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How Seductive is the Reductive Allure?

Exploring the suggested bias for scientific explanations containing irrelevant reductive information

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Abstract

Earlier studies have shown that when assessing explanations of psychological phenomena, there is a bias for explanations including references to neuroscience, even when these references contain logically irrelevant information (Fernandez-Duque, Evans, Christian & Hodges, 2015; Minahan & Siedlecki, 2016; Weisberg, Keil, Goodstein, Rawson and Gray, 2008; Weisberg, Taylor & Hopkins, 2015). Recently, it was suggested that this bias applies to reductive explanations within many sciences, i.e., explanations reducing a phenomenon to more fundamental parts, regardless of explanation logic (Hopkins, Weisberg & Taylor, 2016). The current study expands upon these findings through a methodological improvement, investigating individual preferences for reductive information within social science, psychology and neuroscience. The results did not indicate a bias towards reductive information. However, results and ratings were not consistent across the scientific fields. It was shown that participants were less able to separate a good explanation from a bad explanation for neuroscientific phenomena. The implications of these findings are discussed.

Keywords: seductive allure, reductive allure, explanations, cognitive bias, reasoning

How seductive is the reductive allure?
Exploring the suggested bias for scientific explanations containing irrelevant reductive information

Many cognitive biases impact our thought processes and evaluations of the world. Some of these biases are well mapped, such as confirmation bias (Nickerson, 1998), which steers our attention towards facts or observations that confirm our preexisting beliefs, while disregarding those that might go against them. Other biases, such as those affecting our ability to assess the quality of explanations, remain relatively unexplored. Yet, as the internet age has increased the amount of information we are exposed to on a daily basis, an understanding of how the presentation and form of explanations can mislead us is vital. Many studies have shown that when assessing explanations, we are not only guided by their quality, as one might wish. Rather, there are several factors influencing our judgment, potentially masking the actual quality of an explanation and making a poor explanation appear as a good one. For example, the length of an explanation influences its evaluation, with longer explanations being perceived as more scientific (Kikas, 2003). Furthermore, explanations that are teleological, referring to an end state, are preferred over mechanistic explanations (Lombrozo & Carey, 2006; Kelemen, 1999). Interestingly, it was recently suggested that people also have a bias towards so called *reductive explanations* even if they contain logically inconsistent or irrelevant information (Hopkins, Weisberg & Taylor, 2016). Reductive explanations describe a phenomenon by reducing it to more basic processes, or by describing how the activity and interaction of smaller components forms the larger phenomenon (see Van Riel & Van Gulick, 2017; Craver, 2007). The present study investigates these recent findings further, and explores if and to what extent this reductive feature of an explanation may confuse our judgement of its overall quality.

As the reporting of neuroscientific findings in media becomes more and more commonplace (Racine, Waldman, Rosenberg & Illes, 2010), the interest in how these findings are interpreted by the public increases, particularly after it was shown that a mere fMRI image significantly increased the perceived quality of accompanying information, even when it is not adding any value in strict, logical terms (McCabe & Castel, 2008). This phenomenon was subsequently called "the seductive allure of neuroscience", suggesting that neuroscience seduces people to believe that it carries more explanatory power than it actually does. Although it has not been possible to replicate the initial results associated with neuroimaging (Michael, Newman, Vuorre, Cumming, & Garry 2013; reviewed in Farah & Hook, 2013), studies have demonstrated that even neuro-jargon was enough to "seduce" people into erroneously believing that an explanation was strong (Fernandez-Duque, Evans, Christian, & Hodges, 2015). Specifically, people tend to judge explanations of psychological phenomena containing irrelevant neuroscience information as more satisfying than explanations without such information (Weisberg, Keil, Goodstein, Rawson & Gray, 2008). Moreover, the ability to choose a good explanation over a bad one diminishes when the bad explanation, in contrast to the good explanation, contains neuroscience information (Weisberg, Taylor & Hopkins, 2015).

There is some individual variability regarding susceptibility to this alluring effect. In a study by Minahan and Siedlecki (2016), participants were presented with poor explanations, either containing or not containing neuroscience. Importantly, the added neuroscientific information did not improve the explanation. Results showed that, independently of whether it added value to the explanation or not, when neuroscience was present, ratings were higher. However, individuals who were more inclined to enjoy and use cognitive effort were better at evaluating the explanations correctly (Minahan & Siedlecki, 2016). These individuals may have a certain disposition towards what Langer, Blank, and Chanowitz (1978) described as mindful processing. In their study on social behavior, they found that mindful processing of information is necessary in order to not overlook relevant details in oral or written communications. Thus, cognitive effort, and perhaps to some extent mindful reading or listening, might reduce the likelihood of being misled by non-explanatory information, such as neuro-jargon. Nevertheless, another study exploring the seductive allure of neuroscience found that high scores on analytical thinking did not protect individuals from the allure (Fernandez-Duque et al., 2015).

It was recently suggested that the seductive allure of neuroscience is likely to only capture part of a more general bias towards reductive information - manifesting across a variety of sciences. In a study by Hopkins et al. (2016), participants were presented with different explanations of various scientific phenomena. Good (coherent) explanations or bad (circular) explanations were presented in either a horizontal or reductive manner. Horizontal explanations included language only associated with the field of science in question, while reductive explanations included language associated with the “lower” level of science. This division is based upon a hierarchy of sciences (Figure 1) according to which psychological phenomena are reduced to neuroscientific components, while neuroscientific phenomena are reduced to biological phenomena, and so on. Although there are times when a reductive explanation may be appropriate, in this study, the reductive information that was added never changed the core logic of the explanation. Thus, if no bias would be at work, the horizontal and reductive explanations should be rated similarly, as they objectively followed the same logic. However, results showed that, although participants were generally successful at distinguishing good explanations from bad explanations, over half of them gave the reductive explanations higher ratings than the horizontal explanations (Hopkins et al., 2016). The effect of explanation level was larger for psychology than the rest of the sample, and statistically significant for psychology and neuroscience, while marginally significant for physics, chemistry and biology. Moreover, the reductive explanations were given lower ratings than horizontal explanations for social science, not following the general pattern of the other sciences.

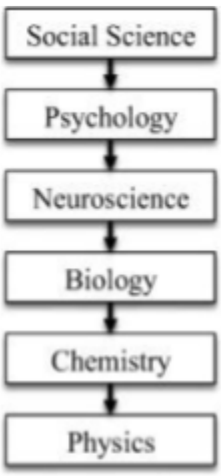

Figure 1. Hierarchy of Science used in the current study (from Hopkins et al., 2016, p. 68)

Yet there are some methodological concerns limiting the generalizability of these findings. Participants in Hopkins et al. (2016) were only exposed to either two horizontal explanations per science (good and bad) or two reductive explanations per science (good and bad), whose quality they should rate on a scale from -3 to +3. Thus, while their results indicated a general bias towards reductive explanations, they did not accurately tell us whether an individual might prefer a good reductive explanation over a good horizontal explanation, or less likely, a bad reductive explanation over a good horizontal explanation. Neither do these results inform about an individual's ability to tell a good explanation from a bad one. A further limitation concerns the sample of the study: reductive explanations were only given higher ratings than the horizontal explanations among participants recruited from Mechanical Turk (an online platform), leaving it unclear why this was not the case for the entire sample. Ultimately, the study by Hopkins et al. (2016) only evaluated and compared individuals' ratings of explanations, but not their preferences when asked to choose. What remains unexplored is whether the tendency towards reductive information, as observed in the mentioned study, is strong enough to persist in the presence of a more or equally accurate horizontal explanation. Will this make it clear that the reductive explanation, in essence, is not more satisfactory?

The current study

Through some methodological changes to the material created by Hopkins et al. (2016), the current study explored the relationship between judged quality of an explanation and explanation level, while treating explanation level as a within-subjects factor, thus exploring the relationship of explanation quality and form within the terms of the reductive allure. Weisberg et al. (2015) showed that the ability to discern a good explanation from a bad one diminishes when the bad explanation contains irrelevant neuroscience information, providing evidence for the seductive (reductive) allure. Inspired by this design, the present study tested three distinct conditions: Participants were asked to rate either two good explanations, horizontal and reductive, respectively, or one good horizontal and one bad horizontal explanation, or, finally, one good horizontal and one bad reductive explanation. The main hypothesis was that reductive explanations would be given higher ratings than horizontal explanations, while good explanations would be rated higher than bad explanations. Also, we predicted that the ability to separate a good explanation from a bad explanation would be compromised if the bad explanation contained reductive information. Additionally, as indicated by earlier studies, we expected individual differences in these effects, where individuals more inclined to use cognitive effort would not be persuaded by the reductive information to the same extent.

Phenomena from social science, psychology and neuroscience were used as stimuli. Including these sciences is particularly interesting considering earlier findings showing that that there is a notable difference in peoples' judgments of the scientific rigor and credibility of these fields, neuroscience tending to be the most admired (Fernandez-Duque et al., 2015; Hopkins et al., 2016). Also, the inclusion of these sciences enables the study of the extent to which different explanations of scientific phenomena are susceptible to the seductive or reductive allure. As earlier studies have indicated a preference for explanations of psychological phenomena containing neuroscience (Fernandez-Duque et al., 2015; Hopkins et al., 2016; Weisberg et al., 2015) we expected the effect of reductive allure to be strongest within psychology, followed by neuroscience. For social science phenomena we expected no effect or a preference for the non-reductive explanations, in line with earlier findings (Hopkins et al., 2016).

Method

Participants

A total of 218 students participated in the study (130 females, 86 males, 2 did not report gender). Participants were approached at different study areas around two universities in southern Sweden, as well as in a public library, and were asked if they would like to participate in a study which would take 10-15 minutes. They were offered a piece of candy as compensation for their time. If they sat in a group, they were instructed to complete the survey individually. Participants' mean age was 23 years (M = 23.26 years, SD = 3.86). Most participants (86.7 %) were in the range of 19-25 years, 8.7 % were between 26-30 years old, and 4.6 % were above 30 years old. Participants' age and gender was evenly distributed across all three experimental groups, following the same distributional pattern as the sample as a whole.

Large proportions of participants studied social sciences (28.9 %, n = 63), humanities (23.9 %, n = 52), technical disciplines (18.3 %, n = 40), and economics (15.1 %, n = 33). Fewer participants studied law (7.8 %, n = 17), medical disciplines (2.3 %, n = 5), and natural sciences (.9%, n = 2). A total of six participants (2.8 %) did not provide information on their field of study.

Design

Participants completed a physical survey, consisting of four parts: rating explanations, logical syllogisms, cognitive reflection test, and demographic information. Participants were randomly assigned to one of three conditions. In the rating of explanations task, each participant was presented with a phenomenon followed by two explanations and a prompt to rate the explanation on a 7- point Likert type scale, from very poor to very good. This allowed for a comparison between the two explanations. All conditions included one good horizontal explanation, later used as a comparative measure to the second explanation, which differed between the groups (Table 1).

Table 1.

Explanation level and quality per condition

Condition	Comparative explanation
Group 1 (n = 72)	Reductive - good
Group 2 (n = 75)	Horizontal - bad
Group 3 (n = 71)	Reductive - bad

Materials

Phenomena and explanations

We selected nine of the 24 phenomena presented in the study by Hopkins et al. (2016), from the field of psychology, neuroscience and social science (3 each), all of which had been developed carefully and in close collaboration with experts within each field. In this material, horizontal explanations only included language within the discipline of the phenomenon, e.g., a phenomenon in psychology was explained only with psychological terminology. The reductive explanations included language from the more basic science (following the hierarchy in Figure 1). For example, reductive explanations for psychological phenomena included neuroscientific language. Horizontal-good explanations were the type of explanations one could find in a textbook, while the reductive-good explanations only had certain parts of the horizontal explanations replaced with language and terminology stemming from the more basic scientific discipline (Table 2, see Appendix A for a full description of the phenomena used). Importantly, this did not alter the logic of the explanation, which was held constant, so the objective quality of the explanation did not change. To prevent participants from using the accuracy of the explanation as a guide, "bad" explanations never included any false information. Instead, they merely removed the crucial part of the explanation, replacing it with circular reasoning or non-explanatory information. As confirmed by experts, the reductive information was always irrelevant to the logic of the explanation (Hopkins et al., 2016).

Table 2

Sample phenomenon and explanations from psychology

Sometimes people don't notice something that's right in front of them. When people view rapidly presented images and are told to press a button every time they see a house, they are generally good at this. However, if two houses are presented close together, people often fail to press the button for the second house. This failure to detect the second house is called "attentional blink."
Why does the attentional blink effect happen?

	Good	Bad
Horizontal	The attentional blink effect occurs because of how people's perceptual and decision-making abilities function in response to the stimuli. People are limited in how many things they can pay attention to at any given point in time. They generally miss seeing the second house because they are still processing the first and do not have enough attentional resources left.	The attentional blink effect occurs because of how people's perceptual and decision-making abilities function in response to stimuli like this. People are limited in how well they can perform on this type of task. The second house appears later in the sequence than the first house, and the failure to notice it when it appears causes the attentional blink.
Reductive	The attentional blink effect occurs because **of how areas in the frontal lobe, previously shown to mediate attention**, function in response to stimuli. People are limited in how much they can pay attention to at any given time. They miss seeing the second house because they are still processing the first and do not have enough attentional resources left.	The attentional blink effect occurs because **of how areas in the frontal lobe, previously shown to mediate attention**, function in response to stimuli. People are limited in how well they can perform on this type of task. The second house appears later in the sequence than the first house, and the failure to notice it causes the attentional blink.

Note. Each group saw two explanations: Group1: Horizontal- Good/Reductive-Good, Group2: Horizontal- Good/ Horizontal-Bad, Group3: Horizontal- Good/ Reductive-Bad. The reductive information was not put in bold in the stimuli showed to participants.

As the study was conducted in Sweden, the original material was translated into Swedish by the authors. The length of explanations was kept constant: For the majority of the phenomena the word difference between explanations was at most 3-8 words, with only a slightly bigger difference in a couple of cases (at most 12 words difference: 55 words for the reductive-bad explanation and 67 words for the opposing horizontal-good explanation).

Individual measures

To explore potential individual differences, measures of reflective thinking and logical reasoning were included. Reflective thinking was measured using the updated version of the Cognitive Reflection Test (CRT, Toplak, West & Stanovich, 2014). This test consisted of four items (internal consistency Cronbach α = .61), where the correct answer requires more careful thinking, as the quick intuitive answer is incorrect. E.g., ”A man buys a pig for 60 dollars, sells it for 70, buys it back for 80 and sells it finally for 90 dollars. How much has he made?”, where the intuitive answer is 10, but the correct answer is 20. Each correct answer gave one point. Logical reasoning was assessed using four syllogisms borrowed from Weisberg et al. (2016). Each syllogism, consisted of two premises, and participants were asked to choose from three possible conclusions or “none of the above”. E.g., “No postal workers ride motorcycles. Some motorcycle riders are swimmers”, followed with the alternatives (a) some swimmers are not postal workers, (b) no postal workers are swimmers, (c) all swimmers ride motorcycles, (c) none of the above, correct answer being (a). Each correct answer gave one point, so that a participant could have a total of 0 to 4 points for logical syllogisms and 0 to 4 points for cognitive reflection, respectively.

Procedure

Participants were randomly assigned to one of the three conditions. The order of the presented phenomena, nine in total, was randomized. The side on which the accompanying explanations were placed was also randomized to either the left or right hand side. This order was then reversed, creating two versions of each condition (e.g., 1.1, 1.2). Thus, in total, six different surveys were created. The questions on logical syllogisms, critical thinking, and demographics were presented in the final position of all surveys. The first page of the survey informed participants that this was a study about information as a part of the thesis work in psychology. Subsequently, the introductory information from the original study (Hopkins et al., 2016, in turn adapted from Fernandez-Duque et al., 2015) was slightly modified due to the change in method and translated to Swedish. Participants were told that they would be presented with descriptions of various scientific findings, all from solid, replicable research, and that they would read two explanations of each finding. They were then told that unlike the findings themselves, the explanations of the findings range in quality, some being better than others and more logically sound. On the following pages, participants were presented with descriptions of nine scientific phenomena, each with two explanations and a prompt to rate each explanation.

Ethical considerations

No personal data was collected, and participants remained completely anonymous throughout the study. It was made clear for participants that this was not a test, and that they had the right to withdraw from the study at any time without giving an explanation for doing so. Upon these instructions they were asked to give their consent to participate. There was no risk of secondary identification of any participant, as very little information about the individual participants was gathered (age, gender, field of study). Finally, as the information presented did not in any way concern personal matters, there was no risk that it would evoke negative feelings.

Data preparation and analysis

Average scores on explanations of phenomena from each scientific discipline - psychology, neuroscience, and social sciences, were calculated. This created four average measures for ratings within each discipline; horizontal-good, reductive-good, horizontal-bad, and reductive-bad.

Difference scores

Difference scores were used to reflect the participants' ability to evaluate distinct explanations differently. The horizontal-good explanations were included in all surveys as we wanted to use it as the comparative value. The score on this explanation was subtracted from the score on the reductive-good, horizontal-bad or reductive-bad explanation, depending on condition (see Table 1). This meant that if a participant from the reductive-bad condition gave a rating of 6 to the horizontal-good explanation, and a rating of 5 to the reductive-bad explanation, the difference score would in this case be -1 (5-6 = -1). Difference scores in this context best reflect the extent to which participants are able to differentiate between the explanations. The higher the difference score, the more distinct the ways in which two explanations have been rated. For figures, a transformation to the absolute value of each difference score was made. Once again, note that difference scores for the horizontal-bad condition and the reductive-bad condition reflected ability to separate a good explanation from a bad explanation. In contrast, difference scores for the reductive-good condition reflected differences in ratings based on explanation level, horizontal or reductive. Another way of measuring ability to evaluate distinct explanations differently was by creating a common variable for the participants' ratings on the comparative explanation (the between-groups factor), later used in the analysis.

We also wanted to know if there would be any differences in the pattern of ratings depending on the science of the phenomenon, namely, social science, psychology and neuroscience. To explore this, difference scores were averaged for each participant across all cases within each scientific discipline (ratings on explanations for psychological phenomena, ratings on explanations of neuroscientific phenomena and ratings on explanations from social science).

Hypothesis testing

The hypothesis for the current study was that ratings would be lowest for horizontal-bad explanations, followed by reductive-bad explanations, followed by horizontal-good explanations, and ultimately being the highest for the reductive-good explanations. To compare the three experimental conditions, a multivariate ANOVA was conducted, with difference scores for each discipline as dependent variables, including condition and field of study as fixed factors. The same analysis was repeated using scores on the comparative explanation instead of difference score, ultimately measuring the same thing in different ways, creating a more thorough data analysis.

Individual differences

A Pearson product-moment correlation coefficient was computed to assess the relationship between scores on the Cognitive Reflection Test and difference scores within each discipline. As the reliability of the questions with logical syllogisms was low (α=.50) this measure was not considered further in the analysis.

Results

Distribution bias

Participants were divided into three groups based on field of study: (1) economics and law (2) humanities and social sciences and (3) technical, medical, and natural sciences. Preliminary analysis indicated that the distribution of participants from each field of study among the three experimental conditions was uneven (Table 3).

Table 3

Distribution of participants from different fields of study within conditions

Condition	Field of study		
	Humanities & Social science	Economics & Law	Technical, Medical & Natural sciences
Reductive-good (n = 72)	36	18	16
Horizontal-bad (n = 75)	38	22	12
Reductive-bad (n = 71)	41	10	19

Descriptives

The horizontal-good explanations were on average rated highest, followed by the reductive-good explanations. The horizontal-bad explanations were rated lowest, the reductive-bad explanations slightly higher (Table 4).

Table 4.

Mean ratings for explanations by quality and explanation level

	HGood (N = 218)		RGood (n = 72)		HBad (n = 75)		RBad (n = 71)	
	M	SD	M	SD	M	SD	M	SD
Social science	5.52	.98	4.93	1.10	4.15	1.29	4.09	1.12
Psychology	5.26	.89	5.08	.89	4.16	1.17	4.53	1.01
Neuroscience	5.55	.98	5.22	.93	4.64	1.18	4.80	.97
Average tot.rating	5.45	.68	5.08	.67	4.32	.96	4.47	.68

For difference scores, a negative score indicates that the horizontal-good explanation rated higher, as this was the comparative value for all groups. See Table 5 and Figure 2 for mean difference scores across conditions and disciplines.

Table 5.

Mean difference scores for each condition between disciplines

	Reductive-good (n= 72)		Horizontal-bad (n = 75)		Reductive-bad (n = 71)	
	M	SD	M	SD	M	SD
Social science	-.58	1.30	-1.32	1.52	-1.51	1.53
Psychology	-.12	1.17	-1.12	1.60	-.72	1.52
Neuroscience	-.27	1.10	-.86	1.73	-.72	1.55
Average tot. diff.	-.32	.69	-1.08	1.15	-.93	1.10

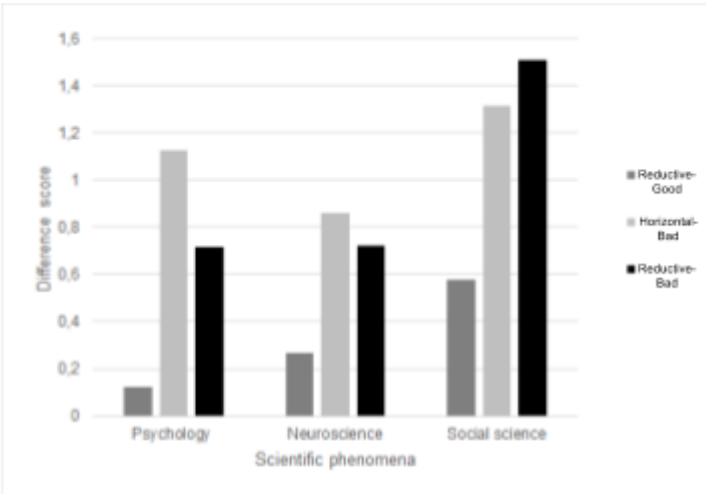

Figure 2. Difference scores for each condition and scientific field

Differences between conditions

The multivariate ANOVA with difference scores for each discipline (psychology, social science and neuroscience) as dependent variables, and experimental condition (Group 1 vs. Group 2 vs. Group 3, see Table 1 for a description) and field of study (humanities and social science vs. economics and law vs. technical, medical, and natural sciences) as fixed factors, revealed a multivariate main effect of experimental condition, for all three discipline difference-scores considered together

[$F(2, 215) = 6.1$, $p < .001$; *Wilk's* $\Lambda = .84$, partial $\eta^2 = .08$, observed power .90]. No other multivariate effects were found. The multivariate ANOVA using the comparative values as scores, in place of difference scores, gave the same pattern of significant results. As this measure does not include as much information of ratings (excluding the ratings for the horizontal-good explanations), it was not considered further in the analysis. The univariate analysis confirmed effects of treatment group for all discipline difference-scores. For psychology [$F(2, 203) = 8.53$, $p = <.01$ partial $\eta^2 = .08$, observed power .96], for social science [$F(2, 203) = 8.13$, $p = <.01$, partial $\eta^2 = .07$, observed power .96], and for neuroscience [$F(2, 203) = 5.36$, $p = <.01$, partial $\eta^2 = .05$, observed power .84].

Post-Hoc analysis

Post hoc comparisons were carried out using the Scheffé test - a conservative method keeping the risk for a type 1 error low (Aron, Coups & Aron, 2013). The effect of group was strong enough to be revealed in the post-hoc analysis for all sciences. Comparisons of difference scores on psychological phenomena with the Scheffé test showed a significant difference between the reductive-good condition ($M = -.12$, $SD = 1.17$) and the horizontal-bad condition ($M = -1.13$, $SD = 1.59$), $p < .01$, and between the reductive-good and reductive-bad condition ($M = -.72$, $SD = 1.52$), $p = .05$, but the horizontal-bad condition and the reductive-bad condition did not differ ($p = .23$). Similarly, when comparing difference scores on social science phenomena using the same procedure, there was a significant difference between the reductive-good condition ($M = -.58$, $SD = 1.29$) and the horizontal-bad condition ($M = -1.31$, $SD = 1.52$), $p = .01$. A significant difference between the reductive-good condition and reductive-bad condition ($M = -1.51$, $SD = 1.53$) was also found, $p = <.01$. As with difference scores on psychology phenomena, no significant difference was found between the horizontal-bad and the reductive-bad condition, p = .72. Within neuroscience, the same test showed no significant differences between conditions, though a notable difference was found between the reductive-good (M = -.27, SD = 1.10) and the horizontal-bad condition (M = -.86, SD = 1.73) at p = .06, but not significant. A comparison between the reductive-good and the reductive-bad condition (M = -.72, SD = 1.55) was shown to be at p = .19, and a comparison between the reductive-bad and the horizontal-bad condition was shown to be at p = .85.

Univariate effects of participants' field of study

The multivariate effects of different academic groups - technical, medical, and natural sciences, humanities and social science, as well as economics and law - showed a tendency towards an effect of participants' field of study [F(2, 203) = 1.8, p = .10, *Wilk's* Λ = .95, partial η^2 = .03, observed power = .67]. The univariate analysis, however, revealed no effects for judgements of explanations of phenomena in social sciences [F(2, 209) = .37, p = .70, partial η^2 = <.01, observed power = .11], or psychology [F(2, 209) = .78, p = .46, partial η^2 =<.01, observed power = .18], but a significant effect for the discipline of neuroscience [F(2, 209) = 3.74, p = .025, partial η^2 = .04, observed power = .68]. Post hoc comparisons using the Scheffé test showed a significant effect on difference scores for the neuroscientific phenomena between technical, medical, and natural sciences students (M = -1.11, SD = 1.44) and humanities and social science students (M = -.48, SD = 1.49) (p = .05). Once again, because of discrepancies in participants from certain fields of study between each of the survey groups, these results remain inconclusive.

Individual factors

There was a significant negative correlation between CRT and overall difference scores (r = -.28 p <.01). A negative correlation meant that high scores on the CRT test, reflecting an inclination to use cognitive effort, correlates to higher (negative) difference scores - demonstrating the ability to detect differences in quality of explanations. The correlation remained significant also when dividing the phenomena into scientific field. As only group 2 and 3 compared a good and bad explanation, correlations were also calculated within groups, showing that correlation between CRT and difference score differs depending on science and group. This was true specifically for neuroscience (Table 6).

Table 6

Correlations between CRT and difference scores

	Group 1 Rgood	Group 2 Hbad	Group 3 Rbad
Social Science	-.08	-.32**	-.31**
Psychology	.18	-.37**	-.26*
Neuroscience	.26*	-.30**	-.22
Total	.18	-.43**	-.40**

*p<.05. **p<.01 ***p<.001

Age was not correlated with difference scores (r = .01, p = .77) for any of the groups.

Discussion

The aim of the present study was to investigate if there is a preference for reductive explanations, even when they contain logically irrelevant information. This was done by asking participants to rate the quality of different explanations for phenomena stemming from particular scientific fields. The results show that university students, independently of age or focus of study, basically are able to distinguish between coherent (good) and logically inconsistent (bad) explanations and judge them accordingly, while not being carried away by jargon from a more fundamental level of explanation. As such, no robust support for the reductive allure was found.

Interestingly, the science within which the capacity to separate a good explanation from a bad one was least clear, thereby pointing to a hint of bias or allure, was neuroscience. In psychology and social science, there was a significant difference between the reductive-good and horizontal-bad condition, and the reductive-good and reductive-bad condition, demonstrating participants' ability to differentiate between good and bad explanations. Yet for neuroscientific phenomena there was no significant difference in ratings between the reductive-good condition and the horizontal-bad condition (p = .06), nor between the reductive-good condition and the reductive-bad condition (p = .19). What impacted participants' ability to correctly assess the quality of explanations of neuroscientific phenomena? Earlier studies have shown that neuroscience as a scientific discipline is more admired than psychology or social science (Fernandez-Duque et al., 2015; Hopkins et al., 2016). Perhaps there is a more general allure of the neuroscientific phenomena themselves, which spills over onto the ratings of the explanations. A potential reason for this might be a lack of general knowledge of neuroscience among participants, in particular since the fields of technical, medical and natural sciences was underrepresented in the study. Without a clear understanding of the mechanisms underlying the neuroscientific phenomena it may be difficult to assess explanation quality. Regardless, the indication that participants are not able to detect these differences does highlight the importance of clarity when reporting neuroscientific findings to the public, especially considering the authoritative weight given to the field of neuroscience when explaining behavior (Racine et al., 2010).

Moreover, in line with the findings of Hopkins et al. (2016), the trend of mean ratings for social science differed from that of psychology and neuroscience. Here, the reductive-bad explanations received the lowest ratings, rather than the horizontal-bad explanations. Although this tendency was not significant in either study, it was replicated, suggesting that the results are not anomalous. As such, this relationship would be interesting to explore in future studies.

Remarkably, while reflective capacity was significantly correlated to difference scores in the horizontal-bad and reductive-bad condition for both social science and psychology, it was not significantly correlated for the reductive-bad condition for neuroscience. This suggests that within neuroscience reflective capacity is not related to the ability to separate a good explanation from a bad explanation when the bad explanation contains reductive information. Once again, a lack of general knowledge of neuroscience might explain this - without preexisting knowledge it is possible that the capacity to reflect upon arguments is limited. As our sample included a majority of participants from the humanities and social sciences, they may have had more previous knowledge of psychology and social science. This previous knowledge may have improved their ability to critically evaluate the explanations from these fields. Future studies may want to explore the individual differences within this aspect further.

When analyzing ratings in relation to participants' field of study, once again a distinct pattern for neuroscience is revealed. There was a significant difference in ratings of neuroscientific explanations between participants from technical, medical, and natural sciences and participants from the humanities and social sciences. Although we are tempted to investigate this relationship further, the distribution of participants from different faculties over the three groups was not equal, thus not giving us enough statistical power to address the questions. Nonetheless, future studies may want to look further into the potential effect of academic experience in this context.

There are some similarities between the present study and another study unable to find strong support for the seductive allure of neuroscience. The sample is comparable to that in Tabacchi & Cardaci (2016) where individuals preferred explanations that did not contain neuroscientific jargon. Yet, unlike the participants in the current study, they were unable to distinguish between good explanations and bad ones. Unfortunately, there is no clear indication as to why these results differed from earlier findings, but perhaps this provides some insight to the seemingly contextual nature of the seductive allure of neuroscience, and perhaps also the reductive allure. If anything, the evidence suggests that past knowledge and individual characteristics has an impact on the ability to correctly evaluate explanations of scientific phenomena (Hopkins et al., 2016; Minahan & Siedlecki, 2016; Weisberg et al., 2008).

Providing participants with two explanations allowed for strict testing of the reductive allure. Yet, being asked to rate two explanations is a very specific scenario, not common in everyday life. Perhaps the lack of habit in this task resulted in a lot of mental effort and “mindful processing” (see Langer et al., 1978), unmasking the reductive allure. This would also go in line with previous research showing that individuals are better at differentiating arguments when stronger cues are ”unavailable and if participants are under pressure to discriminate among the arguments” (Rips, 2002, p.789).

With this in mind, a different design eliciting more intuitive thinking could perhaps reinforce the reductive allure. Instead of simply asking participants to rate the two explanations, an alternative design may instead explicitly ask participants which explanation they prefer, and that their ratings on the scale for each explanation should reflect such a comparison. This task potentially increase the demand for cognitive effort, as a more explicit comparison is made. As our cognitive capacity is a limited resource, and the cost of error in this task is low, this might result in the use of heuristic thinking (Kahneman, 2015), ultimately letting participants take a cognitive shortcut rather than analyzing the explanations in detail. The heuristic thinking relies more on feelings - which could favor the reductive explanations, particularly since it has been argued that reducing a phenomenon to component parts might provide people with a false *sense* of understanding, through an illusion of explanatory depth (Rosenblit & Kiel, 2002). It has been suggested that "functional sub-assemblies that are easy to visualize and mentally animate may lead to strong (but mistaken) feelings of understanding at a high level of analysis" (Rozenblit & Kiel, 2002, p. 523). Nonetheless, this line of reasoning is less likely to hold when considering that a reductive allure was revealed when participants were asked to rate only one explanation (Hopkins et al., 2016).

Methodological considerations

There are some methodological considerations regarding the generalizability of the current findings. The uneven distribution of representatives from the different fields of study across the three conditions restricted the analysis of the results. Also, our sample consisted of bachelor students, who in their studies are encouraged to critical thinking and analysis. As scores on the cognitive reflection test were highly correlated with difference scores, this implies that the ability to differentiate between explanations is at least partially dependent on reflective capacity. As such, a study including younger or less academically experienced participants may yield different results. This would be an interesting aspect for future studies to investigate.

Conclusion

Perhaps it is premature to dismiss the idea that the seductive allure of neuroscience is part of a more broad bias towards reductive information. Though the same material as in Hopkins et al., (2016) was used, unlike the results from their study we did not find a significant preference for reductive explanations. On the other hand, we have mirrored the results they gained from the part of their sample that was comprised of undergraduate students, in which no effect was found. Potentially, our design of letting participants rate two explanations weakened the reductive allure, making it clear that the reductive explanations merely contained logically irrelevant information, resulting in the highest ratings for the horizontal-good explanations. Regardless, results indicate that the reductive allure is not robust enough to persist when individuals are encouraged to look closely at explanations.

While the reductive allure did not reveal itself in ratings on explanations for scientific phenomena, there were interesting patterns of differences between the sciences. For neuroscience this was most apparent: the gap in ratings between good and bad explanations was not as pronounced as in psychology or social science. This indicates that our ability to judge explanations is not always guided by logical reasoning, especially since our results also showed that reflective capacity was not consistent in its correlations with ratings. This highlights the importance of future studies exploring these effects, as our ability to extract relevant, good information from today's incessant information flow is constantly being tested.

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Appendix A
Full stimuli material used

Cognitive Reflection Test (Toplak, West, & Stanovich, 2014)

Om Johan kan dricka en tunna vatten på 6 dagar, och Maria kan dricka en tunna vatten på 12 dagar, hur lång tid skulle det ta dem att dricka en tunna vatten tillsammans (i dagar)?
Svar: 4 dagar

Jerry fick både det 15:e högsta och det 15:e lägsta betyget i klassen. Hur många elever finns det i klassen?
Svar: 29 elever

En man köper en gris för 600 kronor, säljer den för 700 kronor, köper tillbaka den för 800 kronor, och säljer den slutligen för 900 kronor. Hur mycket har han tjänat?
Svar: 20 dollar

Simon bestämde sig för att investera 8.000 i aktiemarknaden en dag i början av 2008. Sex månader efter det att han investerade, den 17:e juli, hade aktierna han köpt gått ned 50 %. Lyckligtvis för Simon, gick de aktier han köpt upp 75 % från 17 juli till 17 oktober. Vid det laget hade han

- gått jämnt ut på aktiemarknaden
- mer pengar än när han började
- **förlorat pengar**

Logical Reasoning (Hopkins et al., 2016)

Vissa mekaniker är fotbollssupportrar. Inte alla fotbollssupportrar tycker om brädspel.

- **Vissa mekaniker tycker om brädspel**
- ingen som tycker om brädspel är en mekaniker.
- Alla fotbollssupportrar är mekaniker
- Inget av ovanstående

Alla skådespelare tycker om fågelskådning. Inga skådespelare kör hybridbilar

- **Vissa fågelskådare kör inte hybridbilar**
- Ingen som kör en hybridbil tycker om fågelskådning
- Alla fågelskådare är skådespelare
- Inget av ovanstående

Inga brevbärare kör motorcykel. Vissa motorcykelförare är simmare.

- **Vissa simmare är inte brevbärare**
- Inga brevbärare är simmare
- Alla simmare kör motorcykel
- Inget av ovanstående

Alla akrobater är djurälskare. Inga ingenjörer är akrobater

- **Vissa djurälskare är inte ingenjörer.**
- Inga ingenjörer är djurälskare
- alla djurälskare är akrobater
- inget av ovanstående

Neurovetenskap - 1

Forskning inom neurovetenskap använder flera tekniker för att studera den mänskliga hjärnan. För att kunna samla viktig data om hjärnaktivitet, som till exempel kognitiv nedsättning orsakat av en stroke, används olika typer av hjärnavbildningstekniker. "Functional magnetic resonance imaging" (fMRI) är ett viktigt verktyg i studier inom neurovetenskap. Den gör det möjligt att mäta olika aktiveringsmönster genom att granska blodflödet i en aktiv hjärna.
Varför använder fMRI blodflöde som en indikator på hjärnaktivitet?

	Good	Bad
Horizontal	fMRI använder ett magnetfält för att mäta transporten av syre genom hjärnan. Blod som bär på höga nivåer av syre reagerar annorlunda på magnetfältet än blod som bär på låga nivåer av syre. Mycket aktiva hjärnområden kommer att få en högre andel av syrerikt blod för att fylla på aktiva celler. fMRI maskiner detekterar flödet av syrerikt blod till de aktiva områdena, vilket ger data om hjärnaktivitet.	fMRI använder ett magnetfält för att mäta relativ aktivitet i hjärnans olika delar. Blod som bär på höga nivåer av syre reagerar annorlunda på magnetfältet än blod som bär på låga nivåer av syre. Mycket aktiva hjärnområden upptäcks av det magnetiska fält som genereras av fMRI-maskinen. fMRI maskiner detekterar blodflödet genom hjärnan, vilket ger data om aktivitet i varje hjärnregion.
Reductive	fMRI använder ett magnetfält för att mäta transporten av syre genom hjärnan. Hemoglobin i blodet som bär syre har en annan magnetisk resonans än hemoglobin utan syre. Mycket aktiva hjärnområden kommer att få en högre andel av syrerikt blod för att fylla på aktiva celler. fMRI maskiner detekterar flödet av syrerikt blod till de aktiva områdena, vilket ger data om hjärnaktivitet. (61 ord)	fMRI använder ett magnetfält för att mäta relativ aktivitet i hjärnans olika delar. Hemoglobin i blodet som bär syre har en annan magnetisk resonans än hemoglobin utan syre. Mycket aktiva hjärnområden kan upptäckas med hjälp av magnetfältet som genereras av fMRI-maskinen. fMRI maskiner detekterar blodflödet genom hjärnan, vilket ger data om aktivitet i varje hjärnregion. (55 ord)

Neurovetenskap - 2

Exponering för artificiellt ljus kan vara störande för sömnen. Det här gäller särskilt blått ljus från energieffektiva glödlampor och elektroniska apparater. Människor som bär glasögon som blockerar blått ljus i 3 timmar före läggdags har bättre sömnkvalitet och bättre humör än de som inte gör det.
Varför stör blått ljus sömncykler?

	Good	Bad
Horizontal	Sömncykler styrs av en del av hjärnan som kallas suprachiasmatiska kärnan (SCN). SCN tar emot input från ögonen och är känslig för ljus. Den producerar också ett hormon som är viktigt för att reglera sömnmönster. När det blå ljuset når ögat triggar det en dämpning av SCNs tillverkning av detta hormon. Lägre nivåer av hormonet hindrar förmågan att reglera sömn. (60 ord)	Sömncykler styrs av en del av hjärnan som kallas suprachiasmatiska kärnan (SCN). SCN tar emot input från ögonen och är känslig för ljus. Den producerar också ett hormon som är viktigt för normal funktion. När det blå ljuset når ögat hindrar det kroppens normala rytmer och stör sömnmönster. Dålig sömnkvalitet är kopplat till en rad olika hälsoproblem. (57 ord)
Reductive	Sömncykler styrs av en del av hjärnan som kallas suprachiasmatiska kärnan (SCN). SCN tar emot input från ögonen och är känslig för ljus. Den producerar melatonin, ett hormon som är viktigt för att reglera sömnmönster. När det blå ljuset absorberas av ett fotopigment i ögat triggar det en dämpning av SCNs tillverkning av detta hormon. Lägre nivåer av hormonet hindrar sömnreglering.	Sömncykler styrs av en del av hjärnan som kallas suprachiasmatiska kärnan (SCN). SCN tar emot input från ögonen och är känslig för ljus. Den producerar melatonin, ett hormon viktigt för normal funktion. När det blå ljuset absorberas av ett fotopigment i ögat hindrar det kroppens rytm och stör sömnmönster. Dålig sömnkvalitet är relaterat till flera andra hälsoproblem.

Neurovetenskap - 3

Morfin är en effektiv smärtstillande medicin för att den härmar kroppens naturliga smärtlindrande mekanism. Som svar på ett smärtsamt stimuli utlöser kroppen endorfiner. Endorfiner binder till nervceller i hjärnan och orsakar utsläpp av dopamin. Mer dopamin i hjärnan minskar känslan av smärta. Morfin kan också binda till endorfinreceptorer och orsaka utsläpp av dopamin. Trots att morfin är väldigt effektivt så är det också väldigt beroendeframkallande.
Varför är morfin beroendeframkallande?

	Good	Bad
Horizontal	Morfin är beroendeframkallande eftersom förlängd användning minskar känsligheten hos endorfinreceptorer i hjärnan. Kroppens egna endorfiner blir då mindre effektiva och användaren upplever smärtsamma abstinenssymptom. Eftersom receptorerna blir mindre känsliga för drogen behöver användaren större doser för att uppnå samma effekter.	Förlängd användning av morfin leder till ändringar av kroppens endorfinreceptorer. Användare kommer generellt uppleva begär efter mer av drogen. När en person slutar ta morfinet upplever de ofta smärtsamma abstinenssymptom. Sådana symptom kan vara upp till 72 timmar och inkluderar värkande muskler, ångest och sömnlöshet.
Reductive	Morfin är beroendeframkallande eftersom förlängd användning ändrar proteinstrukturen hos endorfinreceptorer och minskar deras känslighet. Kroppens egna endorfiner blir då mindre effektiva, och användaren upplever smärtsamma abstinenssymptom. Eftersom receptorerna blir mindre känsliga för drogen behöver användaren större doser för att uppnå samma effekter.	Förlängd användning av morfin ändrar proteinstrukturen hos endorfinreceptorer i hjärnan. Användare kommer generellt uppleva begär efter mer av drogen. När en person slutar ta morfinet upplever de ofta smärtsamma abstinenssymptom. Sådana symptom kan vara upp till 72 timmar och inkluderar värkande muskler, ångest och sömnlöshet.

Psykologi - 1

Ibland märker inte människor något som är rakt framför dem. När människor får titta på hastigt presenterade bilder och ombeds att trycka på en knapp varje gång de ser ett hus är de vanligtvis skickliga på detta. Om två hus däremot visas nära intill varandra misslyckas människor ofta med att trycka på knappen för det andra huset. Denna oförmåga att upptäcka det andra huset kallas för ”uppmärksamhetsblinkning” (på engelska – ”attentional blink”).
Varför sker uppmärksamhetsblinkningen?

	Good	Bad
Horizontal	Effekten ”attentional blink” sker på grund av hur människors perceptuella och beslutsfattande förmågor fungerar i respons till stimuli. Människor har begränsningar gällande mängden saker de kan vara uppmärksamma på i varje ögonblick. Då de fortfarande bearbetar bilden av det första huset saknas mentala resurser för att upptäcka det andra.	Effekten ”attentional blink” sker på grund av hur människors perceptuella och beslutsfattande förmågor fungerar i respons till stimuli som denna. Människor har begränsningar gällande hur väl de kan utföra denna typ av uppgift. Det andra huset dyker upp senare i bildsekvensen än det första huset och oförmågan att upptäcka det när det dyker upp orsakar s.k. ”attentional blink”.
Reductive	Effekten ”attentional blink” sker på grund av hur områden i frontalloben, som tidigare visats reglera uppmärksamhet, fungerar i respons till stimuli. Människor har begränsningar gällande mängden saker de kan vara uppmärksamma på i varje ögonblick. Då de fortfarande bearbetar bilden av det första huset saknas mentala resurser för att upptäcka det andra. (52 ord)	Effekten ”attentional blink” sker på grund av hur områden i frontalloben, som tidigare visats reglera uppmärksamhet, fungerar i respons till stimuli. Människor har begränsningar gällande hur väl de kan utföra denna typ av uppgift. Det andra huset dyker upp senare i bildsekvensen än det första huset och oförmågan att upptäcka detta orsakar s.k. ”attentional blink”. (56 ord)

Psykologi - 2

Människors förmåga till att associera ord varierar beroende på hur lång tid det tar att säga det första ordet som dyker upp. Ord som yttras väldigt hastigt efter det att ursprungsordet nämnts låter sannolikt väldigt likt detta ord. Men ord som yttras efter en mindre fördröjning har sannolikt en liknande innebörd som ursprungsordet.
Varför påverkar timing den typ av ord som människor associerar till?

	Good	Bad
Horizontal	Den effekt som timing har på ordassociation är på grund av det kognitiva system som möjliggör språkbruk hos människor. Detta system kategoriserar i första hand ord baserat på hur de låter och först därefter baserat på deras innebörd. Ju mer tid en människa tar på sig att yttra ett associerat ord ju större blir sannolikheten att detta ord kommer ha en liknande innebörd som ursprungsordet. (65 ord)	Den effekt som timing har på ordassociation är på grund av det kognitiva system som möjliggör språkbruk hos människor. Detta system associerar två olika typer av ord med ursprungsordet vid olika tidpunkter. Ju mer tid en människa tar på sig att yttra ett associerat ord ju större blir sannolikheten att detta ord kommer ha en liknande innebörd som det första ordet. (61 ord)
Reductive	Den effekt som timing har på ordassociation är på grund av ”Brocas område”, en del av hjärnans språksystem. Detta område i hjärnan kategoriserar i första hand ord baserat på hur de låter och först därefter baserat på deras innebörd. Ju mer tid en människa tar på sig att yttra ett associerat ord ju större blir sannolikheten att detta ord kommer ha en liknande innebörd som det första ordet. (68 ord)	Den effekt som timing har på ordassociation är på grund av ”Brocas område”, en del av hjärnans språksystem. Detta hjärnområde associerar två olika typer av ord med ursprungsordet vid olika tidpunkter. Ju mer tid en människa tar på sig att yttra ett associerat ord ju större blir sannolikheten att detta ord kommer ha en liknande innebörd som det första ordet. (60 ord)

Psykologi - 3

Spädbarn är kapabla till att utföra enkel aritmetik (räkning). Ett exempel är att låta spädbarn se en docka placeras på en scen för att sedan skymmas bakom en ridå. Efteråt får de se en hand placera ytterligare en docka bakom ridån. Om ridån sedan avlägsnas för att visa endast en docka istället för två tittar spädbarn längre på detta. Skillnaden i hur länge spädbarnen tittar på en eller två dockor visar att de kan beräkna 1 + 1 = 2.
Hur visar denna skillnad i hur länge man tittar att spädbarn kan utföra aritmetik?

	Good	Bad
Horizontal	Förståelse för siffror och matematik dyker upp tidigt i spädbarnens liv. Denna förståelse för siffror styr spädbarnens förväntningar gällande hur många dockor det bör vara på scenen. Spädbarnen vet att det borde finnas två dockor på scenen, och deras förvåning över att endast se en leder till att de tittar längre.	Förståelse för siffror och matematik dyker upp tidigt i spädbarnens liv. Denna förståelse för siffror styr den tid spädbarnen tittar på scenen. Den tid de tittar på scenen indikerar hur länge de är uppmärksamma på uppvisningen, och kan användas för att beräkna spädbarns tendens till att titta på den ensamma dockan när den dyker upp.
Reductive	Den del av spädbarns hjärnor som involverar räkning är parietalloben. Detta hjärnområde styr spädbarnets förväntningar på hur många dockor det bör vara på scenen. Spädbarnen vet att det borde finnas två dockor på scenen, och deras förvåning över att endast se en leder till att de tittar längre.	Den del av ett spädbarns hjärna som involverar räkning är parietalloben. Detta hjärnområde styr hur länge spädbarn tittar på scenen. Den tid de tittar på scenen indikerar hur länge de är uppmärksamma på uppvisningen, och kan användas för att beräkna spädbarns tendens till att titta på den ensamma dockan när den dyker upp.

Social science - 1

Män och kvinnor har generellt sett samma intellektuella förmågor vad gäller inlärning av naturvetenskap och humaniora. I högstadiet tenderar pojkar dock att få bättre betyg i naturvetenskap och matte, medan flickor tenderar att få högre betyg i språk och litteratur. Varför presterar pojkar och flickor på olika nivåer i olika ämnen?

	Good	Bad
Horizontal	Olika kulturella normer styr förväntningarna som finns på pojkar och flickor. Eftersom pojkar och flickor förväntas lyckas i olika ämnen, skapar det här olika incitament för elevernas ansträngningar i olika ämnen. Trots att det inte finns några egentliga skillnader mellan pojkars och flickors förmågor leder skillnaden i uppmuntran till olika betygsfördelningar för de två könen.	Olika kulturella normer styr förväntningarna som finns på studenter. Eftersom pojkar och flickor förväntas närvara vid alla lektioner skapar det här olika incitament för elevernas prestationer på sina lektioner. Trots att det inte finns några egentliga skillnader mellan pojkars och flickors förmågor överträffar pojkar flickor i vissa ämnen och flickor överträffar pojkar i andra ämnen.
Reductive	Lärare och föräldrar har olika förväntningar på pojkar och flickor. Eftersom lärare och föräldrar förväntar sig att pojkar och flickor lyckas i olika ämnen, anstränger sig varje individ mer i det ämnet där han eller hon förväntas lyckas. Trots att det inte finns några egentliga skillnader mellan pojkars och flickors förmågor leder skillnaden i uppmuntran till olika betygsfördelningar för de två könen.	Lärare och föräldrar har olika förväntningar på elever. Eftersom lärare och föräldrar förväntar sig att pojkar och flickor går på alla sina lektioner, anstränger sig varje individ mer för att prestera på de lektioner de går på. Trots att det inte finns några egentliga skillnader mellan pojkars och flickors förmågor överträffar pojkar flickor i vissa ämnen och flickor överträffar pojkar i andra ämnen.

Social science - 2

Människor som är experter inom ett visst fält vet en hel del om det fältet. Sådana människor borde vara kapabla till att ta bra beslut gällande frågor som berör detta fält. När förmågan till att ta bra beslut däremot prövas är ofta fallet att grupper bestående av vanliga, självständiga människor tar bättre beslut gällande särskilda frågor än individuella experter. Detta fenomen är känt som ”the wisdom of crowds”. Varför tar grupper bättre beslut än individer?

	Good	Bad
Horizontal	Den samlade informationen i en grupp är ett mer representativt urval sett till all tillgänglig information, så en grupp kommer totalt sett att veta mycket mer om ett ämne än vad en enskild expert kan veta. Genom att samla denna information tas allas kunskap i åtanke, vilket därmed kan leda till ett bättre beslut.	Den samlade informationen i en grupp kan leda till att mer passande beslut tas, så en grupp kommer att bestämma hur man tänker och agerar bättre än vad en enskild expert kan. Att arbeta tillsammans i en grupp kan vara en fördel för alla och kan därmed leda till ett bättre beslut.
Reductive	Varje person känner till en unik uppsättning av fakta som tillsammans skapar ett mer representativt urval sett till all tillgänglig information, så medlemmarna i en grupp kommer totalt sett att veta mer än vad en enskild expert kan veta. Genom att samla denna information tas allas kunskap i åtanke, vilket därmed kan leda till ett bättre beslut.	Varje person känner till en unik uppsättning av fakta som tillsammans kan leda till att mer passande beslut tas, så medlemmarna i en grupp kommer att bestämma hur man tänker och agerar bättre än vad en enskild expert kan. Att arbeta tillsammans i en grupp kan vara en fördel för alla och kan leda till ett bättre beslut. (58 ord)

Social science - 3

Grannskap med synliga småbrott, såsom vandalism och graffiti tenderar att också ha högre nivåer av grövre brott, såsom rån och mord. När åtgärder vidtas för att förhindra småbrott minskar även graden av grövre brott, även om inget särskilt görs för att förhindra grövre brott. Detta har kallats för “the broken windows theory of crime”. Varför kan rensning av vandalism och graffiti minska graden av grövre brott?

	Good	Bad
Horizontal	När ett grannskap inte hålls rent tas det som ett tecken på låg polisnärvaro i området. Därför ses grannskapet som en plats där grövre brott kan begås utan risk för att bli gripen. Men om man bevarar grannskapet genom att rensa upp graffiti och ersätta trasiga fönster leder det till uppfattningen av en ökad polisnärvaro. Den här uppfattningen fungerar avskräckande för all kriminell aktivitet, inklusive grövre brott.	När ett grannskap inte hålls rent tas det som ett tecken på lågt intresse från polisens sida av att förebygga vandalism. Därför ses grannskapet som en plats där graffiti och vandalism är vanligt förekommande. Men om man bevarar grannskapet genom att rensa upp graffiti och ersätta trasiga fönster leder det till uppfattningen av en ökad polisnärvaro som är riktad mot att förebygga vandalism. Den här uppfattningen fungerar avskräckande för småbrott.
Reductive	När ett grannskap inte hålls rent tar kriminella detta som ett tecken på att poliskonstaplar inte är närvarande i området. Därför ser kriminella grannskapet som en plats där grövre brott kan begås utan risk för att bli gripen. Men om man bevarar grannskapet genom att rensa upp graffiti och ersätta trasiga fönster leder det till att människor tänker att poliskonstaplar är mer uppmärksamma. Kriminella blir därför avskräckta från att begå brott, inklusive grövre brott.	När ett grannskap inte hålls rent tar kriminella detta som ett tecken på att poliskonstaplar inte försöker förebygga vandalism. Därför ser kriminella grannskapet som en plats där graffiti och vandalism är vanligt. Men om man bevarar grannskapet genom att rensa upp graffiti och ersätta trasiga fönster leder det till att människor tänker att poliskonstaplar är mer uppmärksamma på att förhindra vandalism. Kriminella blir därför avskräckta från att begå småbrott.

Appendix B.

Original material

The material associated with the original article by Hopkins et al. (2016) can be found, in the online version, at http://dx.doi.org/10.1016/j.cognition.2016. 06.011.