple Formal Order relationships are coordinated. The role of the expert is to make judgments about several formal order relationships between variables rather than following rigid rules and regulations.

At the Metasystematic Order 13, systems of relationships may be compared. One understands that an expert cannot be bias-free.

Based on the descriptions of the different Orders of Hierarchical Complexity, for the purposes of this article on how stage and value interact, we will use factor analysis (Gorsuch, 1983) to address the following questions: How do the different items from the bias questionnaire group together? How can each of the factors be characterized? What is it about the each of three factors that make them different? Do the factors pick up the stages of the reinforcers that create the bias?

## Method

### Participants

Participants in this study were 46 attendees at the annual meeting of the American Academy of Psychiatry and Law (AAPL). They were 81.4% (35 of 43) M.D.'s. There were 89.2% (33 of 37) who were APA (psychiatry) members, and 83.3% (30 of 36) were members of AAPL. There were 9.3% (4 of the 43) who were psychologists, 75% (3 of 4) of whom were also members of the APA (Psychological), and one of whom was in Division 41, American Psychology-Law Society. There were two lawyers, one with an M.D. and one with a Ph.D. There was one person with a B.A. The average number of years in forensic practice was 11.34 ($SD = 9.32$) and the annual number of forensic cases was 48.82 ($SD = 79.07$). The study used a sample of convenience that is not likely representative of the general population of practicing forensic experts. The attendees were largely homogeneous. There was no reason to believe that the results were influenced by this small variation among the participants because of their high level of involvement in forensic matters.

### Procedure

After obtaining permission through the Massachusetts Mental Health Center human studies committee and approval from the Research Committee of the AAPL, a questionnaire was handed out at the annual meeting of the American Academy of Psychiatry and Law (AAPL). Participants in this study were 46 attendees at one of the "professional issues in the twilight zone" workshops held at the meeting. Participants voluntarily attended a workshop advertised as an opportunity to participate in both research and discussion of attorney–expert matters that were not often openly addressed, for example, that existed in an insufficiently assessed "twilight zone." As some of those present had also attended similar workshops previously, and the basic theory and early results had been presented at the AAPL presidential address of 2000 (Gutheil, 2001), there was some familiarity with the format from at least some attendees.

After results were obtained, data analysis was performed. First, Rasch analysis (Bond & Fox, 2007; Linacre, 2002; Linacre, 2003; Rasch, 1960; Wright & Linacre, 2001) was used to measure the perceived bias of items on a single one-dimensional manner. Second, a factor analysis was performed. The factor analysis showed how the items are related to one another. Third, the inherent difficulty of the items was scored using the Model of Hierarchical Complexity Scoring Manual (Commons, Miller, Goodheart, & Danaher-Gilpin, 2007). This scoring was used to understand the result of the factor analysis as well as the degree of bias of items measured by Rasch analysis.

### Instrument

The instrument was constructed by the authors (Commons, Miller, & Gutheil, 2004; Commons, Miller, Li, & Gutheil, 2012). The introduction to the questionnaire stated that it concerned "expert witness reactions to cases" as the focus of the study. Participants were asked to think of recent cases in which they had served as expert witnesses as they answered the questions. Beyond basic demographic questions, there were 24 questions on various types of biasing situations. The first series of queries addressed, on 6-point scales (mean 3.5), the issue of an expert's influence on case outcomes and the subjects' emotional reactions to those outcomes. Next was a series of queries that asked subjects to identify potentially biasing factors, from least biasing to most biasing, such as money, prestige, high profile cases, and so forth. The final series of queries focused on expert attitudes toward bias and biasing factors. The majority of questions were asked with regard to "opposing experts." This phrasing was used to minimize the desire to answer less than honestly about one's own actions if they were not seen as socially acceptable.

## Results

### Principal Components Analysis

A principal components Analysis (factor analysis) was performed on the items asking about bias. Items with coefficients of less than 0.45 were eliminated. Of the original 24 items, 18 remained. As seen in Table 2, Factor 1 accounted for 15.6% of variance and has 7 items with factor loading higher than 0.45. Factor 2 accounted for 12.0% of variance and has 7 items with factor loading higher than 0.45. Factor 3 accounted for 9.2% of variance and has 4 items with factor loadings of higher than 0.45. The three factors collectively explained 36.8% of total variance.

These three factors were first examined in terms of their content. Factor 1 items were concerned with the degree of bias attributable to high profile cases, working for only one side, judging the quality of respondents' work based on outcome and expert witness' desire to show off expertise. Factor 2 items were biased by personal philosophy, believing in one's own bias freeness, identifying with the attorney, social goals, holding a position that mental illness never causes insanity. Factor 3 represented items that were relatively unbiased.

### Scoring for Orders of Hierarchical Complexity

On a further examination of the items, it appeared to the authors as if the items in each of the factors shared a common characteristic, and that was their Order of Hierarchical Complexity. It was decided to score the items, to check whether this was true. The way in which one goes about scoring is rather simple. First, one has to carefully describe what has to be done to complete the task successfully. Then one makes a judgment as to the hierarchical complexity of that task based on the task analysis (see Commons et al., 2007).

Then one checks that guess using the three axioms for a higher Order of Hierarchical Complexity. Please refer to Table 1 for a list of item Orders. What follows next is a description of how the different items were scored.

### Abstract Order 10

The one item scored as Abstract Order 10 is as follows:

> Respondent's assessment from professional experience of the biasing potential of the high profile of a given case on expert witness. This loads .638 on factor 1.

A *high profile* is an Abstract Order value of a variable, because there could also be profiles that are not high. Responding to that continuum shows sensitivity beginning at Stage 10.

### Formal Order 11

All of the remaining items from factor 1 were scored at the Formal Order 11. Items at the formal Order 11 coordinate two variables. An example is the item that states that an expert working for only one side shows bias. As explained in the Introduction, this item coordinates two variables: the behavior of working for one side, and the outcome of being hired more often. If the attorney wants the expert to work for one side, then the attorney will hire the expert with their bias. All of the items listed below suggest on the one hand one event or condition (such as working for only one side, or desiring to show off), and then a consequence in terms of the expert's degree of bias. The items at the Formal Order are as follows:

Table 2
*Factor Analysis of Items*

| Component matrix[a] | Component 1 | 2 | 3 |
|---|---|---|---|
| Respondent's level of agreement that any prosecution-only criminal-case expert witness reveals bias | 0.863 | | |
| Respondent's level of agreement that any defense-only criminal-case expert witness reveals bias | 0.818 | | |
| Respondent's level of agreement that any defense-only civil-case expert witness reveals bias | 0.816 | | |
| Respondent's level of agreement that any plaintiff-only civil-case expert witness reveals bias | 0.794 | | |
| Respondent's assessment from professional experience of the biasing potential of the high profile of a given case on expert witness | 0.638 | | |
| Respondent's level of agreement on whether favorability of outcome for his/her own side in a given case indicates the quality of respondent's work on that case | 0.519 | | |
| Respondent's assessment from professional experience of the biasing potential of an expert witness' desire to show off his own expertise, skill, erudition, or the like | 0.511 | | |
| Respondent's assessment from professional experience of the biasing potential of an expert witness' own "personal philosophy" on him/her | | 0.772 | |
| Respondent's assessment from professional experience of frequency of opposing expert witnesses' belief in their own bias-freeness | | 0.678 | |
| Respondent's assessment from professional experience of the biasing potential of an expert witness' identification with the (retaining?) attorney | | 0.646 | |
| Respondent's assessment from professional experience of the biasing potential of an expert witness' inclination to one side (plaintiff/prosecutorial) or another (defense) in court cases | | 0.606 | |
| Respondent's assessment from professional experience of the biasing potential of an expert witness' dedication to his/her social goals | | 0.551 | |
| Respondent's assessment from professional experience of frequency of opposing expert witnesses' confidence in their own ability to compensate for obvious bias (e.g., for always working for one side in court cases) | | 0.544 | |
| Respondent's assessment of proportion of expert witnesses believing, to a degree that biases their testimony in insanity cases, crime almost never to be related to mental illness | | 0.44 | |
| Respondent's assessment of degree of his/her own "happiness" in a given case where, despite his/her having testified "appropriately," his/her side wins with the possibility of an unjust outcome | | | 0.653 |
| Respondent's assessment at the time of the given events of the rectitude of opposing expert witness' also being the examinee's treater | | | 0.558 |
| Respondent's assessment of degree of competence felt by the opposing expert witness who has testified in an "appropriate manner" in a given case, if the latter's side loses | | | 0.529 |
| Respondent's assessment of degree of his/her own "happiness" in a given case where, despite his/her having testified "appropriately," his/her side loses with the possibility of an unjust outcome | | | 0.451 |

*Note*. Extraction method: principal components analysis.
[a] Three components extracted.

Respondent's level of agreement that any prosecution-only criminal-case expert witness reveals a bias. This loads 0.863.

Respondent's level of agreement that any defense-only criminal-case expert witness reveals a bias. This loads 0.818.

Respondent's level of agreement that any defense-only civil-case expert witness reveals a bias. This loads 0.816.

Respondent's level of agreement that any plaintiff-only civil-case expert witness reveals a bias. This loads 0.794.

Respondent's level of agreement on whether favorability of out-come for his or her own side in a given case indicates the quality of respondent's work on that case. This loads .519.

Respondent's assessment from professional experience of the biasing potential of an expert witness' desire to show off his own expertise, skill, erudition, or the like. This loads .511.

## Systematic Order 12

Items in Factor 2 were scored at the Systematic Order 12. At the Systematic Order 12, multiple relationships at the Formal Order 11 are coordinated to form systems. The role of the expert is to make judgments (Kahneman, Slovic, & Tversky, 1982) rather than following rigid rules and regulations. Items that loaded highly on factor 2 were the assessment of the biasing potential of an expert's personal philosophy, believing in their own bias freeness, identifying with the attorney, social goals, holding a position that there is never mental illness that causes insanity, and so forth. Four systems of relationships are described by these statements, as described in more detail next.

**System 1: Personal philosophy and view.** Personal philosophy and views may bias an expert witness. For example, some expert witnesses have to make judgments as to whether the defendant is mentally ill. An expert witness may believe that a person is legally insane when they cannot tell right from wrong, and when they do not have the capacity to know what they were doing. An alternative view would be that a person is insane when they could not conform their behaviors to the social norm and the law. These beliefs are at the Systematic Order, because personal philosophy is formed by Formal Order relationships. It is the product of analysis and abstraction of personal experiences, acquired knowledge and values. Items related to System 1 are as follows:

Respondent's assessment from professional experience of the biasing potential of an expert witness' own "personal philosophy" on him/her. This loads .772.

Respondent's assessment from professional experience of the biasing potential of an expert witness' dedication to his or her social goals. This loads .551.

Respondent's assessment of proportion of expert witnesses believing, to a degree that biases their testimony in insanity cases, crime almost never to be related to mental illness. This loads .449.

**System 2: The experts believe themselves to be bias free, or that the opposing experts have confidence in their own abilities to compensate for obvious bias (e.g., for always working for one side in court cases).** Judging the degree of bias of an opposing expert witness who believes in his or her bias-freeness is a task at the Systematic Order 12. One has to be able to know the cause of one's own bias, and one has to act on it. Then one feels that the bias is compensated, and one is bias-free. To do that, one has to evaluate one's own behaviors, or step outside of the self. As Rodriguez (1992) has shown, this is a task at Systematic Order 12.

Items in this system are as follows:

Respondent's assessment from professional experience of frequency of opposing expert witnesses' belief in their own bias-freeness. This loads .678.

Respondent's assessment from professional experience of frequency of opposing expert witnesses' confidence in their own ability to compensate for obvious bias (e.g., for always working for one side in court cases). This loads .544.

**System 3: Identification with the lawyer.** Tasks at this Order coordinate two relationships. First, the expert witness identifies with the lawyer, and therefore takes the lawyer's side. Second, the lawyer hires expert witnesses who identify with the lawyer. The item in this system is as follows:

Respondent's assessment from professional experience of the biasing potential of an expert witness' identification with the (retaining) attorney. This loads .646.

**System 4: Showing inclination to one side.** Tasks at this Order coordinate two relationships. First, expert witnesses who show inclination to one side of cases may help one side win more often. Second, winning more often causes expert witnesses to be hired more often. The item in this system is as follows:

Respondent's assessment from professional experience of the biasing potential of an expert witness' inclination to one side (plaintiff/prosecutorial) or another (defense) in court cases. This loads .606.

## Metasystematic Order 13

Items in factor 3 are at the Metasystematic Order 13. At the Metasystematic Order 13, systems of relationships may be compared. Be-

cause the task of evaluating these items requires a very high stage, items on the factor 3 loaded less than the items on the first two factors. In Commons, Miller, Li, and Gutheil (2012), they were also rated to be less biasing than the items in factors 1 and 2. Each item will be analyzed in the following:

> Respondent's assessment of degree of their own "happiness" in a given case where, despite his or her having testified "appropriately," his or her side wins with the possibility of an unjust outcome. It loads .653.

> Respondent's assessment of degree of their "happiness" in a given case where, despite his or her having testified "appropriately," his or her side loses with the possibility of an unjust outcome. It loads .451.

These two items say that the person testifying is reinforced by the quality of that judgment and testimony and not controlled by the outcome of the case. To testify "appropriately" is likely to be a task at the Metasystematic Order, which coordinates three systems: (a) that of the legal principles involved, (b) the expert's own personal moral judgments, and (c) their personal understanding of the case. That indicates the expert's behavior is principled and controlled by principled Metasystematic Stage 13 reinforcers.

> Respondent's assessment of degree of competence felt by the opposing expert witness who has testified in an "appropriate manner" in a given case, if the latter's side loses. It loads .529.

Again, this is about the quality of that judgment and testimony, not controlled by the outcome. That indicates the expert's behavior is principled and controlled by principled Metasystematic Stage 13 reinforcers.

> Respondent's assessment at the time of the given events of the rectitude of opposing expert witness' also being the examinee's treater. It loads .558.

This is a conflict of interest scenario. The expert witness' role is to give neutral opinions about the patient's state of mind, not to get involved in judging others. Judging others is the job of the court. The examinee's treater, or therapist, should represent the interest of the patient. Judging the righteousness of the opposing expert witness is a task that requires understanding of the roles of the expert witness and the treater, both of which are systems at Systematic order.

## Discussion

Here we showed that the stage required to understand an item predicts how strong the perceived bias of that item is. This is probably what underlies our common-sense notions of bias. Somewhat to our surprise, the three factors obtained reflected the a priori difficulty of the items. Factoring shows that the predominant Order is formal, next most frequent is systematic, and third more frequent is metasystematic. This is what the Model of Hierarchical Complexity would predict. The results support the theory that value and difficulty interact. This means that the perceived value, which biases choice, is partially determined by the Order of Hierarchical Complexity of the item, and therefore the difficulty in understanding the item. What was not done here was to have an independent manipulation of value, so that contribution of the value and difficulty could be gauged separately.

Bias is usually thought of as a dependent variable to be described and predicted. In the simplest sense, it represents a deviation from having a neutral value ascribed to a choice. In psychology and economics it is a choice-outcome–related dependent variable that alters the rating or probability of an action. Hence it belongs to the Behavioral Economics "value/reinforcement" paradigm. In behavioral economics, all bias reflects the probability of making a response (or the tendency to make a response) based on perceived value of the outcome. The more often one does something that has a positive outcome, the higher the value of doing it. This is true whether an expert is aware of this effect or not. Because the lower stage items were seen as more biased, stage and not just emotional response was seen as a major determinant of degree of bias. This supports the view that one should consider the possible interaction between stage and value.

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