Original Article

Individual Differences and the Susceptibility to the Influence of Anchoring Cues

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Abstract. This study looks at individual difference (personality and intelligence) correlates of proneness to anchoring bias. In all, 172 participants completed four anchoring tasks, and in each case there was a significant effect of the high/low anchor. They also completed the NEO-FFI personality test (measuring Neuroticism, Extroversion, Openness to Experience, Agreeableness, and Conscientiousness) as well as two intelligence tests. Only Extroversion was found to be related to individual judgments – and only for one of the tasks. The results are discussed with respect to the literature on individual differences and anchoring bias.

Keywords: personality, intelligence, anchoring

The earliest mention of the anchoring bias can be traced back to the research on psychophysical functions in the 1950s, where judgments of others' weights were influenced by one extreme weight (Chapman & Johnson, 1994). This is a perceptual contrast effect, while more recent work is concerned with the assimilation toward a numerical standard. Tversky and Kahneman (1974) introduced the now well-known anchoring and adjustment heuristic in their pioneering work on judgment under uncertainty. There are presently a number of systematic reviews of the literature covering different theories of underlying mechanisms (e.g., Furnham & Boo, 2011).

According to Tversky and Kahneman (1974), the anchoring effect is the disproportionate influence on decisionmakers to make judgments biased toward an initially presented value. In a classic study, participants were required to provide an estimation for the percentage of African countries in the United Nations with reference to a range of randomly generated numbers by spinning a wheel of fortune between 0 and 100. Participants were asked to consider whether the actual answer was higher or lower than the reference value presented (comparative judgment) before the absolute judgment was made.

Thereafter, many studies went on to illustrate the prevalence of anchoring effects throughout human decision processes in a variety of domains including general knowledge (Epley & Gilovich, 2001; McElroy & Dowd, 2007; Mussweiler & Englich, 2005; Mussweiler & Strack, 1999, 2001a, 2001b) and probability estimates (e.g., Chapman & Johnson, 1994; Plous, 1989). For example, researchers investigated the anchoring effect by asking questions such as the freezing point of vodka (Epley & Gilovich, 2001), the length of the Mississippi river (McElroy & Dowd, 2007), and the annual mean temperature of Germany (Mussweiler & Englich, 2005). The anchoring effect also works with legal judgments (e.g., Englich & Mussweiler, 2001; Englich & Soder, 2009; Englich, Mussweiler & Strack, 2005, 2006), valuations and purchasing decisions (e.g., Ariely, Loewenstein & Prelec, 2003; Mussweiler, Strack & Pfeiffer, 2000), forecasting (e.g., Critcher & Gilovich, 2008), negotiation (e.g., Galinsky & Mussweiler, 2001), and self-efficacy (Cervone & Peake, 1986).

Following the attitudinal approach, it is suggested that susceptibility to anchoring effects is influenced by affective factors. Emotions are usually directly used as information in judgment situations, or they indirectly influence decision making by changing how people process information (Englich & Soder, 2009). Studies demonstrated that individuals in happy moods often process information relying on the use of superficial or heuristic strategies, whereas information is processed more thoroughly when judges are in a sad mood (Englich & Soder, 2009).

Anchoring tasks shows considerable individual variability in estimates. Yet there are very few studies on personality and the anchoring effect, despite the fact that there is a large literature on individual difference correlates of decision making. Most previous studies in anchoring based their results on the average performance of a group of subjects but neglected the importance of individual differences. However, McElroy and Dowd (2007) tested Big Five

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Table 1. Anchor values used and the correct answer for each anchoring task

	Anchors used		Correct answer
	High	Low	
What is the current population of the Ukraine?	68 million	22 million	45.7 million
How many countries are there in Africa today?	77	17	54
In England, what is the greatest distance you can be from the sea?	113 miles	49 miles	70 miles
How many people in America have licenses to keep lions, leopards and tigers as pets?	187	24	76

correlates of anchoring on one judgment. In two studies with different tasks they found individuals high in Openness were more influenced by anchoring cues relative to those low in Openness. None of the other four traits proved significant.

More recently Eroglu and Croxton (2010) looked at certain demographics (sex, age, education, work experience) as well as personality trait correlates of anchoring biases and found that individuals high on Agreeableness and Conscientiousness but low on Extraversion were more prone to anchoring bias. This study attempts to replicate McElroy and Dowd (2007) using a larger sample size, four as opposed to two anchoring tests, and a more robust measure of the Big Five.

This study also looks at the role of intelligence on anchoring bias responding (Bergman, Ellingsen, Johannesson, & Svensson (2010). In an exhaustive study, Stanovich and West (2008) found 14 tasks/effects (including anchoring) that seem unrelated to cognitive ability, but a similar number (including the overconfidence effect) that are.

Oechssler, Roider, and Schmitz (2009) tried to provide an explanation for the pronounced influence of anchoring on participants with higher cognitive abilities: They might be more likely to understand the psychology of the questioner and hence estimate the guess based on the provided anchor. This explanation, however, needs further investigation. Nonetheless, mixed results were found between the influence of cognitive abilities and anchoring effect. Therefore, the present study examines the relationship between cognitive abilities and the anchoring effect.

This study investigates how individual difference factors, the Big-Five personality traits, intelligence and gender differences may affect the susceptibility to the influence of anchoring cues. It replicates in part Eroglu and Croxton (2010) with respect to personality and Stanovich and West (2008) with respect to cognitive ability. It predicts that Openness to Experience is positively associated with anchoring bias (hypothesis 1) but that intelligence is not associated with anchoring bias (hypothesis 2)

Methods

Participants

This study involved a total of 172 undergraduate students, of whom 154 provided information on their sex: 67% were female. The mean age of the participants was 19.6 years (SD = 2.6 years, N = 151). They were randomly allocated to the two anchoring conditions; 82 were exposed to the high anchors and 90 to the low anchors.

Materials

Anchoring

Four questions on general or factual knowledge were used for the anchoring tasks: "What is the current population of the Ukraine?", "How many countries are there in Africa today?", "In England, what is the greatest distance you can be from the sea?", and "How many people in America have licenses to keep lions, leopards, and tigers as pets?" Participants were to make a comparative judgment of whether the answer for each question is higher or lower than the number presented. Then they were instructed to make the estimation for each of the answers. The anchor values used are presented in Table 1.

Individual Differences Measures

- NEO-FFI (Costa & McCrae, 1992): This 60-item test questionnaire was used to measure the Big Five personality traits (i.e., Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness). There is ample evidence of its reliability and validity.
- Wonderlic Personnel Test (Wonderlic, 1992): This 50-item test was used as a test of general intelligence. It involves mathematical and logical solutions to tasks like word and number comparison, analysis of geometric figures, and story problems. The scores of the test were within the range of 0–50, higher scores indicating higher intelligence.
- Baddelely Reasoning Test (Baddeley, 1968): This 64-item test was administered within 3 minutes to obtain the scores of participants' fluid intelligence through logical reasoning. Each item involved grammatical transformation that had to be answered with *true* or *false*. For example, "A is preceded by B-BA" (true); "B is preceded by A-BA" (false). This test had been employed in several studies (e.g., Chamorro-Premuzic & Furnham, 2008; Furnham & McClelland, 2010) to measure an individual's intellectual ability in a reliable and quick way.

Table 2. Judgment task performance as a function of individual difference variable and anchor

Variable	Question	*F*-Values (R^2)			Geometric means[a]	
		Trait	Anchor	Trait × anchor	High anchor	Low anchor
Neuroticism						
	Population of Ukraine?	< 1 (0.2%)	17.65* (10.8%)	1.15 (0.7%)	34.4	23.3
	Countries in Africa?	< 1 (0.0%)	100.94* (41.2%)	< 1 (0.0%)	51.0	25.9
	Distance from the sea?	1.41 (0.8%)	35.22* (19.4%)	2.24 (1.2%)	130.3	73.5
	Number of pet licenses?	< 1 (0.1%)	14.87* (9.3%)	< 1 (0.0%)	106.7	52.1
		All on 1, 144 dfs				
Extraversion						
	Population of Ukraine?	< 1 (0.2%)	15.69* (10.0%)	1.56 (1.0%)	34.1	22.6
	Countries in Africa?	< 1 (0.0%)	95.82* (40.9%)	< 1 (0.4%)	51.2	25.9
	Distance from the sea?	5.68 (3.1%)	34.57* (18.9%)	9.63* (5.3%)	130.7	73.6
	Number of pet licenses?	1.09 (0.7%)	16.49* (10.5%)	1.23 (0.8%)	110.5	51.5
		All on 1, 138 dfs				
Openness						
	Population of Ukraine?	< 1 (0.2%)	21.70* (12.9%)	< 1 (0.3%)	34.9	22.5
	Countries in Africa?	< 1 (0.4%)	112.62* (43.8%)	< 1 (0.1%)	52.1	25.6
	Distance from the sea?	< 1 (0.0%)	35.99* (20.0%)	3.74 (2.0%)	130.5	72.5
	Number of pet licenses?	1.55 (1.0%)	14.64* (9.1%)	< 1 (0.0%)	105.5	52.4
		All on 1, 144 dfs				
Agreeableness						
	Population of Ukraine?	< 1 (0.2%)	19.69* (12.1%)	< 1 (0.6%)	35.0	22.9
	Countries in Africa?	< 1 (0.2%)	101.93* (41.7%)	< 1 (0.2%)	50.7	25.6
	Distance from the sea?	< 1 (0.3%)	35.31* (19.4%)	< 1 (0.1%)	130.7	73.0
	Number of pet licenses?	1.61 (1.0%)	15.09* (9.4%)	3.99 (2.5%)	104.4	51.1
		All on 1, 142 dfs				
Conscientiousness						
	Population of Ukraine?	1.55 (1.0%)	15.85* (10.1%)	< 1 (0.3%)	34.1	23.0
	Countries in Africa?	< 1 (0.2%)	101.50* (41.9%)	< 1 (0.4%)	51.6	26.0
	Distance from the sea?	< 1 (0.2%)	32.50* (19.0%)	< 1 (0.2%)	130.6	72.9
	Number of pet licenses?	< 1 (0.0%)	16.16* (10.3%)	2.32 (1.5%)	106.7	50.6
		All on 1, 138 dfs				
General intelligence						
	Population of Ukraine?	1.73 (1.0%)	19.91* (11.2%)	< 1 (0.2%)	34.9	22.7
	Countries in Africa?	< 1 (0.0%)	99.23* (38.6%)	< 1 (0.0%)	50.7	26.3
	Distance from the sea?	1.60 (0.8%)	43.73* (21.7%)	< 1 (0.0%)	130.7	71.8
	Number of pet licenses?	< 1 (0.0%)	21.96* (12.3%)	< 1 (0.0%)	110.8	49.4
		All on 1, 157 dfs				
Verbal reasoning						
	Population of Ukraine?	< 1 (0.0%)	18.36* (10.0%)	< 1 (0.0%)	34.81	23.4
	Countries in Africa?	5.15 (3.0%)	115.10* (40.8%)	< 1 (0.0%)	51.2	26.5
	Distance from the sea?	< 1 (0.1%)	43.12* (20.6%)	< 1 (0.2%)	128.6	69.3
	Number of pet licenses?	< 1 (0.2%)	23.13* (12.2%)	< 1 (0.0%)	109.8	47.3
		All on 1, 166 dfs				

Notes. *$p < .05$ (Bonferroni-corrected); [a]Adjusted for personality trait.

Procedure

Participants completed the personality and intelligence tests in class. Then, 3 weeks later the class was divided into two groups, and one group was exposed to the high-anchor and the other group to the low-anchor questions. For each question they were asked to indicate whether they thought the correct numerical answer was higher or lower than the anchor that they had been shown and were then requested to provide their own estimate of the true value. After having finished the four anchoring tasks, participants were informed about the correct answer for each question and thanked for their participation. They were then given a full explanation of the anchoring effect.

Results

Logarithmic transformations of variables were conducted to reduce the positive skew evident in the response distributions and the transformed scores were used in all analyses. Furthermore, the personality and intelligence variables (continuous data) were centered so that the tests between the intercepts of the regression lines would provide a test of the difference between the adjusted means for the two anchored groups – even in the presence of a significant interaction. This method also avoids the loss of statistical power and other problems associated with the dichotomization of the participants into high or low (personality traits and intelligence) groups. Thereafter, regressions were conducted to analyze the results of the variables (type of anchor, Neuroticism, Extraversion, Openness to Experience, Agreeableness, Conscientiousness, general intelligence, and fluid intelligence) in relation to participants' estimations. For each regression analysis, anchor, personality, or intelligence variables and the anchor × personality or intelligence variables served as the independent variables and participants' estimations for the four questions acted as dependent variables. Because of the large number of tests undertaken, the results of the statistical analyses were corrected using a Bonferroni procedure (Holm, 1979). An effect size measure (R^2) is provided for each predictor variable, and the geometric means of the estimates (adjusted for the individual difference variable) are also reported. The results are presented in Table 2.

Table 2 reveals the strong influence of the anchor on the estimates provided for each question. For all four questions, the mean estimate given was significantly higher for participants exposed to the high anchor than the estimate given by participants exposed to the low anchor. The strongest anchor effect (as measured by R^2) was for the question regarding the number of countries currently in Africa. The anchor accounted for approximately 40% of the variance in the estimates. It is noteworthy that the high anchor (77) results in mean estimates that were extremely close to the true figure (54 countries); the low anchor (17) led to a marked underestimate. The question with the next largest anchor effect was the one concerned with the greatest distance an individual can be from the sea in England. The anchor accounted for approximately 20% of the variance in the estimates. In this case it is the low anchor (49 miles) that resulted in mean estimates close to the true figure of 70 miles, whereas the high anchor (113 miles) produced marked overestimates. For the remaining two questions, the anchors had a weaker effect (approximately 10% of the variance accounted for) and led to poor mean estimates of the true values. It is also clear from an inspection of Table 2 that none of the individual difference variables were significant. There was a single interaction between a trait and the anchors; for question 3 (distance from the sea) Extraversion interacted with the anchor such than less extraverted participants were influenced more by both the high and low anchor than more extraverted individuals.

Discussion

Significant anchoring effects were demonstrated in all experimental tasks indicating that the estimations made by individuals were biased toward the anchors, once again illustrating the powerful influence of anchors in judgment and decision-making tasks (Furnham & Boo, 2011; Oechssler et al., 2009; Wilson, Houston, Etling, & Brekke, 1996).

With respect to individual differences, the results were rather disappointing. We failed to replicate the effect obtained by McElroy and Dowd (2007), who in two experiments showed that individuals with high values on the Openness to experience scale were influenced by the anchors more than those with low values. However, we did replicate Eroglu and Croxton's (2010) finding that introverts are more susceptible to anchoring bias than extraverts – but this was only evident for one of the questions (distance from the sea) – and we did not replicate their finding of a moderating effect of Conscientiousness and Agreeableness on anchoring bias. There was no evidence for an effect of cognitive ability on anchoring bias which replicated the finding of Stanovich and West (2008). In fact, Stanovich and West (2008) suggest that cognitive ability does correlate with success in many heuristic tasks (i.e., hindsight bias), and they suggest that very specific traits (like need for cognition and reflexivity/impulsivity) are more closely associated with heuristic and bias tasks.

In conclusion, the effects of the Big Five personality traits on susceptibility to anchoring bias appear to be rather unreliable. Although several personality traits have been implicated as moderators of anchoring bias, only Extraversion was found to have an effect in the present study – and for only one question. Thus, the conclusion drawn by Furnham and Boo (2011) that "researchers have failed to identify any . . . trait variables that have a systematic and explicable effect on anchored decisions" (p. 40) would seem to be supported by the findings from the present study.

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