ISSA Proceedings 2002 – Processing Syllogisms And Enthymemes In Relation To Their Logical And Pragmatic Function

1. Introduction

This paper reports the results of two experiments comparing the mental processing that occurs when individuals are presented with a two premise and conclusion syllogism or a single premise and conclusion enthymeme. Typically, the processing of these two forms of argument structure takes place with different goals in mind. For the syllogism the individual's goal is usually determining whether the syllogism is logically valid; for the enthymeme, it is usually concerned with the enthymeme's pragmatic function, such as the extent to which the enthymeme is persuasive.

While these are the most prevalent relationships between a person's goal and the particular argument structure, others may be found. For example, a person may employ a pragmatic goal when processing a syllogism or employ a goal of determining logical soundness when processing an enthymeme. However, each of these goal-structure relations raises questions. Considering first the pragmatic goal used in the context of a syllogism, a question is whether the syllogism's logical soundness or the lack thereof may influence the pragmatic judgment, as for example a judgment of persuasion. Will the persuasiveness of a syllogism be greater when the syllogism is logically sound than when it is not, given roughly equivalent contents?

In the case in which a judgment of logical soundness is being made in reference to an enthymeme, there are at least two types of processing that may occur. One is that the individual may construct the missing premise and then evaluate the syllogism. This possibility relates to the distinction made by van Eemeren and Grootendorst (1992), and later by Gerritsen (1999) in an ISSA paper, indicating that an enthymeme has at least two functions, the logical and the pragmatic, with the logical interpretation defining the enthymeme as a syllogism with a premise missing. The individual adding the missing premise and then judging the

syllogism for soundness is applying the logical interpretation of the syllogism. Govier (1987), however, has pointed out that by adding one or more such premises, one can always make the syllogism logically sound.

A second way in which an individual may process an enthymeme when being asked to determine its logical soundness is to consider the enthymeme as an argument in itself, an issue discussed in an ISSA paper by Hitchcock (1995). In this case the individual would likely consider soundness to be a function of the traditional enthymeme evaluation components, the perceived strength of the supporting premise and the extent of support that premise is taken to provide for the conclusion. In support of the latter view are the findings of an informal study we conducted. When college students were asked to evaluate the soundness of an enthymeme they not only did not generate the missing premise, they usually could not generate such a missing premise when asked to do so. While having a knowledge of logic or of Toulmin's (1958) model could perhaps lead to successful generation, the inability of college students to perform these tasks at least suggests that missing premises are not generally considered when there is the goal of examining for their logical validity.

The purpose of the comments made thus far is to point out that there are a number of questions concerning how people process argumentative language structures. The two experiments reported in this paper were designed to study the operation of particular variables in such processing, especially emphasizing the goal of the processing, the form of argument structure, and the pragmatic quality of the arguments under study, that is, whether they are strong or weak. In the first of the two experiments, participants rated syllogisms or enthymemes on a 6-point scale for logical soundness or for persuasion effectiveness. In the interest of brevity the hypotheses being tested are presented in relation to the results.

2. Experiment 1
2.1. Conditions and Procedures

Each of 96 participants was presented with a series of 8 arguments. The arguments were logically valid and about controversial issues, namely, casino gambling, abortion, handgun registration, marijuana legalization, aids, assisted suicide, availability of contraceptives in high school, and capital punishment.

One experimental variable, termed Instruction, consisted of one-half of the participants being asked to rate the logical soundness of each argument on a 1-6

scale, with 6 as "definitely logically sound" and 1 as "not logically sound." The other half of participants was asked to rate each argument on a 1-6 scale of persuasion effectiveness with 6 "definitely persuasively effective" and 1 "definitely not persuasively effective." For both rating scales, each of the scale values, that is, 1 to 6, was verbally labeled on the participant's rating sheets. Within each half of each of the two Instruction conditions, one-half of the participants received arguments in the form of a syllogism and the other half received arguments in the form of an enthymeme. This variable is termed argument Form. The arguments used for the syllogisms and the respective enthymemes were identical, except that the major premise was deleted in the enthymeme conditions.

Another manipulated variable was Quality, that is, the relative strength or weakness of an argument in relation its pragmatic contents. All variables were orthogonal.

An example of the arguments presented for the topic of handgun registration is as follows. Syllogism-strong: Helping to reduce violent crimes should be required by law. Handgun registration can help reduce violent crimes. Handgun registration should be required by law. Enthymeme-strong: Handgun registration can help reduce violent crimes. Handgun registration should be required by law. Syllogism-weak: Allowing the government to know where most hunters reside should be required by law. Handgun registration allows the government to know where most hunters reside. Handgun registration should be required by law. Enthymeme-weak: Handgun registration allows the government to know where most hunters reside. Handgun registration should be required by law. It is noted that in all versions of arguments for a given topic, the conclusion was always the same. All participants received all four versions of the topic with materials counterbalanced via a Greco-latin square.

One other aspect of the experiment is noted. Since participants received the same conclusions for the set of conditions of a particular topic, and since a person's judgment of the logical soundness or the persuasive effectiveness of an argument tends to be related to the person's attitude toward the claim of the argument, we measured each participant's attitude toward each claim and in our analyses we covaried the attitude variable.

2.2. Results
The first hypothesis considered is that the ratings of logical soundness and of persuasiveness would be differentially distributed along the respective 1-6 rating

scales. Specifically, since judgments of logical soundness are usually made in a dichotomous manner, that is, the argument is either valid or not valid, the ratings of soundness should show relatively more 1 and 6 judgments, especially 6, given that logically valid syllogisms were being rated. Correspondingly, there should be relatively few 2-5 ratings. On the other hand, persuasion judgments, generally probabilistic in nature, should have relatively more 2-5 and fewer 1 and 6 ratings. The data shown in *Figure 1* indicate that the ratings were generated as hypothesized, with greater differences at the high extreme than the low extreme rating.
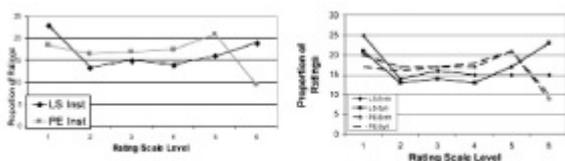

Figure 1 Proportion of Rating Responses as a Function of Rating Scale Level for the Instruction Conditions.

Figure 2 Proportion of Rating Responses as a Function of Rating Scale Level for the Instruction Conditions.

Figure 2 presents the Figure 1 data broken down to include the Form condition. (Statistically, the Instruction x Form interaction is significant.) First, the 1 ratings, indicating not logically sound, were relatively frequent for both Form conditions with, somewhat surprisingly, the enthymeme Form yielding the higher proportion. This result suggests that perhaps the ratings were based upon the argument's contents. Second, when logical soundness Instruction ratings are made for enthymemes, the proportion is virtually flat for ratings 2 to 6. An interpretation of this result is that with enthymemes there was not enough information to make a reasonable judgment of the argument's soundness. This interpretation also suggests, of course, that individuals did not generate a missing premise to analyze soundness. Soundness ratings of syllogisms, however, led to a relatively high number of 6 ratings, thus supporting the idea that given the syllogism, accurate ratings could be made. For the persuasive ratings, argument Form had relatively little effect, with both yielding the peaking at 5 and showing the lack of certainty at 6. Persuasion was not rated as being more effective with use of the enthymeme than the syllogism form.

The second hypothesis is that logical soundness ratings should be higher when rating syllogisms than when rating enthymemes, as suggested by the above data and by the fact that a syllogism has the information relevant to judging logical soundness. With persuasiveness ratings, however, there should be little difference as a function of Form, unless an enthymeme is a particularly good persuasive device, which the above data do not support. The interaction of Instruction x Form is statistically significant, with logical soundness judgments having mean

ratings of 3.28 and 3.60, respectively, for the enthymeme and syllogism forms. The respective means for the persuasion ratings are 3.29 and 3.42. The second hypothesis is thus supported with syllogisms producing higher logical soundness ratings than enthymemes. Persuasiveness ratings were slightly higher for syllogisms than enthymemes.

The third hypothesis refers to a previous statement of the paper, namely, that if individuals have only a single premise and a conclusion, their ratings of logical soundness may be based upon the contents of the argument rather than generating a premise and evaluating. The finding that the enthymeme means are virtually identical for the two Instruction conditions is at least consistent with the stated hypothesis, albeit a null result.

The fourth hypothesis is that the difference between strong and weak arguments is better discriminated when making persuasive judgments than when making logical soundness judgments. This was expected because in persuasion rating the focus is on the contents while in making logical soundness judgments, focus is on structure and, probably to a lesser extent, content. The significant interaction of Instruction x Quality is significant, with the means supporting the hypothesis. The mean logical soundness rating for strong arguments is 4.24 and for weak us 2.64. The mean persuasiveness rating for the strong was 4.33 and the weak was 2.38. The results thus indicate the mean strong and weak difference was greater for the persuasive ratings.

2.3. Discussion

The results of Experiment 1 provide experimental support for some ideas of how individuals may process argument structures within the context of particular goal conditions. In particular, the Figure 1 data indicate not only that individuals process argument structures in relation to the person's goals but that the nature of the argument structure under study can influence such processing. As would be expected, judgments of logical soundness were readily made when syllogisms were presented, whereas enthymemes afforded little opportunity for such judgments. Somewhat surprisingly however, making logical soundness judgments of enthymemes did provide for a substantial proportion of not valid ratings, the 1 level, suggesting that participants were sensitive to argument contents. One other question about the findings is why more 6 logical soundness ratings were not obtained. Few of the students had had a course in logic, and quite possibly were making judgments on content with some frequency. The rating data also

confirmed the idea that persuasion ratings are processed in a probabilistic manner with relatively little reference to positive or negative certainty. Individuals making pragmatic ratings seem to do about the same thing whether they are presented with a syllogism or an enthymeme. This result may be expected with the emphasis on contents in making such ratings.

One shortcoming of the first experiment is that while there was the manipulation of the Quality variable, there was not a corresponding manipulation of a logic variable, that is, presenting syllogisms so that one-half were valid and the other half not valid. Another shortcoming that is being addressed in a third experiment in how processing may be affected in a dichotomous judgment procedure.

3. Experiment 2

3.1. Conditions and Procedures

Forty arguments were employed in the present study. Instruction was not manipulated, with the same instruction given to all participants, namely, to rate each of the presented arguments for its strength on a 1-10 scale, with 1 (not strong) and 10 (very strong). There were 96 participants, with one-half of them receiving arguments in syllogism form and the other half receiving the same arguments in enthymeme form with the major premises missing.

In addition to the between-subject manipulation of Form, the experiment consisted of a 2 x 2 within-subject design of syllogisms logically valid or not logically valid, and the Quality of argument, strong or weak, as in the first experiment. The syllogism materials were constructed as follows: All valid syllogisms had the form A-B, B-C, A-C. All non-valid syllogisms had the form A-B, B-D, A-C. Content-wise, A-B and A-C were identical in the valid and non-valid syllogisms, as was the B in the second proposition of each. D was inserted as a reasonable content for the particular syllogism. All enthymemes consisted of A-B, A-C, omitting the B-C or B-D component of the corresponding syllogism. Thus, for the enthymemes, the logically valid and not logically valid distinction did not hold. The 2 x 2 manipulation of Syllogism Validity and Quality held for both Forms of material. Attitude was also covaried in this experiment.

3.2. Results

Each of the three main effects of the experiment was statistically significantly. Strong arguments yielded higher strength ratings than weak arguments, the strong mean = 6.60, weak = 4,71. Logically valid arguments were rated stronger than logically non-valid, with respective means of 6.19 and 5.11. Syllogisms

received a higher mean strength rating than enthymemes: Syllogisms = 6.08, enthymemes = 5.22. The significance of Quality and Logical Validity each served as a manipulation check for the experiment.

The first hypothesis, as suggested by the findings of Experiment 1, is that judgments of argument strength differentiate strong and weak arguments better for the enthymeme form than the syllogism form. This hypothesis was supported with means for strong arguments in the respective enthymeme and syllogism conditions of 6.44 and 6.75 and 4.01 and 5.41 for the weak condition. Thus, presenting arguments as enthymemes produces better differentiation of strong and weak arguments, especially weak arguments. Noted also is that this result holds regardless of whether the syllogism is valid or not valid. Indeed, the Form x Quality x Logical Soundness interaction does not approach significance.

The second hypothesis is that argument strength judgments would be greater for logically valid syllogisms than for non-valid syllogisms, but only for the syllogism presentations, not for the enthymemes. The results supported this rather obvious hypothesis, with a mean argument strength for valid syllogisms of 6.75 and for non-valid 5.41. The mean argument strength ratings of the respective pseudo logically valid and not logically valid enthymeme conditions virtually coincided, at 5.21 and 5.24. What is perhaps surprising is that non-valid syllogisms are rated as stronger than enthymemes. This result suggests that the presence of the three components of a syllogism somehow makes an argument appear stronger than having only the enthymeme present.

The third hypothesis was not supported. This hypothesis is that the highest strength ratings should occur when arguments were strong and logical, which also would mean for syllogisms and not enthymemes. This finding would have supported the idea that the effects of combining a strong argument that is logically valid, would summate. Actually, the mean of this condition, 7.82, is the highest of any mean when the data are broken down into the means for the eight conditions of the three variables. But statistically, the three-term interaction does not approach significance.

4. General Discussion

If an enthymeme is encountered, how is a person likely to process it? If the person's goal is to evaluate it, the premise and conclusion probably will be examined in relation to the two traditional criteria and, acceptance without certainty may be established such that the argument is perhaps regarded as somewhat strong or perhaps not very strong. Such responses will vary with the

argument's contents and the person's attitude or beliefs as they relate to the argument's contents. The present experiments do raise the question of the possible relationship of the dependent variables of logical soundness, persuasion effectiveness and argument strength. While it seems that there should be a strength of an argument per se, something like logical soundness, internal to the argument itself, and an external usefulness type of criterion for argument effectiveness, it is less than clear to specify how these two aspects should be separated, especially since making the enthymeme logically valid seems to be a non-issue (cf. Govier, 1987).

But what happens when encountering an enthymeme if the person's goal is to provide a rating of logical soundness? The present data provide no support that individuals add a missing premise or in some other way are able to evaluate an enthymeme as logically valid. Indeed, there is at least some evidence that such evaluation is based upon the contents of the enthymeme.

What happens when an individual encounters a syllogism and is asked to indicate its pragmatic effectiveness or it argumentative strength? The present findings suggest that about the same thing that happens when a person processes an enthymeme with such goals.

What happens when a syllogism is encountered with the goal to evaluate it for logical soundness or logical validity? Although not trained in formal logic, the present participants were able to delineate valid from non-valid, even though there were a number of errors. But there also was evidence that processing syllogisms for their logical validity, whether the syllogisms are valid or not valid, inflates the value of weak arguments and reduces the ability to discriminate strong and weak arguments.

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