Effect of Type of Source
on Response Change

Cognitive Science 1 Report

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Executive Summary

We propose an experiment that studies the effect of the type of source of explanation on response change with supporting evidence. The experiment's basic assumption is that additional explanation, being it from an anonymous person or an expert, triggers a change in response to a question already answered. Confidence in the answer and trust in the source of the explanation influences how the information is used. The experiment specifies people's responses and the confidence level is low when there is no additional explanation. Providing additional explanation from an anonymous source or expert may produce some change in response, confidence in response, and level of trust in the source of explanation. Two conditions are reported. Condition 1 showed questions without an explanation provided. Condition 2 is done with the same set of questions, only with an explanation from an anonymous or an expert. Together, the findings support models that people trust experts more than anonymous persons. Results are discussed with respect to their implications for different stages of this process, such as the activation of causal hypotheses and their subsequent selection, as well as with respect to source influences on this process.

Introduction and Rationale (George)

Knowing the source of an explanation influences its credibility. This is our motivation for a scientific experiment to evaluate the effect of information about the source of explanation on the change of response to a question.

We are investigating the impact of the source of information on response change and how the explanation of the source influences the change in response too.

For the explanations, we may have two conditions: clarifications and introduction to new information that is helpful and could guide us to the correct answer. The explanation may further clarify the question or hint either directly or not to the correct answer.

People are usually not content with merely taking explanations from others, they seek to know whether the person is an expert in that field or not to determine the value they place on such explanations. Suppose, for example, the meteorologist announced that there is an 80 percent chance of rain, compared to an anonymous person. You will most probably find yourself perceiving the information in a different way depending on the source. Is this simply a sign of the effect of the source of explanation for you?

The study of explanations has traditionally been undertaken in attribution theory "Perceived Source Variability Versus Familiarity: Testing Competing Explanations for the Truth Effect" (Richards, A. S., & Hample, D., 2016). While other effects of source of explanation exist (e.g., Bates, B. R., Romina, S., Ahmed, R., & Hopson, D. (2006), the effect of source credibility on consumers' perceptions of the quality of health information on the Internet. According to Medical informatics and the Internet in medicine, source effects of explanations are the most important type in that the vast majority of everyday explanations involve causality and the causal elements of an explanation are the parts that have the strongest influence on perceptions and judgments (Keil, 2006).

The present report focuses on the question of how people change their response and confidence when exposed to an additional explanation from an anonymous person or an expert. It is assumed that people trust profiles that look like experts and have more trust in sources that look like an expert than anonymous people when they provide the same

information. The non-conformance of information and source produces cognitive dissonance which reduces their trust in the source and confidence in the explanation.

Explanations are very helpful and the source of the explanation influences how they are perceived and used. The provision of additional information as well as the type of source may lead to a change in the initial response to a question. The level of confidence in the response may also depend on the type of source, whether it is from an anonymous or an expert. The level of trust in the source may change with the type of source (expert E / anonymous A).

There has been a growing interest in understanding source effects on explanations. Some studies (Karlsson, M., Clerwall, C., & Nord, L., 2014) have shown effect on source and message credibility. The source of the explanation determines how the explanation is perceived and used. Besides, the confidence in response and trust in the source may vary depending on whether it is from an anonymous or expert.

Although some research has been carried out on the effect of source of explanation, there have been few empirical investigations into the effect of source of explanation on response change. This present study focuses particularly on the effect of the source of explanation on change of response to a question. The assessment of participants' changes of response, confidence in the response as well as their trust in the source from an anonymous or expert.

Three questions were thus addressed in this study: (1) How does a response change after exposure to an explanation from an anonymous or expert? (2) How does the confidence in a response change after exposure to an explanation from an anonymous or expert? (3) What is the level of trust in an explanation coming from an anonymous or expert source?

This report is organized as follows: we start by presenting Methods A (design) and B (stimuli). Then, we present the step-by-step of the experiment in Method C. In the last section, we discuss the results, conclusion and future work.

Method A: Design (Hajar)

For our experiment design, we chose between group design. This type of design is also known as the independent measures design. It is a research design method that assigns participants to different groups and compares them to each other. We chose between subject design and made sure to do the random assignment of the participants. We used Qualtrics to build our questionnaire. We launched our survey through Prolific to get 50 subjects since it is a pilot study. Those 50 participants answered six questions twice which led to a data set of 300 data points. Each question contains 5 Multiple Choice options in order to keep the same probability of random answers for all questions. Additionally, the order of questions was randomized - to avoid order effect - but not the order of answers - so that the respondents could keep track of their options before and after the explanation.

The independent variable in this study is the *condition* being either the expert or anonymous explanation. It is the variable that we manipulate in our experimental study to explore its effect. It is called independent because it is not influenced by any other variables in our study. The dependent variables that we measured in our experimental design are the change in response, the confidence in the answer (*confidence_1* for the confidence level before explanation and *confidence_2* for the confidence level after explanation either expert or anonymous) and the trust in source (*trust_source*). In this part, we needed to transform the data downloaded from Qualtrics to another more useful way, shown in Table 1.

Table 1: Sample from dataset table with variable names

topic	condition	correct_1	correct_2	confidence_1	confidence_2	trust_source	change_answer
economy	Anonymous	1	0	2	4	4	1
king	Expert	0	0	4,06	4	4	1
map	Expert	1	0	5	5	3	1
sauce	Expert	1	1	4	4	4	0
ship	Anonymous	0	0	4	4,06	2,39	1
star	Anonymous	1	0	2	4	4	1
economy	Anonymous	1	0	1	4	4	1

We are measuring three dependent variables: *confidence_1*, *confidence_2*, and *trust_source*. For the scale for the measurements, we used 1 as the minimum value and 7 as the maximum. The reason we chose this scale from 1 to 7 is because the participants will have a wider range for the rating of confidence and the values from 1 to 7 allow to have discriminatory values.

Stimuli (Fidel)

Experimental stimuli refers to any stimulus or manipulation used in an experiment to elicit a response from the participants or to test a hypothesis. The choice of experimental stimuli is critical in experimental design and can impact the results and interpretation of the experiment. In this experiment, the stimuli were the types of sources of explanations (the variable *condition*). These types of sources of explanations included explanations from anonymous sources and an expert. The explanations given by both sources were the same but only differ by whom (either expert or anonymous source) it is coming from. In other words, the difference was the subject of the sentence as the expert was recognized as one while the anonymous had no reference preceded by the explanation. Below are snapshots (Figure 1 and 2) from Qualtrics that show the explanations from anonymous and that of the expert.

Figure 1: Example of anonymous explanation.

Figure 2: Example of expert explanation.

It must also be noted that in all cases except one, the explanation is in no way a direct hint to the correct answer but only a clarification that could guide it. The explanation's helpfulness was set in a way to balance the question difficulty with the provided explanation.

Furthermore, each subject answered the same questions twice. Once without an explanation and the second time with either an anonymous or an expert explanation. There were a total of 6 questions from different fields (Economy, Geography, Culture, Astronomy, History). Three (3) out of the six (6) questions have pictures from which the questions were asked on. The snapshot below is an example of such questions.

Figure 3: example of questions with pictures

Method C: Step by step (Chaymae)

In this step-by-step part, we will be breaking down the experimental process into the series of specific steps used to develop the survey that the participants filled.

In this experiment, we used the Qualtrics platform that offers many advanced features and customization options. To introduce participants to the experiment, we started with a consent form in which participants agreed to participate in a study after being fully informed about the study's purpose, procedures, risks, benefits, and alternative options.

Informed consent was a fundamental aspect of ethical research and was necessary to ensure that participants' rights and well-being are protected as seen below in Figure 4.

Figure 4: Consent of the experiment

Participants were exposed to two sections: section 1 shows 6 blocks in a variety of fields and with no explanation only one question and a rate of level of confidence in the answer in each block, adding up to a total of 2 questions per block as seen in Figure 5. Section 2 shows the same structure of questions but we added two explanations expert and anonymous and level of confidence in response and level of trust in the source as the Figure 6 shows, with a total of three questions per block.
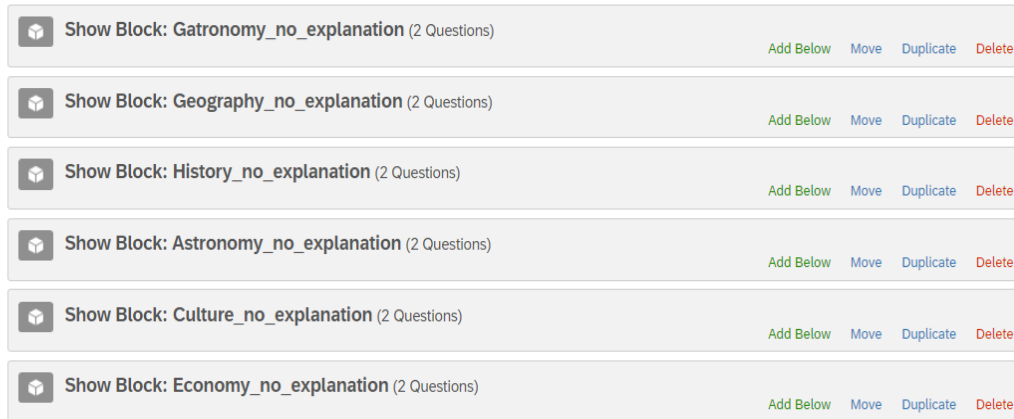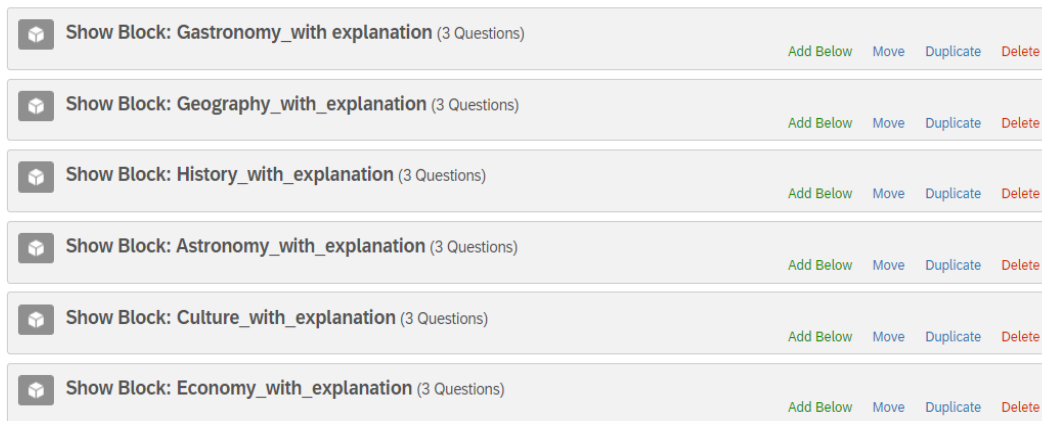
Figure 5: Section 1 no explanation

Figure 6: Section 2 with explanation (Explanation/Anonymous)

The first section had 6 blocks without any explanations and with only 1 question per block with 5 possible answers among which only 1 is correct and also another question to rate on a scale (from 1 minimum confidence to 7 maximum confidence) the confidence in response, as the Figure 7 shows.

Figure 7: Example of a question in section 1.

The second section starts with an introduction to explain the next step to the participants, (Figure 8). This section contains 6 blocks and each block has the same questions as the first section. The only difference is that Qualtrics will choose to display either the first question with an anonymous explanation or the second one with an expert explanation. As previously mentioned about the Stimuli, the only difference between the two explanations is the clause. After this question, the participant will be exposed to two scale measurements (1 minimum to 7 maximum) to rate their levels of confidence in the answer and trust in the source as the following Figure 9 shows.

Figure 8: Introduction to section 2.

Figure 9: Example of a question in section 2.

For both sections we have used randomization between the blocks, and not the answers. Randomization has a process of randomly assigning participants to questions in a random order to avoid memorizing the order of questions, as seen in the following Figures 10 and 11.

Figure 10: Randomization in section 1.

Figure 11: Randomization in section 2.

Counterbalancing was used in section 2 between the two type questions with explanations to display only one question to the participant, either the anonymous or the expert. As the following figure 12 shows one example of the questions.

Figure 12: Counterbalancing between two questions.

By using both randomization and counterbalancing, we can increase the internal validity of this study and reduce the impact of extraneous variables on the results. This helps to ensure that the effects observed in the study are due to the independent variable, rather than other factors that could confound the results.

General Discussion (Ghizlane, Hajar)

In this section, we will be getting some insight from the data we collected. It must be noted that in our study, we do not care whether the participants answered correctly or not; we specifically investigate the change in response, change in confidence level, and trust in the source. Nonetheless, we are still keeping track of the correctness of answers in case we may have to investigate further.
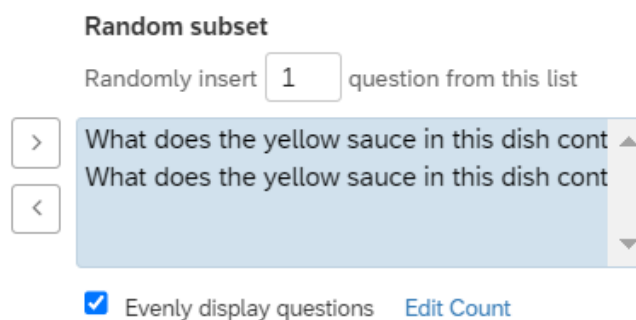
1. **General Insights**

From Table 2, we can tell that both the anonymous vs. expert conditions have the same mean for the confidence in response before being exposed to the explanation. This reassures us that the participants in both conditions are comparable and that the randomization was effective. After exposure to the explanation, on average, the participants exposed to the expert explanations ($\overline{X} = 4.63$) were more confident in their new answers than those exposed to anonymous explanations ($\overline{X} = 4.51$).

Table 2: Mean of Confidence Score in response with vs. without explanation

Source type	$\overline{X}$: mean confidence score in response without Explanation	$\overline{X}$: mean confidence score in response with explanation
Anonymous	3.20	4.51
Expert	3.20	4.63

Out of curiosity, we then took a look at how many people answered correctly after being exposed to correct answers in Table 3: Only 16 out of all the 50 participants got the answer correct after the explanation and it was only for the Expert not the Anonymous condition.

Table 3: Correct response after explanation

Topic	Anonymous	Expert	Total
economy	0	0	0
king	0	0	0
map	0	0	0
sauce	0	16	16
ship	0	0	0
star	0	0	0

From Table 4 below, we can see that even with some of the explanations directly hinting at the correct answer, we notice that 287 out of 300 people changed their answers, meaning that only 13 people did not change their response after explanation. This difference is caused by the cell about sauce where the value of (*Anonymous+Expert*) is less than 50 and equal to 13. Overall, from Table 4, we can see that the expert and anonymous conditions are almost comparable but for the cases where there is a little difference (*economy* and *sauce*), the change in response happened more when there was an expert.

Table 4: Changing response for anonymous vs. expert

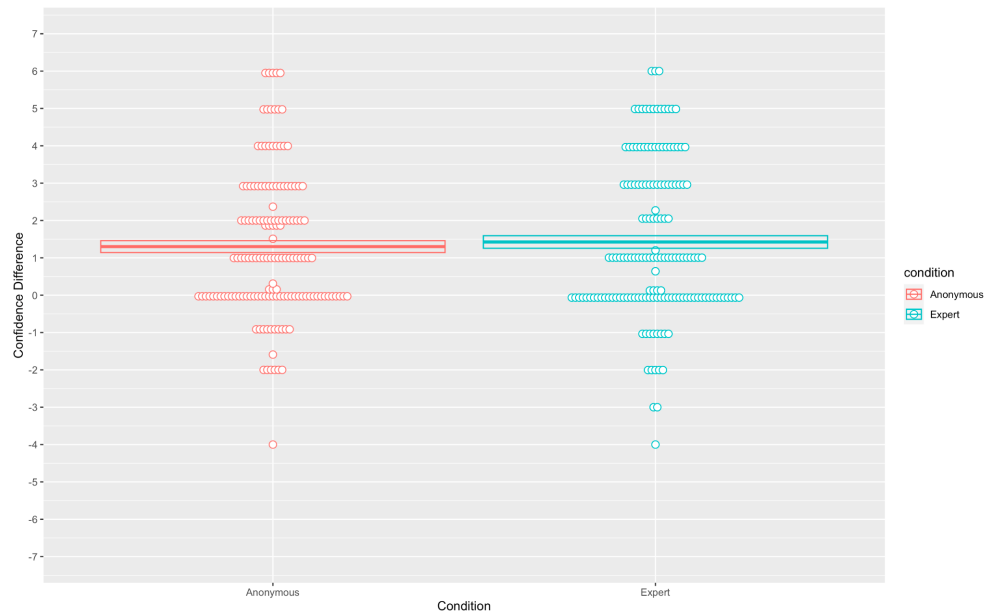| Topics	Anonymous	Expert	Anonymous + Expert	Type of explanation
economy	22	28	50	direct
king	25	25	50	indirect
map	25	25	50	indirect
sauce	18	19	37	indirect
ship	25	25	50	indirect
star	25	25	50	direct
Total	**140**	**147**	**287**	

2. Confidence in Response per Question

Figure 13: Boxplot of overall confidence changes in response after anonymous vs. expert

For Figure 13, as seen from the boxplots where we plot the confidence difference: ($\Delta conf = confidence\_2 - confidence\_1$), we can see that there is not much difference between confidence changes in each question overall. We can see this more clearly in Figure 14 where the bar plot shows that there is a slightly higher confidence in the second section of questions for the Expert than the Anonymous condition after being exposed to the explanation. There also is a higher confidence when exposed to any explanation.
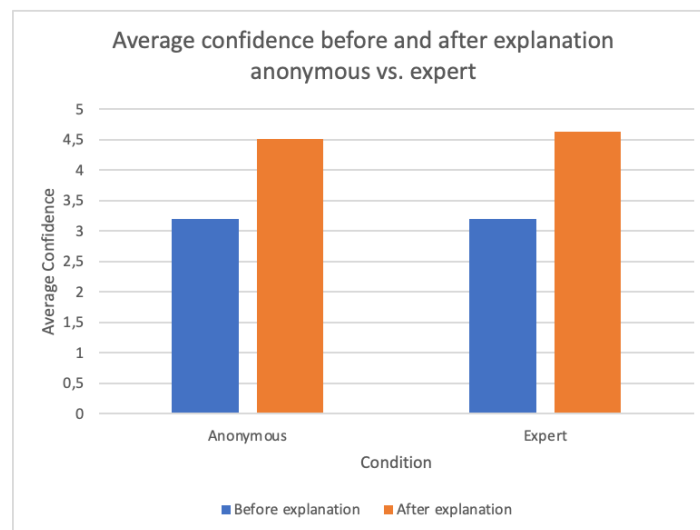

Figure 14: Average confidence before and after explanation from anonymous vs. expert
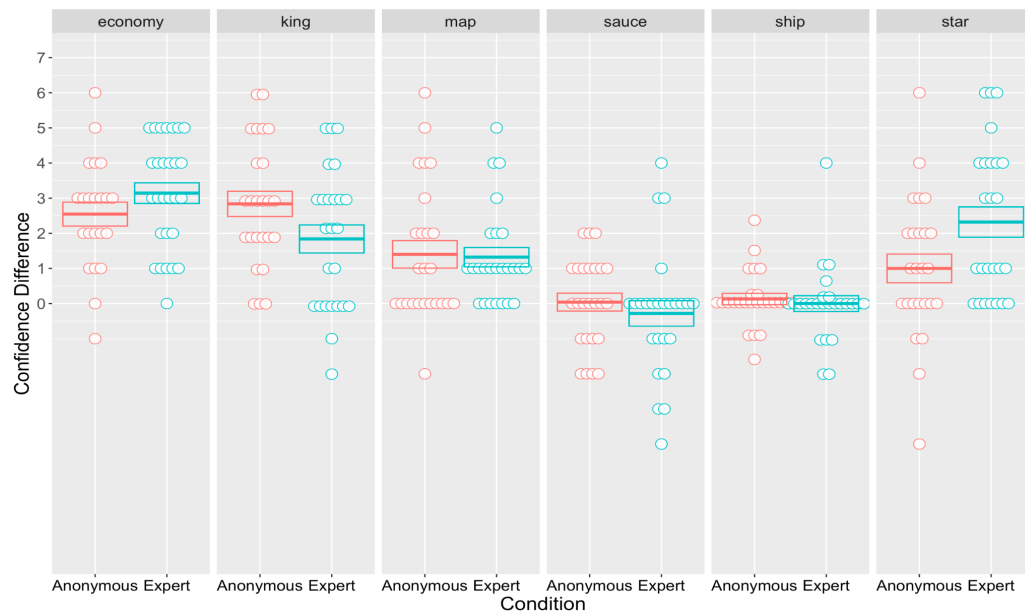
Figure 15: Boxplot of difference in confidence per question after explanation from anonymous vs. expert

In the Figure 15 above, we can see that generally, the difference in confidence (*Δconf*) for the Expert vs. Anonymous conditions is about the same based on the median. However, for the two questions about *economy* and *star*, there is a higher difference in confidence for the Expert condition, meaning that the participants who were exposed to the Expert explanations got more confident in their answers than the Anonymous condition. We also notice that there is a higher difference in confidence for the question about the first King of Morocco (*king*) for the anonymous than for the expert condition. This could perhaps be due to the difficulty of the question combined with the fact that anyone that seems to satisfy the minimum qualifications (stereotypical name of a Moroccan person for example) will be considered as an expert.
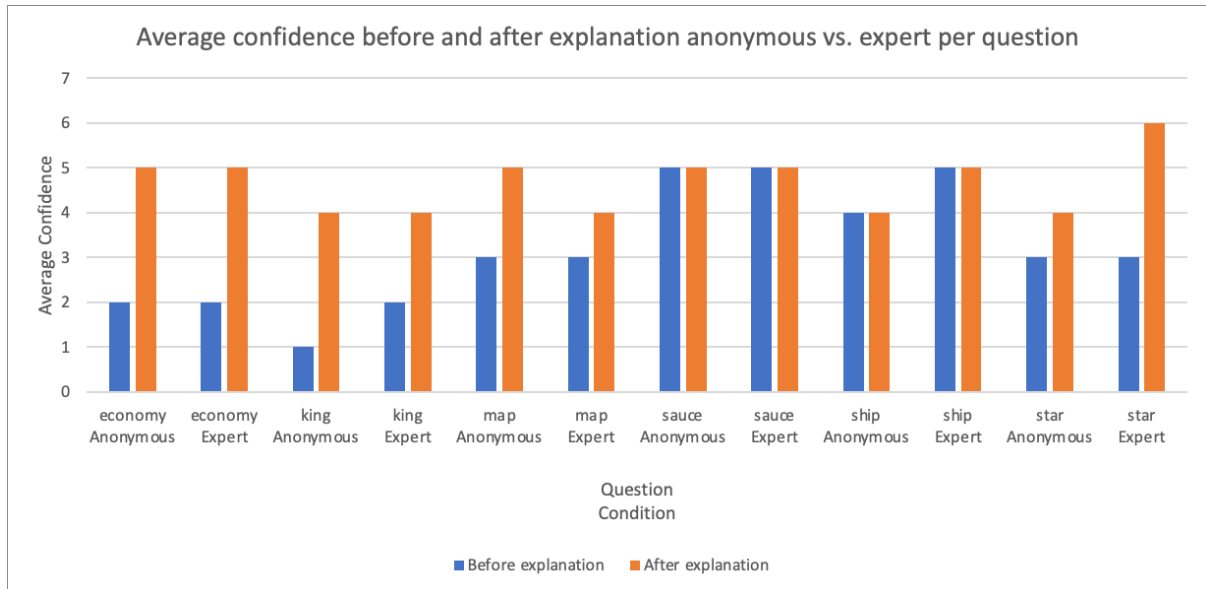
Figure 16: Bar plot of average confidence before and after anonymous vs. expert explanation per question

Figure 16 shows the average confidence for each question before and after the explanation depending on the *condition*. The confidence difference is more visible in this graph than the previous plot. The *economy* question has the highest difference in confidence compared to the other questions but the difference is more prominent in the expert condition. For the *sauce* question, the confidence difference in the anonymous condition is about the same as the confidence difference in the expert condition. This also applies to the *ship* question. We also notice that overall, in all questions, the confidence difference is prominent in the expert condition and not as much in the anonymous condition.
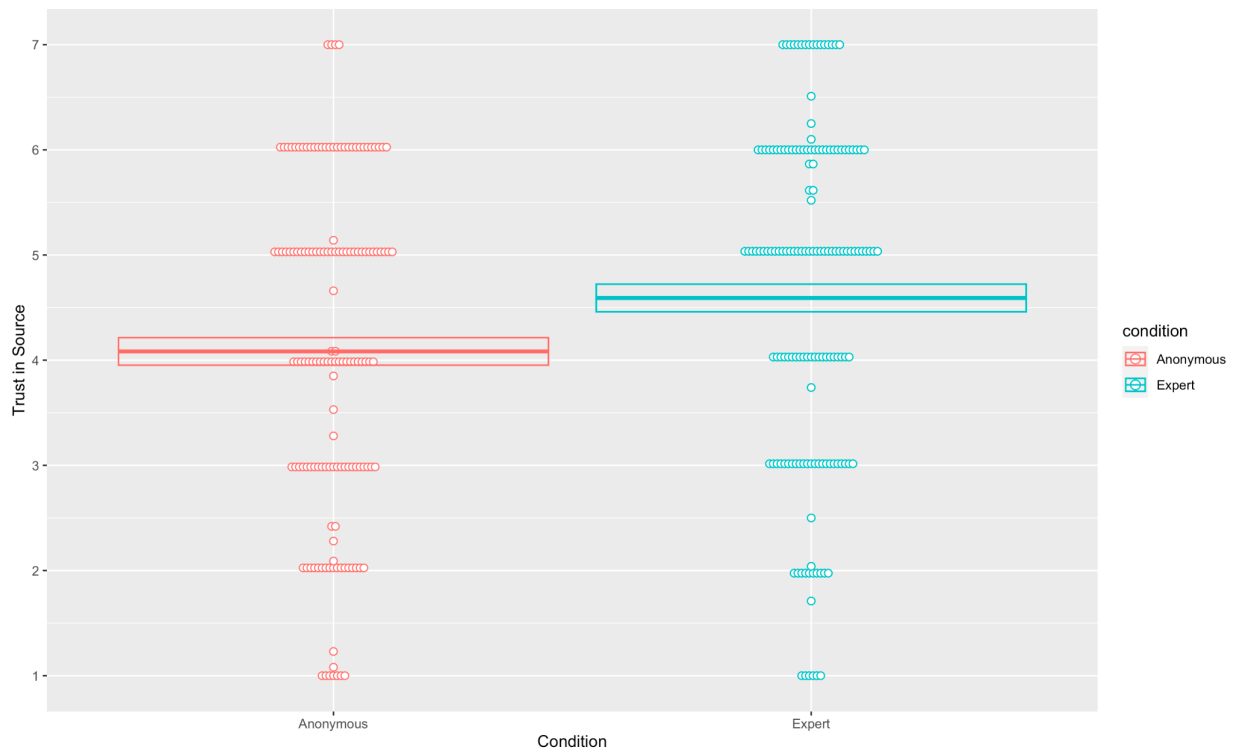
3. Trust in Source

Figure 17: Boxplot of overall Trust in the source after Anonymous vs. Expert

According to Figure 17, the median of trust for the anonymous condition is 4.1 whereas the median of trust for the expert condition is 4.6: the overall trust is higher for experts compared to anonymous.
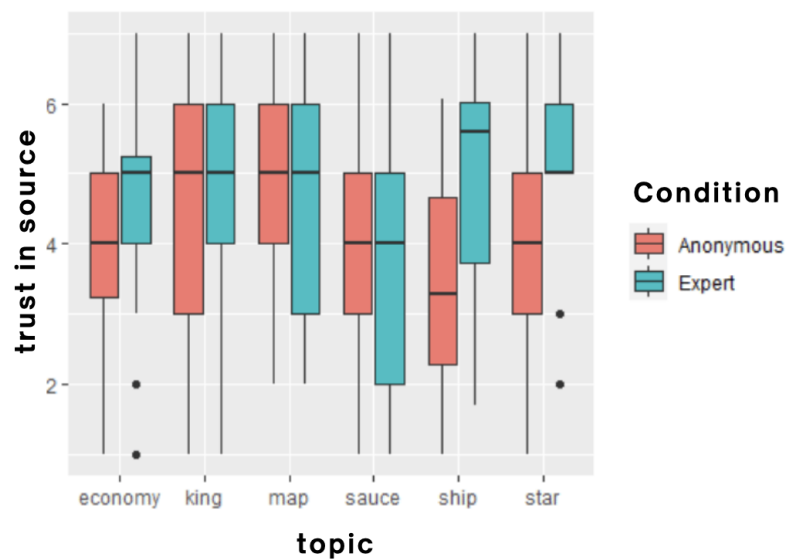

Figure 18: Boxplot of trust in the source after Anonymous vs. Expert per question

For each topic, in Figure 18, we plotted the distribution of trust according to the expert and anonymous. Between the topics, there is a difference in distribution of trust. For example *king*, *map* and *sauce* topics are normally distributed with an average higher than the average of the other topics like *ship*, *economy* and *star*. For each topic the distribution of the trust differs in terms of anonymous vs expert. For example in *map*, both anonymous and expert are normally distributed: the anonymous one is a gaussian centered on a mean = 5 whereas the expert one is a gaussian but skewed to the right.

4. Limitations (Fidelis and Ghizlane)

The sample size was small: A total of 50 subjects with 300 data points for both anonymous and expert explanation. This was a considerably small number despite it being a pilot study.

Data manipulation: Dataset from qualtrics was in rows. This format in the dataset was extremely difficult to be reformatted into fewer columns which was the most appropriate format for data analysis in R.

Ceiling effect because the questions were too difficult: Even though some questions gave direct hints to the correct answers for both anonymous and expert, the questions were too difficult and most subjects did not get the answers correct.

Small number of questions: There are only 6 questions and hence increasing the number of questions over the different fields (Economy, Geography, Culture, Astronomy, History) in future experiments would be great.

Subjects fatigue: The experimental design implored was a between-group design which required answering the questionnaire twice. This means that subjects could be fatigued by the double exposure to a total of 12 questions and similar-looking stimuli.

Conclusion (Ghizlane, Fidelis, Chaymae)

From this study, we could conclude that:

1. The mean subjects' confidence in response is higher in expert than in anonymous.
2. The mean trust in explanations from expert source is slightly higher than anonymous.
3. Everyone changes their response after being privy to expert explanation.

In summary, this study provides evidence for the effect of source type on response change, and suggests that exposure to a trusted source leads to a greater change in beliefs or attitudes compared to exposure to an untrusted source. Nonetheless, this should be tested statistically for significance. The results have important implications for understanding how individuals process information and update their beliefs or attitudes. We may consider the level of difficulty and level of familiarity with questions as other parameters to control in future work.

Future research could expand on these findings by exploring other factors that influence the credibility of information and their effect on response change. Subject fatigue may be another limitation to further investigate when trying to generalize our results since the participants would have to answer questions twice. Additionally, research could also examine the effects of type of source on other aspects of information processing, such as attention and memory. We may improve subjects' focus by allowing them to rest before taking the second part of the experiment. This will also help the participants forget the previous answers and thus reduce the influence of previously answering the question on their new response and basing this new response solely on the explanation provided.

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