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How Argument Structure Biases Acceptance of Advertising Claims: Explaining Deviations from Logical Reasoning in Terms of Subjective Probabilities

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ABSTRACT
Arguments in advertising are intended to maximize the acceptance of the product claims being made. The structure of the argument can influence claim acceptance apart from the quality of the substantiating evidence presented. Specifically, arguments having irrelevant but representative conditionals, hierarchically-related claims, multiple data propositions supporting a single claim, and irrelevant qualifications of conditionals trigger systematic deviations from logical reasoning and over-acceptance of the claim. Probability theory is used to contrast the logical relationships among the beliefs corresponding to each argument with the actual integration rule used by message recipients.

INTRODUCTION
Given the importance of persuasion in marketing communications, the literature has surprisingly little to say about why some arguments are more effective than others (Areni 2002; McGuire 2002). This omission is, perhaps, due to the limited number of empirical paradigms adopted over the last three decades to study advertising and persuasion. Questions as to how to construct persuasive arguments have been given marginal status in research based on expectancy-value models (Lutz 1975; Wilkie and Pessemier 1973), cognitive response theory (Wright 1975, 1980), and dual-process models (Petty, Cacioppo and Schumann 1983; Ratneshwar and Chaiken 1991). The research reported below addresses this gap in the literature by linking judgment biases (Tversky and Kahneman 1982a) to structural aspects of arguments likely to trigger illogical reasoning (Areni 2002).

Ilogical reasoning is expressed in terms of alternative rules for integrating relevant beliefs compared to the rules prescribed by logic. In some cases, actual reasoning deviates from logical reasoning because message recipients are unable to integrate their beliefs according to requisite mathematical rules (McGuire 1960; Wyer and Goldberg 1970), whereas in other situations, the deviation results from a conflict between inductive reasoning based on personal experience, and deductive reasoning based on the information actually presented (Evans et al. 1983; Sloman 1996; Cherubini et al. 1998). This research focuses on four argument structures commonly used in advertising: (a) representative but irrelevant conditionals, (b) hierarchically-related data propositions, (c) multiple data propositions supporting a single claim, and (d) irrelevant qualifications of conditionals. Probability theory is used to contrast logic with the actual reasoning processes adopted by message recipients, with the latter resulting in over-acceptance of the focal claim.

ARGUMENT STRUCTURE AND MESSAGE ACCEPTANCE
Arguments are comprised of three basic types of propositions, claims—the fundamental points being argued, data—the evidence presented to support one or more claims, and conditionals—statements explaining how or why presented data support a given claim (Jaccard 1980; Toulmin 1958). All arguments are essentially arrays of data, conditionals, and claims, with the minimum requirement that at least two of the three proposition types must be explicitly stated rather than implied (Areni 2002). However, some of the propositions comprising an argument may be entailed or conversationally implicated rather than explicitly stated (Geis 1982; Leech 1974). The acceptance of a claim can be assessed in terms of the beliefs corresponding to the propositions in the argument, which can be represented as subjective probabilities ranging from complete acceptance (1.0) to complete rejection (0.0) (McGuire 1960; Wyer and Goldberg 1970). This is not to say that individuals form actual probabilities in response to arguments (Slegers, Brake and Doherty 2000). Rather, there is reason to believe that message recipients do something like forming subjective probabilities in response to persuasive communications, to the point of using probability markers that incorporate expressions of relative certainty (e.g., “undoubtedly,” “probably,” “unlikely,” etc.) into verbal propositions (Fillenbaum et al. 1991).

Within this basic framework, arguments make take on a number of structures based on the various combinations of claims, data, and conditionals. However, arguments having (a) representative but irrelevant conditionals, (b) hierarchically-related data propositions, (c) multiple data propositions supporting a single claim, and (d) irrelevant qualifications of conditionals are particularly likely to trigger over-acceptance of the claim given the acceptance of the corresponding data and conditionals. As shown in Table 1, actual (i.e., but illogical) reasoning in response to each of these argument structures can be expressed as an alternative integration of beliefs compared to logical reasoning.

REPRESENTATIVE BUT IRRELEVANT CONDITIONALS
Research regarding the representativeness of propositions given existing knowledge and experience lends insight to understanding how logical and actual reasoning differ in the processing of certain arguments (Tversky and Kahneman 1982a, 1982b). Specifically, arguments with conditionals that are consistent with previous experiences are likely to be accepted as valid when the datum and conditional do not logically establish the claim. For example, an actual 30-second television advertisement for LG washing machines states that:

“A washing machine that shakes won’t last. That’s why LG have designed a direct drive system giving greater balance and durability.”

Assuming the term “balance” refers to the absence of shaking and that “durability” refers to lasting a long time (i.e., by conversational implication), the propositional structure of this argument is:

Datum: LG washing machines don’t shake. (-shake)
Conditional: If a washing machine shakes, it won’t last. (¬last | shake)
Claim: LG washing machines will last. (last)

The claim that LG washing machines will last a long time does not actually follow from the data and conditional because washing machines can break down for reasons unrelated to shaking. Nevertheless, this argument is likely to be persuasive because shaking is salient and typical of machines that do breakdown. Johnson-Laird (1986) suggests that message recipients generate “mental models” of the various possibilities suggested by an argument. Instances that confirm a representative conditional are easily brought to mind, whereas less salient instances that would invalidate the argument
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are harder to imagine (Hastie and Dawes 2000; Kahnemann and Tversky 1982). For example, besides shaking, what salient symptoms are exhibited by a washing machine just prior to breaking down? To the extent that no mental models come to mind (e.g., odd noises, leaking water, etc.), the data that the machine doesn’t shake makes a seemingly convincing case for the claim. So, representative conditionals often result in mental models with significant confirmation biases (Hoch and Deighton 1989), leading to the acceptance of invalid arguments.

According to probability theory, the subjective beliefs associated with this argument must be combined in one of two ways:

\[ p(c)=p(c|d)p(d) + \ldots \]

However, the argument as stated is not captured by either product on the right side of equations 1a or 1b. In practical terms it is invalid because washing machines may break down even when they do not shake [i.e., \( p(-last | -shake)p(-shake) \) could be substantially greater than 0]. In terms of logic, it is invalid because the conditional presents what will happen if the machine does shake, whereas the data establishes that it does not shake. This is the Aristotelian fallacy of denying the antecedent. But the representativeness of the conditional invites the following integration of beliefs:

\[ p(c)=\min[p(c|d_1)p(d_1),p(d_2)p(d_2)] \]

The beliefs corresponding to this argument should logically be integrated as:

\[ p(c)=p(d_1)p(d_1) + \ldots \]

**Hierarchically-Related Data Propositions**

Hierarchical arguments have multiple levels such that the claim of one argument serves as the data for another. For example, an advertisement for the Breville Express Cooker contains the following copy:

“The Breville Express Cooker cooks up to 8 times faster, that’s because it’s essentially an electric saucepan with a lid that has an airtight seal when locked. Once airtight, the Express Cooker becomes pressurised, resulting in food cooking much faster than normal.”

This argument can be reduced to the following propositional structure, where one of the conditionals is implied rather than stated:

**Table 1**

<table>
<thead>
<tr>
<th>Structural Features of Verbal Arguments</th>
<th>Subjective Probability Theory (Actual Reasoning)</th>
<th>Objective Probability Theory (Logical Reasoning)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Representative But Irrelevant Conditional</td>
<td>( p(c)=p(c</td>
<td>d)p(d) + \ldots )</td>
</tr>
<tr>
<td>Hierarchically-Related Data Propositions</td>
<td>( p(c)=\min[p(c</td>
<td>d_1)p(d_1),p(d_2)p(d_2)] )</td>
</tr>
<tr>
<td>Multiple Data Propositions Supporting a Single Claim</td>
<td>( p(c)=p(c</td>
<td>d_1)p(d_1) + \ldots )</td>
</tr>
<tr>
<td>Irrelevant Qualification of the Conditional</td>
<td>( p(c)=p(d_1) + \ldots )</td>
<td>( p(c)=p(d_1)p(d_1) + \ldots )</td>
</tr>
</tbody>
</table>

*Where: \( p(c) \) = the subjective probability that the claim is true, \( p(d) \) = the subjective probability that the datum is true, \( p(-c) \) = the subjective probability that the datum is not true, \( p(c|d) \) = the conditional probability that the claim is true given that the datum is true, and \( p(d_1 \cap d_2) \) = the conjunctive probability that datum 1 and datum 2 are both true.*
However, research suggests that individuals do not assess hierarchical arguments according to equation 2\textsubscript{a}, but instead truncate the argument according to one of two rules (c.f., Kardes et al. 2001). The “as if” heuristic posits that people process hierarchical arguments in stages. If datum 2 and conditional 2 provide a reasonable basis for accepting datum 1, then datum 1 is accepted with certainty [i.e., $p(\text{pressure}) = 1$] at the next stage of processing (Cohen, Chesnick and Haran 1982; Wyer and Goldberg 1970). So, if message recipients are persuaded that the product has an airtight seal, and that the seal increases pressure during cooking (i.e., the corresponding probabilities are reasonably high), then this level of the argument is considered to be established [i.e., $p(\text{pressure}) = 1$], such that the probabilities corresponding to acceptance of the ultimate argument are reduced to:

$$2_b. \quad p(\text{cook}) = p(\text{cook} | \text{pressure})$$

The “weak link” heuristic suggests that individuals equate the likelihood of the claim with the minimum acceptable proposition in the hierarchical argument (Tversky and Kahneman 1982a). In short, the claim is no more plausible than the weakest link in the chain, or in terms of subjective probabilities:

$$2_c. \quad p(\text{cook}) = \min[p(\text{cook} | \text{pressure}), p(\text{pressure} | \text{seal}), p(\text{seal})]$$

The implication of these truncations is that the message recipient will tend to be overly certain of the claim given the argument, or in other words, that the right sides of equations 2\textsubscript{b} and 2\textsubscript{c} are higher than equation 2\textsubscript{a}. Hence, hierarchical arguments should be terribly effective despite limitations in the individual propositions comprising the argument (Tversky and Kahneman 1982a; Wyer and Goldberg 1970).

**MULTIPLE DATA PROPOSITIONS SUPPORTING A SINGLE CLAIM**

Arguments containing multiple data propositions present message recipients with numerous reasons for accepting a single claim. For example, an advertisement for EPSON Printers states:

“Thankfully with an EPSON Stylus Photo Printer you’re always guaranteed great photo texture. How? First there’s our Perfect Picture Imaging system with its unique Micro Piezo Technology. This controls the size, shape and placement of ink dots, giving superb levels of detail—even up to an amazing 2880 dpi. But the perfect photo look doesn’t end there. EPSON Print Image Matching Technology ensures optimum photo quality.”

In terms of propositional content, this argument can be represented as:

**Datum 2:** The EPSON Stylus Photo Printer controls the size, shape and placement of ink dots up to 2880 dpi. (2880 dpi)

**Conditional 2:** If a printer controls the size, shape and placement of ink dots up to 2880 dpi, then it provides great photo texture. (texture | 2880 dpi)

**Datum 1:** The EPSON Stylus Photo Printer ensures optimum photo quality imaging. (imaging)

**Conditional 1:** If a printer ensures optimum photo quality imaging, then it provides great photo texture. (texture | imaging)

Claim: The EPSON Stylus Photo Printer provides great photo texture. (texture)

Both conditionals are implied rather than stated explicitly. According to probability theory, the subjective beliefs corresponding to the argument should be integrated as follows (Wyer and Goldberg 1970; Kardes et al. 2001):

$$3_{a} \quad p(\text{texture}) = p(\text{texture} | 2880 \text{ dpi}) p(2880 \text{ dpi}) + p(\text{texture} | \text{imaging}) p(\text{imaging}) - p(\text{texture} | 2880 \text{ dpi} \text{ I imaging}) p(2880 \text{ dpi} \text{ I imaging}) + \ldots$$

However, there is evidence that individuals do not integrate their beliefs according to equation 3\textsubscript{a}. Instead, message recipients process the “sub-arguments” separately, basing their ultimate acceptance of the claim on the sum of each sub-argument (Hastie and Dawes 2000; Areni 2002). In terms of subjective probabilities, equation 3\textsubscript{a} is truncated to:

$$3_{b} \quad p(\text{texture}) = p(\text{texture} | 2880 \text{ dpi}) p(2880 \text{ dpi}) + p(\text{texture} | \text{imaging}) p(\text{imaging})$$

As the number of sub-arguments increases, the inflation of the probability associated with the claim increases, as more and more conjunctions are effectively counted twice, thrice, etc. (Van Wallendael and Hastie 1990). Hence, arguments with multiple data propositions promote greater message acceptance than logically follows from the corresponding beliefs.

IRRELEVANT QUALIFICATIONS OF CONDITIONALS

Empirical arguments containing irrelevant qualifications specify additional conditions that either strengthen (e.g., “especially if…”) or weaken (e.g., “unless…”) the main conditional of an argument. In the former case, the qualification applies to virtually all message recipients, whereas in the latter case it applies to relatively few. An advertisement for Yasmin birth control pills includes a qualification that weakens the main conditional:

“A pill that works with your body chemistry? Yasmin is the only birth control pill that affects the excess sodium and water in your body while also maintaining, or in some cases increasing your potassium… How can you be sure that Yasmin is safe for you? ... You should not take Yasmin if you have kidney, liver or adrenal disease because this could cause serious health problems.”

This argument has the following propositional structure:

**Datum:** Yasmin birth control pills maintain or increase potassium. (potassium)

**Conditional 1\textsubscript{a}** If a birth control pill maintains or increases potassium, then it is safe. (safe | potassium)

**Conditional 1\textsubscript{b}** Unless the user is suffering from kidney, liver, or adrenal disease. (safe | potassium ∩ -disease)

**Claim:** Yasmin is a safe birth control pill. (safe)

The subjective beliefs relevant to the propositions in this argument can be represented as:

$$4_{a} \quad p(\text{safe}) = p(\text{safe} | \text{potassium} \cap -\text{disease}) + \ldots$$
For the vast majority of message recipients, the qualification is irrelevant [i.e., p(-disease) => 1]. If the qualification is deemed inapplicable, then the system of beliefs corresponding to the argument logically reduces to:

\[ 4_b: \ p(safe) = p(safe \mid potassium)p(potassium) + \ldots \]

That is, if p(-disease) = 1, then equation \(4_a\) is equivalent to equation \(4_b\). However, there is evidence that discounting the qualification has the effect of bolstering acceptance of the main conditional toward complete certainty [i.e., p(safe \mid potassium) => 1], such that equation \(4_b\) is truncated to:

\[ 4_c: \ p(safe) = p(potassium) + \ldots \]

In short, actual reasoning includes the inference: “Well, I’m not suffering from kidney, liver, or adrenal disease, so a pill that maintains or increases potassium will definitely be safe for me” (Areni 2002). The only remaining consideration is the data proposition (i.e., “does it actually maintain or increase potassium levels?”), which becomes the principal determinant of message acceptance. So, irrelevant qualifications lead to greater acceptance of the claim than that which is logically justified.

**TESTING FOR DIFFERENCES IN LOGICAL AND ACTUAL REASONING**

Wyer (1975) developed an interesting approach for testing whether message recipients engage in logical versus illogical reasoning when presented with verbal arguments. To illustrate, for the data proposition in the LG advertisement, respondents would evaluate the statement “LG washing machines don’t shake,” using an 11-point scale anchored by 0 (not at all likely) and 10 (extremely likely). The subjective probability would then be derived by dividing the observed response by 10. The subjective probabilities corresponding to the remaining propositions in the ad would be measured in a similar manner.

These scales are interesting in that they create a measure ranging from 0.0 to 1.0, similar to actual probabilities. It is perhaps tempting to combine the measured beliefs according to the integration rules implied by logical versus pragmatic reasoning to determine which computed score best predicts the directly measured acceptance of the claim; but such an approach is valid only if the reported “probabilities” are ratio scale measures of the unobservable level of certainty regarding the truth of the corresponding propositions (Anderson 1982; Birnbaum 1973, 1974). Research regarding the measurement of subjective probability suggests that this assumption is not likely to hold (Fillenbaum et al. 1991), and as a result an incorrect function might predict the target belief more accurately than the actual integration rule used by the individual (Birnbaum 1973, 1974; Lynch 1985). However, functional measurement analysis necessitates only the more modest assumption that a monotonic relationship exists between the observed measure and the underlying construct (Anderson 1982; Birnbaum 1974).

Under these conditions, logical reasoning can be tested against actual reasoning by including all the relevant subjective beliefs in a general linear model and noting which terms emerge as significant predictors of claim acceptance (Wyer 1975).

For example, consider the representative but irrelevant conditional in the LG washing machine advertisement. The subjective probabilities corresponding to the argument are: p(last), p(shakes), p(last \mid shakes), and p(-last \mid shakes). Given these terms, the logical integration rule shown in equation \(1_b\) implies that the p(last \mid shake) x p(shake) interaction effect will provide incremental predictive power beyond the corresponding main effects, and equation \(1_b\) suggests that the p(last \mid shake) x p(shake) interaction effect will provide incremental predictive power beyond the corresponding main effects. On the other hand, actual reasoning involves a p(last \mid shake) x p(-shake) interaction, which can be distinguished from the corresponding logical interactions based on the sign of the correlation with p(claim). That is, probability theory indicates a perfect negative correlation between the following pairs of probabilities: p(shakes) and p(-shakes), p(last \mid -shakes) and p(-last \mid -shakes), and p(last \mid shakes) and p(-last \mid shakes), so for actual reasoning, the correlation of the interaction term with claim acceptance must be opposite in sign to that for the logical interaction terms.

A similar approach can be applied to testing the remaining pragmatic integration rules against those prescribed by logic. For example, the actual processing of hierarchical arguments implies one of two simple main effects models. Either p(claim \mid datum\(_1\)) is the lone predictor of claim acceptance (i.e., the “as if” heuristic, or the minimum value of p(datum\(_2\)), p(datum\(_1\) \mid datum\(_2\)), p(claim \mid datum\(_1\)) is the only significant term in the resulting model (i.e., the “weak link” heuristic). By contrast, the logical integration rule necessitates that the p(claim \mid datum\(_1\)) x p(datum\(_1\) \mid datum\(_2\)) x p(datum\(_2\)) interaction effect provides incremental predictive power beyond the main effects and 2-way interactions in the model (Kardes et al. 2001).

Actual reasoning with respect to arguments with qualified conditionals implies that the subjective belief regarding datum 1 (i.e., Yasmin birth control pills maintain or increase potassium) is the sole predictor of claim acceptance (i.e., Yasmin is a safe birth control pill). Logic, on the other hand, requires that the p(claim \mid datum\(_1\)) x p(datum\(_1\) \mid datum\(_2\)) x p(datum\(_2\)) interaction effect provides incremental predictive power beyond the simple main effects. A strong test of logical versus actual reasoning would involve presenting respondents with either of two versions of the Yasmin argument—one with the qualifying condition and one without. Respondents in the latter condition should be relatively logical, such that the p(safe \mid potassium) x p(potassium) interaction term provides incremental predictive value. Respondents in the former condition who do not reject the qualifying condition as irrelevant should also reveal a significant two-way interaction. The pragmatic truncation should only emerge for respondents who reject the qualifying condition as irrelevant or implausible.

Perhaps the most difficult test of logical versus actual reasoning involves arguments where multiple data propositions support a single claim, due mainly to the challenge of measuring the conjunctive probabilities in the logical integration rule. For example, in the aforementioned ad for Epson printers, the conjunctive probability would necessitate that respondents answer the following item: “The Epson Stylus Photo Printer controls the size, shape and placement of ink dots up to 2880 dpi and ensures optimum photo quality imaging,” in addition to the items for each data proposition separately. Although this basic approach has been used in previous research examining irrationality in assessments of conjunctive probabilities (Kahneman and Tversky 1982a), it is not clear that respondents would understand the distinctions among these items. Nevertheless, despite these measurement issues, the actual integration rule implies that the interaction effect involving the conjunctive probabilities provides additional predictive value beyond the main and 2-way interaction effects associated with p(claim \mid datum\(_1\)), p(datum\(_1\)), p(claim \mid datum\(_2\)), and p(datum\(_2\)).

**DISCUSSION**

It seems likely that advertising copywriters have an implicit understanding of each of the principles identified above and exploit these limitations in reasoning to create “convincing” arguments.
Perhaps nowhere is this better illustrated than a recent 30-second television ad for Oil of Olay, which states that the skin cream keeps women looking younger by fighting the seven signs of aging. Each of these conditions is stated in succession by the voiceover with a corresponding visual showing how the product eliminates the condition. The magazine version of the ad also leverages the multiple data propositions with large, bold font stating that the product (1) diminishes the appearance of fine lines and wrinkles, (2) evens skin tone for younger-looking, more balanced color, (3) evens skin tone for younger-looking, more balanced color, (4) improves surface dullness, giving skin a radiant healthy glow, (5) minimizes the appearance of pores, (6) reduces the appearance of blotches and age spots, and (7) soothes dry skin, hydrating with Olay moisture. Given the integration of beliefs implied by equation $3_p$ even if the audience largely rejected each data-conditional combination, the claim would still be accepted with quite a bit of certainty.

Likewise, a magazine advertisement for Mountain Herbs Herbal Enhancement supplement makes the following hierarchical data argument.

"Treat the cause not the symptoms and simplify your life. Herbal Enhancer may reduce the symptoms of PMS by addressing the cause of the problem–hormonal imbalance. Herbal Enhancer contains a synergistic blend of 9 herbs that promote the healthy function of the hypothalamus with herbs that are phylo-oestrogens."

In this 3 level hierarchy, the herbal ingredients (i.e., data$_2$) promote a healthy hypothalamus (i.e., data$_3$), which regulates hormonal imbalance (i.e., data$_4$), which reduces PMS symptoms (i.e., claim). The corresponding conditionals are implied rather than stated. But note that the opening statement draws attention to the hierarchical nature of the argument by discussing the importance of treating the ultimate (i.e., further up the hierarchy) cause of PMS rather than the proximal (i.e., further down the hierarchy) causes, which are nothing more than symptoms of the true problem. In both cases, the ad copy seems to be designed to maximize the impact of the argument structure.

Does this mean that consumers exposed to these argument structures in ads are inherently illogical and prone to over-accepting product claims? Not all deviations from logic can be characterized as illogical, since the mental effort required for logical reasoning comes at a cost. Consumers using these and other heuristics may produce reasonably accurate beliefs on a relative economy of thought. In addition, consumers likely possess complicated beliefs systems linking the propositions in an argument to countless others. Actual reasoning may deviate from “logical” reasoning because consumers rely on exogenous beliefs not actually presented in the argument. Reasoning from experience is likely to result in numerous conscious and unconscious inferences that are perhaps best described as “extra-logical” reasoning.

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