Beyond one's own understanding: How text comprehensibility affects laypeople's decision about scientific claims

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Abstract

The study investigated whether the facilitating effect of high text comprehensibility on lay recipients' inclination to rely on their own decision about scientific claims is mitigated if the presented information is controversial. Moreover, it was assessed whether the impact of both information features is mediated by perceptions of topic complexity. Lay readers read medical text information varying in comprehensibility and controversiality and indicated their agreement strength and confidence with contained claims. Results revealed that participants' reliance on their own agreement decision was stronger after reading comprehensible than incomprehensible texts, but this difference was larger in case of uncontroversial than controversial information. However, these effects were not mediated by perceptions of topic complexity.

Keywords: knowledge evaluation; expertise; text comprehensibility; controversiality

Introduction

Laypeople often find themselves in situations where they have to come to a judgment about the veracity of science-based knowledge claims, e.g. when they need to decide whether to undergo a certain medical treatment. The ease of accessing information on the Web has eliminated problems regarding the availability of science knowledge that might act as a basis for such decisions. The great challenge lies instead in the evaluation of accessed information and the knowledge claims they contain regarding their acceptability (Mason, Ariasi & Boldrin, 2011). The reason why this evaluation presents such a challenge is that we all are laypeople with regards to most science domains and lack the background knowledge and specialized training usually required for making well-founded decisions about knowledge claims. Consequently, laypeople are generally not in a position to evaluate claims by themselves but rather depend on experts for decision support (Bromme, Kienhues & Porsch, 2010; Keil, 2008). Hence, when confronted with the necessity to decide about a science-based claim, laypeople can choose between two major courses of action: They can either rely on their own judgment despite their lay status or they can outsource the decision to an expert. However, given their own epistemic limitations, relying on experts is most often the appropriate and sensible strategy.

If laypeople nevertheless rely on their own claim decision, this should be reflected in their inclination to be easily persuaded by provided claim-related information that contains apparently sound arguments. Only if they see themselves in a position to decide about information quality should recipients make strong judgments in favor of a claim. Conversely, they should be more hesitant to strongly agree if they do not feel ready to decide. In addition, laypeople's willingness to rely on their own judgments should be reflected in high confidence in their claim decision, i.e. strong trust in their own judgment and a weak desire to hand over the decision to an expert (Scharrer, Bromme, Britt & Stadtler, 2012).

Text Features influence Laypeople's Reliance on their own Decisions

Previous research indicates that laypeople's readiness to rely on their own decision about the veracity of science-based claims can be influenced by features of the text information they read about the topic.

Information Comprehensibility One such text feature is the comprehensibility of contained information. In popular scientific reports addressed to the lay public, information is frequently simplified in order to make it understandable for the audience (Wagner, Elejabarrieta & Lahnsteiner, 1995). Such simplification can be achieved through enhancement of comprehensibility, e.g. by translating technical terms. But while an increase in comprehensibility facilitates laypeople's ability to follow what is being said, it may also

raise their inclination to rely on their own decisions. A layperson's experience of easily understanding information about a scientific topic may induce the impression that they are not in need of expert support to reach a decision about related information. Previous findings support this assumption by showing that science-based information simplified by means of increased comprehensibility leads laypeople to more strongly and confidently agree with claims than incomprehensible information (Eagly, 1974; Scharrer et al., 2012).

Hence, while it may be worthwhile to simplify information for the sake of allowing the lay public to gain insight into topics important for their daily lives, such simplification also comprises the risk of making readers underestimate their own dependence on experts for decision advice. The question arises whether and how it is possible to inform laypeople about scientific topics without tempting them to overconfidently rely on their own derived decisions, i.e. whether there are further information characteristics that can prevent the observed comprehensibility effect.

Information Controversiality A textual feature that might counteract the influence of comprehensibility on laypeople's reliance on their own decisions is information controversiality. Due to the evolving and discursive nature of scientific knowledge production, views on a particular phenomenon held by different scientists are frequently conflicting. Confronting lay recipients with the controversiality of a particular topic might alert them that judging related claims is generally a highly demanding task, independently from whether related text information is easy or difficult to comprehend. The notion that encountering controversies might decrease recipients' persuasion is in accordance with previous findings showing readers to be more hesitant to agree with consistently supported than with controversial claims (Kienhues, Stadtler & Bromme, 2011; Yaniv, Choshen-Hillel & Milyavsky, 2009).

However, as of yet it has not been investigated whether the impact of information controversiality on recipients' persuasion interacts with the influence of information comprehensibility and thus can prevent the persuasive effect of high comprehensibility. Furthermore, it is still unclear which cognitive processes underlie the impact of comprehensibility and controversiality on recipients' reliance on their own decisions.

Possible Mechanism underlying the Influence of Comprehensibility and Controversiality

On a theoretical level it is conceivable that the effects of both comprehensibility and controversiality on laypeople's decision readiness are mediated by recipient's assessment of the epistemic complexity of the topic. If laypeople encounter simplified texts tailored for them to comprehend, their understanding of the *text* may mislead them to consider the *subject matter* itself as less complicated than it really is (cf. Goldman & Bisanz, 2002; Scharrer et al., 2012). Consequently, they may overestimate their actual insight into the topic and their ability to appropriately evaluate the provided information (cf. Keehner & Fischer, 2011). Likewise, laypeople may explain information controversiality with high epistemic complexity of the topic. As a result of encountering a conflict, laypeople might become attentive to the possibility that scientists can have opposing views on the same phenomena, and hence that a given claim might be valid only under specific circumstances. Laypeople may then become aware that reading the provided information does not equip them with sufficient knowledge to confidently decide about related claims.

However, the described mediating role of perceived topic complexity would require that laypeople elaborate on the epistemic demands of the problem at hand relative to their own epistemic capabilities to determine whether or not they can decide. Conversely, it is also possible that lay recipients do not engage in such elaborate reflections but rather base their judgment on intuitive or affective reactions. In light of such alternative possibilities it remains an open empirical question whether the influence of comprehensibility and controversiality on laypeople's decision behavior are indeed mediated by perceived epistemic topic complexity.

The Present Study

The present study set out to pursue two goals. Firstly, we aimed to assess whether laypeople's increased reliance on their own decision after reading comprehensible compared to incomprehensible information is reduced if this information contains conflicting rather than consistent positions. Secondly, given the above considerations about the possible mediating role of perceived topic complexity, we aimed to gain insight into the processes by which comprehensibility and controversiality exert their influence on laypeople's decision behavior. For this purpose, we presented lay readers with argumentative text information that varied in comprehensibility and controversiality.

With regards to the first goal, we expected that comprehensible information would lead laypeople to rely more on their own decision than incomprehensible information if information is uncontroversial. However, we assumed that this comprehensibility effect is mitigated or even prevented if the received information is controversial. Specifically, we hypothesized that laypeople agree more strongly with a claim when reading comprehensible than incomprehensible information but that this difference is greater in case of uncontroversial than controversial information (H1). Furthermore, we expected laypeople's decision confidence to be analogously influenced by comprehensibility and controversiality. Decision confidence should be reflected in laypeople's respective preferences of three decision strategies: Strategy A to decide by oneself based on one's knowledge after reading the information should indicate high decision confidence, Strategy B to decide by oneself but only after obtaining further content information should indicate intermediate confidence, and Strategy C to leave the decision to an expert should indicate

low decision confidence. Hence, we hypothesized that laypeople find Strategy A more preferable after reading comprehensible than incomprehensible texts, but that this effect should be more pronounced in case of uncontroversial than controversial information (H2a). Similarly, Strategy B should be more popular after reading comprehensible than incomprehensible texts, but this difference should be greater in case of uncontroversial than controversial information (H2b). Finally, incomprehensible texts should lead to a greater preference of Strategy C than comprehensible texts but this effect should be stronger if the information is uncontroversial than controversial (H2c).

As to the second goal, we considered it possible that laypeople's impression of epistemic topic complexity mediates the influence of comprehensibility and controversiality on laypeople's persuasion strength and confidence. Comprehensible and uncontroversial information might facilitate the impression of the subject matter being simple and straightforward, i.e. decrease perceptions of epistemic complexity. As a result, laypeople may regard themselves able to appropriately understand the topic and may thus be inclined to rely on their own claim decisions. However, we would assume no mediation effect of topic complexity if laypeople's determination of their own decision readiness does not depend on elaborations of epistemic demands. Since both possibilities are conceivable, we formulated the following exploratory research question: Is the influence of comprehensibility and controversiality on claim agreement and agreement confidence mediated by perceived epistemic topic complexity?

Method

The experiment was conducted using a 2x2 mixed design with the within-participant factor information comprehensibility (comprehensible vs. incomprehensible) and the between-participant factor controversiality (controversial vs. uncontroversial). In each condition, participants were presented with texts about a medical issue that were either comprehensible or incomprehensible and controversial or uncontroversial, respectively. Eighty-eight undergraduates of various majors at a German university participated in the experiment (54 female; mean age = 22.81 years, *SD* = 4.39). To ensure participants' lay status, students of medicine, biology or related subjects were excluded from participation. Moreover, the medical issues addressed in the texts were fictitious in nature to ensure that participants were unable to make informed decisions about the contents based on their everyday knowledge and had no strong prior attitudes about the topics.

Materials

Participants read a document (Document 1) containing a particular medical knowledge claim (e.g. "Bouchard arthrosis is caused by a deficiency of purinerase") followed by an explanation that described the mechanisms underlying the proposed claim and supporting empirical evidence. In addition, a second document (Document 2) was presented consisting of a claim supported by empirical evidence. Depending on the controversiality condition, Document 2 either contained a claim that was in conflict with Document 1 (e.g. "A lack of purinerase is not among the causes of Bouchard arthrosis") or a claim that did not render the Document 1 information controversial (e.g. "A persistent lack of folic acid is not among the causes of Bouchard arthrosis"). The information contained in the documents was furthermore comprehensible or incomprehensible. In the incomprehensible conditions, both texts contained a large number of unexplained technical terms, whereas in the comprehensible conditions, technical jargon was translated into words that should be understandable for laypeople (e.g. "articulations" was translated to "joints"). All documents were comparable in length (*M* = 142.67 words, S*D* = 44.66).

Before reading a document pair, participants were confronted with a framing scenario in which a fictitious friend was described as having a medical problem and, due to their insecurity about the correctness of a particular problem-related claim, asked the participant for advice. The claim in question was the same that was later on stated and supported in Document 1. Participants were then presented with both text documents which they had allegedly found during an Internet search and which were described as being authored by different sources.

Dependent Measures[1]

Manipulation Check In order to verify that comprehensibility had been manipulated as intended, participants rated each document for perceived comprehensibility on a Likert-scale from 1 ("very incomprehensible") to 7 ("very comprehensible"). Before providing their ratings, participants were given a definition of what we meant by comprehensibility. This definition described information as comprehensible when readers perceive the contents as clear and feel able to discriminate essential from less important parts and to evaluate information consistency.

Claim Agreement We assessed the extent to which participants were persuaded by measuring their agreement with the Document 1 claim after reading both documents. For this purpose, participants indicated their agreement on a 1 ("I don't agree at all") to 7 ("I totally agree") Likert-scale.

Confidence in the Agreement Decision Participants' confidence in their ability to decide about the claim was indicated by their agreement with three statements. Each statement reflects a strategy which individuals might use to come to a claim decision. Participants provided their agreement with these strategies on three separate 1 to 7 Likert-scales (1: "don't agree", 7: "strongly agree"):

[1] In addition to the above variables, further measures were collected. However, due to space constraints we only report the analysis of the presently listed measures.

(A) Trust in own agreement decision based on present knowledge: Following this strategy means participants felt ready to decide based on their knowledge after reading the documents. Preference for this strategy was measured by strength of agreement with the statement: "Based on my present knowledge about the topic, I am confident to decide whether it is correct that [Document 1 claim inserted]".

(B) Trust in own decision based on further information: This strategy indicates that participants felt principally able to decide, but only after obtaining further topic information. Preference for this strategy was measured through agreement with the statement: "I want to obtain further information about [topic] which I then use to decide myself whether it is correct that [Document 1 claim inserted]".

(C) Desire to consult an expert: Following this strategy means that participants wished to leave the decision to an expert. Preference for this strategy was measured by agreement with the statement: "I want to obtain information about experts in the field in order to identify a particular competent and credible expert. I would then consult this expert and rely on their judgment as to whether it is correct that [Document 1 claim inserted]".

Perceived Epistemic Complexity Participants' perception of epistemic topic complexity was assessed with six adjective pairs in a 7-point scale semantic differential format (very uncomplex─very complex, very multi-faceted─very single-faceted, very unscientific─very scientific, very easy─very difficult, very uncomplicated─very complicated, very difficult to comprehend─very easy to comprehend). Two additional distracter pairs were presented to decrease transparency of the measurement intent (very unimportant─very important, very boring─very entertaining). Exploratory factor analyses (ML-extraction, oblimin rotation) showed the target items to load on one common factor in both comprehensibility conditions (comprehensible: KMO = .88; $\chi^2(15) = 350.71$, $p < .001$; 70.43% explained variance; incomprehensible: KMO = .86; $\chi^2(15) = 230.52$, $p < .001$; 58.88% explained variance). To determine a score of perceived topic complexity, the arithmetic mean of the target items was calculated. Internal consistency of the items was satisfactory in both comprehensibility conditions (comprehensible: Cronbach's $\alpha = .91$, incomprehensible: Cronbach's $\alpha = .86$).

Procedure

Participants received a paper booklet containing the text materials and scales for collecting the dependent measures. The booklet first presented a scenario describing the fictitious friend's problem. Participants then read the document pair and provided their measures of claim agreement and confidence in their agreement decision. This was repeated four times, so that each participant read four document pairs in total, two in each condition. Afterwards, readers were asked to provide their ratings of comprehensibility for each document they had read and to evaluate the complexity of each addressed topic. Finally, participants completed a demographic questionnaire before being debriefed about the fictitious nature of the text contents.

Results

The means and standard deviations of the collected measures per experimental condition are shown in Table 1.

Manipulation Check

A mixed ANOVA on comprehensibility ratings with document (Document 1 vs. Document 2) and comprehensibility (comprehensible vs. incomprehensible) as within-participant factors and controversiality (controversial vs. uncontroversial) as between-participant factor verified that texts designed as comprehensible were perceived as more comprehensible than texts designed as incomprehensible, $F(1,85) = 648.11$, $p < .001$, part. $\eta^2 = .88$. Moreover, Document 2 was overall rated more comprehensible than Document 1 $F(1,85) = 22.54$, $p < .001$, part. $\eta^2 = .21$. The other main and interaction effects did not reach significance, all $F(1,85) < 2.91$, *ns*.

Claim Agreement

Claim agreement scores were analyzed using a mixed ANOVA with the within-participant factor comprehensibility and the between-participant factor controversiality. Results showed that laypeople agreed more strongly with the Document 1 claim when the supporting information was comprehensible than when it was incomprehensible, $F(1,86) = 9.34$, $p < .05$, part. $\eta^2 = .10$. Moreover, agreement was higher in the uncontroversial than the controversial condition, although this difference was only marginally significant, $F(1,86) = 3.41$, $p = .07$, part. $\eta^2 = .04$. In line with H1 a significant interaction of comprehensibility and controversiality ($F(1,86) = 4.89$, $p < .05$, part. $\eta^2 = .05$) indicated that only in the uncontroversial condition did participants agree more strongly with claims from comprehensible than incomprehensible texts, $t(43) = 3.52$, $p < .01$. In contrast, there was no difference in agreement between comprehensible and incomprehensible texts in the controversial condition, $t(43) = .64$, *ns*.

Confidence in the Agreement Decision

To test H2a-c, we conducted separate mixed ANOVAs for each decision strategy using comprehensibility as within- and controversiality as between-participant factor.

(1) Trust in own agreement decision based on present knowledge This strategy was more popular in the comprehensible than in the incomprehensible conditions, $F(1,86) = 51.08$, $p < .001$, part. $\eta^2 = .37$, as well as in the uncontroversial compared to the controversial conditions, $F(1,86) = 23.74$, $p < .001$, part. $\eta^2 = .22$. Furthermore, and in line with H2a, there was a significant comprehensibility*controversiality interaction, $F(1,86) = 6.43$, $p < .05$, part. $\eta^2 = .07$. This was due to the difference

Table 1: Means and standard deviations (in brackets) of the collected measures as a function of comprehensibility and controversiality.

Condition	Comprehen-sibility		Claim-agreement	Decision based on present knowledge	Decision based on further info.	Decision through expert advice	Epistemic complexity
	Doc.1	Doc.2					
Compr./ uncontr.	5.80 (1.13)	5.93 (1.08)	4.53 (1.05)	3.30 (1.66)	5.16 (1.57)	5.16 (1.87)	4.38 (1.03)
Incompr./ uncontr.	2.05 (1.17)	2.38 (1.34)	3.90 (1.04)	2.10 (1.31)	5.25 (1.64)	5.41 (1.65)	5.46 (.86)
Compr./ contr.	5.57 (1.00)	5.97 (1.05)	3.98 (.94)	1.90 (.94)	4.99 (1.70)	5.47 (1.80)	4.22 (.92)
Incompr./ contr.	1.78 (.80)	2.37 (1.30)	3.88 (.621)	1.33 (.61)	4.82 (1.91)	5.73 (1.73)	5.47 (.78)

between both comprehensibility conditions being larger when the documents were uncontroversial than when they were controversial.

(2) Trust in own decision based on further information With regards to the popularity of this strategy results revealed no significant main or interaction effects (all $F(1,86) < 1.26$, *ns*), hence providing no support for H2b.

(3) Desire to consult an expert This strategy was shown to be more popular in the incomprehensible than in the comprehensible conditions, $F(1,86) = 5.24$, $p < .05$, part. $\eta^2 = .06$. However, contrary to H2c, controversiality had no influence on participants' willingness to ask an expert, all further $F(1,86) < .97$, *ns*.

Perceived Epistemic Complexity

To answer the research question whether the influence of comprehensibility and controversiality on claim agreement and agreement confidence was mediated by perceived epistemic topic complexity, we conducted separate mediator analyses for each combination of independent variable, mediator variable and dependent variable following the approach suggested by Baron and Kenny (1986) and Judd, Kenny, and McClelland (2001). Results showed that of the three preconditions necessary for a variable to act as a mediator (1. the independent variable affects the assumed mediator 2. the independent variable affects the dependent variable, 3. the mediator affects the dependent variable) the first two were fulfilled for most combinations, but the third precondition was fulfilled in no case (all $F(2,41) < 3.23$, *ns*). Hence, complexity perceptions do not appear to mediate the observed comprehensibility and controversiality effects.

Discussion

By presenting medical laypeople with texts varying in comprehensibility and controversiality, the present experiment assessed whether the facilitating influence of high comprehensibility on recipients' reliance on their own decision about scientific claims is mitigated by information controversiality. Moreover, the study was aimed to gain insight into the possible process through which both text features affect laypeople's decision behavior by examining the role of perceived epistemic topic complexity as a potential mediator.

The results revealed that in line with our expectations and previous research (Eagly, 1974; Scharrer et al., 2012), lay recipients agreed more strongly with claims from comprehensible than incomprehensible texts; however, this difference occurred only when the information was uncontroversial. In case of controversial information, laypeople's claim agreement was not affected by text comprehensibility. It seems that encountering controversial information makes laypeople more cautious to agree with a claim even if the information is easy to comprehend.

Moreover, both comprehensibility and controversiality affected laypeople's decision confidence; however this impact was manifested differently on the three decision strategies. Similar to the state of affairs regarding claim agreement, the strategy to decide based only on one's present knowledge was more popular after reading comprehensible than incomprehensible texts, but this influence of comprehensibility was diminished when information was controversial. In contrast, none of the text features had an effect on the strategy to decide based on further information and only comprehensibility had an impact on the strategy to ask an expert, with high comprehensibility decreasing the desire for expert advice. We assume that if information is incomprehensible, laypeople are generally willing to consult an expert regardless of controversiality. In case of comprehensible controversial texts, laypeople feel possibly more encouraged to determine which of both conflicting position is correct due to their comprehension success, for instance by seeking out further information. This might explain why their willingness to ask an expert in this condition is not higher than in case of comprehensible uncontroversial texts.

It is noteworthy that even when participants received comprehensible and uncontroversial texts, ratings of their willingness to ask an expert did not average below 5 on a scale from 1 to 7 (7 indicating a strong willingness).

However, the observed influence of comprehensibility on desire for expert advice suggests that a too strong simplification of scientific contents may mislead lay recipients to underestimate their dependence on experts.

As to our second goal, to get an insight into the possible process through which comprehensibility and controversiality affect laypeople's reliance on their own decisions, we found that the influence of neither information feature is mediated by perceived topic complexity. It seems that laypeople do not base their judgment of whether or not to rely on their own decisions on reflections about epistemic complexity. Perhaps the experience of fluently comprehending information simply triggers positive affective reactions, which then translate to more favorable evaluations in general (Schwarz, 2004). However, this can so far only be assumed, and the exact mechanisms that underlie the influences of comprehensibility and controversiality remain subject to further empirical clarification.

In sum, the present findings largely confirm our assumption of a combined influence of comprehensibility and controversiality on laypeople's reliance on their own decisions. The results indicate that the facilitating influence of comprehensibility on claim agreement found in previous research is more pronounced if the information is uncontroversial but seems to be reduced or even prevented in case of controversial information. As to laypeople's confidence in their claim decision, the results are less conclusive. While it appears that controversiality has a moderating effect on the influence of comprehensibility regarding laypeople's trust in their own decision based on current knowledge, this influence does not translate to their preference of the decision strategy to consult an expert. Finally, we found that perceived epistemic topic complexity does not appear to act as a mediating factor of either the observed comprehensibility or controversiality influence.

The results have practical implications by informing about how scientific information can be optimally communicated to the lay public. Although simplified science reports have the advantage to provide lay recipients insight into scientific issues, it is possible that based on such easy-to-comprehend information laypeople become overly ready to make own decisions, in spite of their lack of background knowledge and training. The present results suggest that when scientific findings are communicated to laypeople, the inclusion of information about related controversies can serve to weaken the comprehensibility effect. As a result, laypeople are more likely to be prevented from readily relying on their own claim evaluations and might rather turn to a pertinent expert for support.

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