



## A literature review of the anchoring effect

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### ARTICLE INFO

#### Article history:

Received 6 July 2010

Received in revised form

17 September 2010

Accepted 5 October 2010

#### Keywords:

Anchoring effects

Individual differences

Rewards

#### JEL classification:

A12 D03

### ABSTRACT

The anchoring effect is one of the most robust cognitive heuristics. This paper reviews the literature in this area including various different models, explanations and underlying mechanisms used to explain anchoring effects. The anchoring effect is both robust and has many implications in all decision making processes. This review paper documents the many different domains and tasks in which the effect has been shown. It also considers mood and individual difference (ability, personality, information styles) correlates of anchoring as well as the effect of motivation and knowledge on decisions affected by anchoring. Finally the review looks at the applications of the anchoring effects in everyday life.

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### 1. Introduction

Behavioural economics is based on the science of judgemental heuristics (or mental shortcuts; rules of thumb) that most people rely on reflexively (Belsky and Golivich, 1999). Heuristics are characterised as an 'intuitive, rapid, and automatic system' (Shiloh et al., 2002, p. 417), which 'reduce the complex tasks of assessing probabilities and predicting values to simpler judgmental operations' (Tversky and Kahneman, 1974, p. 1124). Although the use of rules of thumb reduces cognitive and time constraints, sometimes they lead to severe and systematic errors such as biases and fallacies in decision making (Tversky and Kahneman, 1974).

The idea of heuristics was originally raised by Simon (1955), who proposed a behavioural model of rational choice, which argues for a "limited" rationality, where decisions are derived through the processes of dynamic adjustment on both external (environmental) and internal (human characteristics) factors. The "limited" rationality models are also known as models of heuristic cognition. This has led to many studies of bounded rationality and how heuristics can make accurate decisions in appropriate environments (Goldstein and Gigerenzer, 2008; Todd and Gigerenzer, 2003).

The main focus in this review article is the robust influence of the anchoring heuristic, which is a ubiquitous phenomenon in human judgement. The earliest mention of the anchoring bias can be traced back to the research on psychophysics, where judgments of others' weights were influenced by one extreme weight (Brown, 1953, as

cited in Chapman and Johnson, 1999). The notion of anchoring in decision making was first introduced by Slovic (1967), who studied descriptions of preference reversals (as cited in Chapman and Johnson, 1999). However, the anchoring-and-adjustment heuristics, first introduced by Tversky and Kahneman (1974) in their pioneering work on judgment under uncertainty, will be the main anchoring effect referred to in the current study. The heuristic maintains that anchoring bias is caused by insufficient adjustment because final judgements are assimilated toward the starting point of a judge's deliberations.

According to Tversky and Kahneman (1974), the anchoring effect is the disproportionate influence on decision makers to make judgments that are biased toward an initially presented value. In a classic study by Tversky and Kahneman (1974), 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.

Following Tversky and Kahneman's study, many studies (see Table 1) have illustrated the prevalence of anchoring effect in human decision making processes. These have demonstrated the anchoring effect in a variety of domains including general knowledge (Epley and Gilovich, 2001; McElroy and Dowd, 2007; Mussweiler and Englich, 2005; Mussweiler and Strack, 1999, 2001a,b; Strack and Mussweiler, 1997) and probability estimates (Chapman and Johnson, 1999; Plous, 1989). In general knowledge, for example, researchers have investigated the anchoring effect by asking participants questions such as the freezing point

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**Table 1**  
Existing literature on anchoring effect in various domains.

Domains	Research	Examples of questions/tasks used
General knowledge/factual questions	Blankenship et al. (2008), Wegener et al. (2001)	The record high (hottest) temperature for a day in Seattle, Washington
		The age of George Washington when he died
	Epley and Gilovich (2001)	The average starting annual salary of college graduates in the United States
		The age of Amelia Earhart when she disappeared attempting to pilot a plane around the world
		The weight of Roman Emperor Julius Caesar
		The age of Ernest Hemingway when he wrote his first successful novel
		The length of time an average American person spends eating an evening dinner at home
		The age of Neil Armstrong when he walked on the moon
		When was Washington elected president?
		What is the boiling point of water on Mt. Everest?
Epley and Gilovich (2005)	When did the second European explorer, after Columbus, land in the West Indies?	
	How many states were in the United States in 1840?	
	What is the freezing point of vodka?	
	What is the highest recorded body temperature in a human being?	
	What is the lowest recorded body temperature in a human being?	
	How many days does it take Mars to orbit the sun?	
	What is the gestation period of an African elephant? (months)	
	In what year was George Washington elected President of the United States?	
	In what year did the second European explorer land in the West Indies?	
	What is the freezing point of vodka?	
McElroy and Dowd (2007)	What is the boiling point of water on the top of Mount Everest?	
	What is the population of Chicago?	
	What is the height of the tallest redwood tree?	
	What is the length of the Mississippi River?	
	What is the height of Mount Everest?	
	How many days does it take Mars to orbit the sun?	
	How many states made up or comprised the United States in 1880?	
	In what year was the telephone invented?	
	What is the average number of babies born per day in the United States?	
	Estimate the exact length of the Mississippi river	
Mussweiler and English (2005, Study 1)	Estimate the percentage of African nations in the United Nations	
	What is the annual mean temperature in Germany?	
Mussweiler (2003), Mussweiler and Strack (1999, 2001a), Strack and Mussweiler (1997)	What is the mean temperature of Antarctica in winter (°C)?	
	How old was Mahatma Gandhi?	
Mussweiler and Strack (2001b)	What is the length of a whale (m)?	
	What is the year of birth of Aristotle?	
Tversky and Kahneman (1974)	What is the length of the runway of the airport in Nuremberg (Germany)?	
	What is the height of the World Trade Centre?	
Probability estimates	Chapman and Johnson (1999, Experiment 2)	What is the highest elevation in the Urals?
	Plous (1989)	What is the percentage of African countries in the United Nations?
Legal judgments	Englich and Mussweiler (2001), Englich and Soder (2009), Englich et al. (2005, 2006)	How likely it was that US troops would be sent to the former Yugoslavia for military action within the next year?
	Hastie et al. (1999), Marti and Wissler (2000)	Likelihood estimates of a nuclear war
Valuations/purchasing decisions	Ariely et al. (2003)	Indicate the sentencing demand that they would recommend as a defence attorney (in prison or on probation)
	Mussweiler et al. (2000)	Indicate the length of the sentence as judges would decide on (in prison or on probation)
Forecasting	Wansink et al. (1998)	Judge liability for punitive damages and assign a dollar award if damages were to be assessed
	Critcher and Gilovich (2008)	Willingness-to-pay on a range of products
Negotiation	Galinsky and Mussweiler (2001)	Valuations of an annoying sound in monetary terms
		Valuation of a 10-year-old car
Self-efficacy	Cervone and Peake (1986)	Purchasing decisions on groceries
		Estimations of an athlete's performance
		Forecasting about the sales in the domestic market of a product
		Estimations of spending in a restaurant
		Negotiation task involved the purchase of a pharmaceutical plant
		Negotiation about the amount of assigning bonus for an employee
		How many items of the initial task (anagrams and cyclic graphs) they thought they were capable of solving?

of vodka (Epley and Gilovich, 2001), the length of the Mississippi river (McElroy and Dowd, 2007) and the annual mean temperature of Germany (Mussweiler and English, 2005). Most of these studies were conducted with university students in laboratory settings and utilised questions that the students may not have naturally used for decision making, therefore, their generalizability and validity can be questioned. However "real-world" judgement and decision making tasks such as in legal judgments (Englich and Mussweiler, 2001; Englich et al., 2005, 2006; Englich and Soder, 2009), valua-

tions and purchasing decisions (Ariely et al., 2003; Mussweiler et al., 2000; Wansink et al., 1998), forecasting (Critcher and Gilovich, 2008), negotiation (e.g. Galinsky and Mussweiler, 2001) and self-efficacy (Cervone and Peake, 1986) have shown the effect to be very robust.

Research findings from several domains illustrate the robust influence of anchoring. For instance Thorsteinson et al. (2008) used both field and laboratory studies to show how anchoring works on performance judgements. Similarly in four experimental

**Table 2**  
Different perspectives to the explanations of anchoring effects.

Perspectives	Existing literature	Descriptions
Anchoring-and-adjustment	Tversky and Kahneman (1974), Epley and Gilovich (2001, 2005)	Anchoring effect serves as a result of effortful adjustment processes, which are insufficient, based on an initially presented value Anchor values serve as the reference for people to adjust the boundary of the range of plausible values for the question, presuming that the given anchor is more extreme than the boundary value for the range of plausible answers
Selective accessibility	Chapman and Johnson (1999), Mussweiler and Strack (1999, 2001b), Strack and Mussweiler (1997)	Based on the confirmatory hypothesis testing, individuals test out the hypothesis that the anchor value is the correct answer In doing so, judges look for ways that the answer is similar to the anchor value and thus activate aspects of target that are consistent with the anchor to become accessible
Attitude change	Blankenship et al. (2008), Wegener et al. (2001, 2010)	Anchors could directly serve as a cue or indirectly influence the information processing that bias judgments toward the anchors Low-elaboration anchoring is resulted especially during non-thoughtful processes; anchors are treated as a "hint" to a reasonable answer High-elaborative anchoring involves thorough thinking that engages judges in more effortful information processing with existing knowledge and hence activate the anchor-consistent information that bias judgments

studies Oppenheimer et al. (2008) should that the boundary conditions of anchoring effects are very loose with anchors operating across modalities and dimensions to bias judgement. What is most impressive is the number of studies that have demonstrated the robustness of the anchoring effects with very different judgements, for instance, time estimation (Thomas and Handley, 2008). There have even been electrophysiological studies on the anchoring effect noting how people respond differently when making decisions (Qu et al., 2008).

The literature does indicate that, in decision making, the higher the ambiguity, the lower the familiarity, relevance or personal involvement with the problem, a more trustworthy source or plausible bid/estimate the stronger the anchoring effects (Van Exel et al., 2006).

On the other hand, there are various studies demonstrating that this influence can be mitigated (Galinsky and Mussweiler, 2001; LeBoeuf and Shafir, 2009; Mussweiler et al., 2000). However, mixed results have been found, which suggests the question: "what factors affect the susceptibility to the influence of the anchoring effect?"

## 2. Underlying mechanisms to the anchoring effect

In order to understand the question above, first the psychological processes that contribute to the anchoring effect need to be outlined (see Table 2). Early explanations of the anchoring-and-adjustment heuristic were provided by Tversky and Kahneman (1974). They suggested that people make insufficient adjustments to yield a final estimation based on an initially presented value or parameter. In other words, people who are exposed to a higher anchor make insufficient adjustments downward and vice versa. Therefore, estimates are biased toward the anchor values. Strack and Mussweiler (1997) explained: "Anchor values serve as the reference point for people to adjust the boundary of the range of plausible values for the question, presuming that the given anchor is more extreme than the boundary value for the range of plausible answers". Based on this concept, estimations made using the anchoring-and-adjustment heuristic lie heavily on the effortful process of adjustment (moving toward the range of plausible answers based on an initial value). Nevertheless, it is argued that the process of adjustment does not necessarily occur in the standard anchoring paradigm.

Mussweiler and Strack (1999) however asserted that adjustment per se does not account for the strong influence of anchoring effect. Strack and Mussweiler (1997) argued that the adjustment process only explains the anchoring effect when the given anchor is more extreme than the boundary value for the range of plausible answers. Furthermore, Mussweiler and Englich (2005) demonstrated that people can be assimilated toward the anchor values in a subliminal manner, implying that the process of adjustment may not take place in anchoring.

The current dominant view of the anchoring paradigm focuses on *confirmatory hypothesis testing* (Chapman and Johnson, 1999; Mussweiler and Strack, 1999, 2001b; Strack and Mussweiler, 1997; Wegener et al., 2010) and suggests that the anchoring effect results from the activation of information that is consistent with the anchor presented. It is assumed that judges consider the anchor value to be a *plausible answer* and test out the hypothesis that the anchor value is the correct answer. In doing so judges search for ways in which their answer is similar to the anchor value, and thus activate aspects of the target that are consistent with the first estimate. The notion of anchoring as an activation process has been empirically supported by studies such as Chapman and Johnson (1999) and Strack and Mussweiler (1997). As a result, it can be argued that "confirmatory search" (Chapman and Johnson, 1994) and "selective accessibility" (Strack and Mussweiler, 1997) contribute to the fundamental mechanism that accounts for the anchoring effect.

## 3. Types of anchors

It is, however, premature to claim that the confirmatory hypothesis testing model accounts for all of the underlying psychological processes of anchoring. Different mechanisms appear to account for the anchoring effect under different contexts. Epley and Gilovich (2001, 2005) argued that the anchoring effect is generated by multiple mechanisms. Their findings demonstrate that the adjustment process comes into play when the anchor values are self-generated; where participants adjust slightly from the values they know to be close to the right answer. They also found that the mechanism of selective accessibility is activated when anchors are externally provided by an experimenter or some other external source.

Epley and Gilovich (2001) built their argument on the ground that self-generated anchors are known to be a wrong reference from the start. For example, people may know that vodka freezes at

less than 32 F, but do not know the exact correct answer. Based on the concept of confirmatory hypothesis testing mechanism, there is no reason for judges to consider whether the self-generated anchor is the correct answer (when it is already known to be wrong). Therefore, without confirmatory search, there is no engine activating the accessibility of information that is anchor-consistent. However, an externally provided estimate may have more weight and validity and can be presumed to be related to the correct answer (Epley and Gilovich, 2001). This acts in accordance with the confirmatory search and selective accessibility mechanisms of the confirmatory hypothesis testing model. It provides an explanation for the findings that the adjustment mechanism accounts for the anchoring effect when the anchor is self-generated but an externally provided anchor is the factor responsible for the activation of the confirmatory hypothesis testing mechanism.

Some empirical findings have demonstrated anchors that have informational relevance to the task can lead to anchoring effect. In other words, informational relevance of values may play a role in affecting people's susceptibility to the anchoring effect. For example, in the legal domain higher damage awards are obtained when higher compensations are requested in court (Hastie et al., 1999; Marti and Wissler, 2000). In addition, the sentencing for rape cases are influenced by the prosecutor's sentencing demand (Englich et al., 2005). Strack and Mussweiler's (1997) studies on factual knowledge also demonstrated that anchor values similar or identical in judgmental dimensions to the estimates yield significant interaction effect with the anchoring effect.

Englich et al. (2006) found empirical support which explains the above finding using the *selective accessibility model*. They demonstrated that participants who were exposed to high anchor values responded faster in categorizing incriminating arguments than those presented with low anchor values, indicating that anchor-consistent information is activated by relevant anchors. These studies provide support for the argument that the anchoring effect is vulnerable to the relevance of the reference value in the task.

Some research, however, has found that anchor values that are uninformative to the estimates also yield an effect in judgmental decisions. For example, Tversky and Kahneman (1974) randomly generated the anchor values by spinning a wheel of fortune. Furthermore, participants in Englich et al.'s (2006) study randomly acquired the anchors by throwing a set of die. In addition, Critcher and Gilovich (2008) found that estimations of an athlete's performance could be anchored by the number on his jersey; sales forecasting were influenced by a product's model number; and the estimations of spending in a restaurant were affected by the name of the restaurant ("Studio 17" or "Studio 97"). These studies demonstrate that irrelevant anchors still induce an anchoring effect. Englich and Mussweiler (2001) and Englich et al. (2006) tested the magnitude of the anchoring effect with anchor relevance, but failed to find an effect. This illustrates that assimilation to the anchoring effect in judgment is independent of the informational relevance of the anchors. The comparison with random anchor value activates the accessibility of anchor-consistent knowledge and thus biases judgments. In short, irrelevant anchors produce similar effects in judgmental decisions in comparison to those of informational relevance anchors.

The ubiquitous influence of anchoring effect can be due to the extremity of anchors. Some argue that implausible or extreme anchors lead to a larger anchoring effect compared to plausible anchors (possible values for the target category) (Strack and Mussweiler, 1997; Wegener et al., 2010). The anchoring-and-adjustment perspective, argues that people adjust their boundaries of estimations according to the initial values presented. This leads to the prediction that increases in anchor extremity should bring about larger anchoring effects under conditions where the given anchor value is always more extreme than the boundary value for

the range of plausible answers (Strack and Mussweiler, 1997). On the other hand, under the selective accessibility model, extreme answers would be provided as targets consistent with the anchor becoming activated. Mussweiler and Strack (1999) and Strack and Mussweiler (1997) provided support for the view that extreme anchors lead to larger anchoring effects.

However, Mussweiler and Strack (2001a) demonstrated that differences between high and low anchors occurred only with anchor values within the range of plausible answers but not for the implausible or extreme ones. Furthermore, a study by Wegener et al. (2001) found curvilinear effects of extremity for anchoring, which demonstrated that extreme anchors generated smaller anchoring effects than moderate anchors. These results illustrated that increases in anchor extremity, beyond the range of plausible values, do not increase the anchoring effect. These contradictory results could be explained in terms of the adjustment mechanism, where people adjust their estimates until they reach a boundary for the range of plausible answers regardless of the extremity of anchors (Wegener et al., 2001, 2010). The insufficient adjustment mechanism then resembles the selective accessibility model, where judges adopt a modified version hypothesis testing when implausible or extreme anchors are encountered. Judges test the correct estimate which is adjusted to the boundary of the range of plausible values instead of to the anchor value itself and thus increase the accessibility of knowledge that is consistent with the assumption (Mussweiler and Strack, 1999, 2001a). Although there is a different view regarding the underlying processes of anchoring effect between the two proposed mechanisms, they share the same idea regarding anchor extremity. *The two mechanisms propose that anchor extremity beyond the range of plausible answers do not increase the anchoring effect.*

Wegener et al. (2001) proposed a new perspective on anchoring based on the processes of attitude change. Wegener et al. (2001) found a curvilinear effect for the extremity of anchors. The adjustment mechanism and the selective accessibility model account for the increasing anchoring effect with increasing anchor extremity within the range of plausible answers. However, the attitudinal approach explains the findings beyond the range of plausible anchors. It argues that when values are too extreme, people generate counterarguments to question its validity or ignore the values completely, therefore leading to less attitude change (Wegener et al., 2001). In conjunction with the extremity of anchors, the attitudinal approach implies that implausible or extreme anchors may lead to smaller anchoring effect being generated. Wegener et al.'s (2001) findings suggested that perceptions of plausibility mediate the moderating effects of extremity, which supports the attitude change perspective in anchoring. The adoption of the attitude change perspective in order to explain extremity in anchoring demonstrates part of the attitudinal processes involved in anchoring. This opens up a new area of research which aims to explain the robust influence of the anchoring effect since no single mechanism can fully account for this phenomena. Mixed results have been found demonstrating the effect of extremity and plausibility on anchoring effect. Nonetheless, it is clear that the anchoring effect can be demonstrated in various judgment and decision tasks and both plausible and implausible anchors yield an effect.

#### 4. Mood of participants

After considering the possible factors related to anchor values, researchers in the field have turned to potential human components, which may contribute to the susceptibility to the anchoring effect (Table 3). Drawing from the perspective of attitude change, anchors serve multiple "roles". They can be a simple cue directly influencing decisions, engage in effortful process-



**Table 3**  
Human factors considered in anchoring literature.

Human factors	Research	Findings
Mood	Bodenhausen et al. (2000), English and Soder (2009)	Significant results of affective factor on anchoring effects Participants in sad mood are more susceptible to the heuristic bias of anchoring in comparison to their counterparts in neutral or happy mood
Knowledge/experience/expertise	Wilson et al. (1996) English and Mussweiler (2001), English and Soder (2009), English et al. (2005, 2006), Mussweiler et al. (2000, Study 1), Northcraft and Neale, 1987	Knowledgeable people are less influenced by anchors presented Significant results of anchoring effect on individuals with knowledge and experience in the tasks
Motivation/incentives for accuracy/forewarnings	Epley and Gilovich (2005)  LeBoeuf and Shafir (2009)	Forewarning is effective to diminish the effects of anchoring, only with self-generated anchors Forewarnings about accuracy raised non-significant result to eliminate the anchoring effect. However, specific warning about insufficient adjustment reduced anchoring effect
Personality	Tversky and Kahneman (1974), Wilson et al. (1996) Eroglu and Croxton (2010)  McElroy and Dowd (2007)	Anchoring effects are not eliminated even with incentives and forewarnings Participants with high conscientiousness and agreeableness and low extraversion are more susceptible to the anchoring effects High openness to experience individuals is more influenced by the anchoring effect
Cognitive ability	Bergman et al. (2010) Oechssler et al. (2009)	Anchoring effect decreases with higher cognitive ability No significant results of cognitive ability on the anchoring effect

ing, be similar to selective accessibility mechanism or to the bias judgment (Blankenship et al., 2008; Wegener et al., 2010). The attitudinal approach incorporates both thoughtful and non-thoughtful processes in accounting for the anchoring effect. Following this approach, it is suggested that susceptibility to anchoring effect is influenced by affective factors. Emotions are usually used explicitly as information in judgment situations, or they can indirectly influence decision making by changing how people process information (English and Soder, 2009). Several studies have demonstrated that individuals in happy moods often process information relying on the use of superficial or heuristic strategies, whereas information is processed more efficiently when judges are in a sad mood (Schwarz, 1990, 1998, as cited in English and Soder, 2009). However, an exception to this rule is judgmental anchoring. Bodenhausen et al. (2000) and English and Soder (2009) found that participants in a sad mood were more susceptible to the heuristic bias of anchoring in comparison to their counterparts in a neutral or happy mood. From the attitude change perspective, sad mood causes people to engage in more effortful processing, where people interpret information through elaboration on their existing knowledge and determine the claim to be acceptable or unacceptable (Blankenship et al., 2008). The conception of elaboration in contemporary theories of attitude change is very similar to the mechanism of confirmatory hypothesis testing in anchoring (Wegener et al., 2010). Following the trend of argument proposed by the selective accessibility mechanism, sad mood induces judges to engage in more thorough information processing (English and Soder, 2009) and hence activate the confirmatory search for anchor consistent information. This suggests that a happy mood may lead to judgment that is uninfluenced by the robust influence of anchoring. Further work need to be undertaken to understand mood effects however.

## 5. Knowledge of participants

The effect of mood on magnitude of anchoring, however, does not influence all individuals at the same level. Research by English and Soder (2009) demonstrated that emotions only have an effect on the magnitude of anchoring with non-experts. They found that experts are vulnerable to the anchoring effect regardless of their moods. One could argue that judges with high expertise should have greater knowledge, more experience and less uncertainty in making relevant decisions, thus less is assimilated from the

provided anchors. This is supported by Chapman and Johnson (1994), who illustrated that a smaller anchoring effect was generated by those with a high certainty about an answer. Wilson et al. (1996) discovered that knowledgeable people are less influenced by anchors presented. However, previous studies in the field have provided empirical evidence demonstrating that decisions by expert participants in the judgmental domains also show an anchoring effect. For instance, car experts (car mechanics and car dealers) with all the necessary information evaluated the value of a car based on the anchors provided (Mussweiler et al., 2000), estate agents made pricing estimations biased toward the anchor values (Northcraft and Neale, 1987) and experienced legal professionals, who have higher certainty ratings than non-experts, were significantly influenced by irrelevant anchors on their sentencing decisions (English and Mussweiler, 2001; English et al., 2005, 2006). *These results imply that expertise does not significantly reduce the assimilative bias in decisions that affect inexperienced laypeople.* An explanation for these findings may be drawn from the high-elaboration anchoring process, where judges elaborate and compare the reference with their existing knowledge and engage in more thorough information processing, hence activate the accessibility of anchor-consistent information and bias judgments. Furthermore, the findings of higher certainty ratings by the experts also indicated that they may mistakenly see themselves as less susceptible to the anchoring effect. This supports Tversky and Kahneman's (1974) assertion that "the subjects state overly narrow confidence intervals which reflect more certainty than is justified by their knowledge about the assessed quantities" (p. 1129). Confidence and certainty about their expertise could lead the participants to make insufficient adjustment for the estimates and result in assimilation toward the anchors.

## 6. Rewards for accuracy/motivation

Following the attitude change perspective proposed by Wegener et al. (2001, 2010), the elaboration-based approach has been widely adopted to explain the robust and pervasive influence of anchoring. Low-elaboration anchoring results from non-thoughtful processes, where the motivation and the ability to make the correct judgment is lacking, and therefore, the anchors are treated as a "hint" to a reasonable answer (Schwarz, 1994, as cited in Wegener et al., 2010) without considering the relevance

and plausibility of the anchors. Hence, it is indicated that a motivation for accuracy may have an effect on the magnitude of anchoring effect. However, Tversky and Kahneman (1974) offered payoffs for accuracy to motivate participants in order to reduce the anchoring effect, but to no effect. Moreover, findings by Wilson et al. (1996) demonstrate that anchoring effects are not eliminated with incentives and forewarnings. However, some studies have found the effectiveness of forewarning in diminishing the effects of anchoring when warnings about insufficient adjustment (LeBoeuf and Shafir, 2009) and self-generated anchors are given (Epley and Gilovich, 2005). These findings suggest that motivation or warning may not help avoid the influence of anchoring. This could be explained as a result of high-elaborative anchoring, where motivation and thorough thinking engage the judges in more effortful information processing with existing knowledge and hence activate the anchor-consistent information that bias judgments. Findings have demonstrated that both thoughtful and non-thoughtful processes with low or high level of motivation are susceptible to the robust influence of anchoring effect even when people are explicitly trying to avoid them.

## 7. Individual differences

Individual differences are the different responses generated by an individual toward specific events or circumstances in a way that is different from other people on a regular basis (Brandstätter, 1993). Personality is one of the individual difference variables that affects one's performance and more specifically, the cognitive processing in judgmental decisions. There is limited research on the relationship between personality and the anchoring effect. Previous research has focused on groups of subjects but neglected individual differences variables because people tend to look for a universal rule that would predict reactions or behaviour. Most of the research in the field related to personality has focused on the most widely tested and well-regarded Big-Five personality traits, namely extraversion, neuroticism, conscientiousness, agreeableness and openness (e.g. Eroglu and Croxton, 2010; McElroy and Dowd, 2007).

Based on the cognitive-experiential self-theory (Epstein, 1994), it is assumed that information processing operates in two parallel systems. One is rational, analytic, conscious and rule-based; the experiential system. On the other hand, is more intuitive, emotional and outcome oriented. Study 1 by Shiloh et al. (2002) supports Epstein's (1994) view that normative-statistical responses are related to rational thinking style; while experiential-intuitive system is subjected to heuristic processing.

Literature reviews that investigated the effect of personality traits on anchoring, demonstrated that participants with high conscientiousness and agreeableness and low extraversion (Eroglu and Croxton, 2010), as well as with high openness to experience (McElroy and Dowd, 2007) are more susceptible to the anchoring effect. These results could be explained by the selective accessibility mechanism (Mussweiler and Strack, 1999) and the attitudinal approach (Wegener et al., 2001) to the anchoring effect. Individuals with high conscientiousness engage in more thorough thought processes before judgments are made, those with high agreeableness take the provided anchors seriously, high openness to experience influence individuals who are more sensitive to anchor cues. These attitudes lead to the activation of confirmatory search and selective accessibility mechanisms of anchoring. Furthermore, research on the relationship between participants' moods and the anchoring effect have demonstrated that sad mood leads participants to engage in more effortful information processing which is more prone to anchoring effect (Bodenhausen et al., 2000). Therefore one could argue that individuals with low extraversion may be more susceptible to the anchoring effect. However, there is insufficient

empirical evidence to conclude about the effect of personality on anchoring, therefore, further studies are needed to investigate the relationship between these variables.

Drawing from the theory of cognitive function emphasized by the dual-process model (Kahneman, 2003; Stanovich and West, 2000), heuristics are characterized as the result of System 1, which is automatic, fast, effortless and often emotionally charged, and therefore, difficult to control or modify. According to the dual-process model, anchoring incorporates the descriptions above and the main function of this mechanism serves as a universal influence biasing judgments of individuals. However, it is undeniable that anchoring does not affect each individual at the same level. This is where System 2 comes into play. System 2, is a slower, serial, effortful and more likely to be consciously controlled mechanism (Kahneman, 2003; Stanovich and West, 2000). The operation of System 1 could sometimes be overridden by System 2 and results in individual differences in the anchoring effect (Stanovich and West, 2008). This then raises the issue of the factors that affect System 2 which override System 1, which may in turn provide greater insight into the anchoring effect. Individuals are subjected to psychological constraints such as the resource-limited nature of the human cognitive apparatus, which leads to computational limitations and further behavioural biases in judgmental decisions.

One of the factors that can be investigated is cognitive ability or more specifically, analytic intelligence. It was predicted by Stanovich and West (2008) that there should be a negative relationship between cognitive ability and biased responding. This prediction is parallel to the findings of Bergman et al. (2010), which investigated the relationship between cognitive ability and anchoring effect in economic decisions. They found that anchoring decreases with higher cognitive ability. However, anchor values are still sizeable and yield a significant effect in the high cognitive ability group. On the other hand, results by Oechssler et al. (2009) again illustrated the ubiquitous influence of anchoring, where cognitive ability serves as a moderator to biases in decision making, such as conjunction fallacy and conservatism in probability updating, but it does not play a role in the anchoring effect. More reflective decision making does not seem to diminish the effect of anchoring. This lends support to Stanovich and West (2008). Although results from Oechssler et al. (2009) were not significant, the participants with higher cognitive reflective scores did seem to be more susceptible to anchoring. Oechssler et al. (2009) argued that participants with higher cognitive abilities – might be more likely to understand the psychology of the questionnaire and hence estimate their answers based on the provided anchor, however, this needs further investigation. Methodologically, the cognitive reflection test (CRT) developed by Frederick (2005) which differentiates between impulsive and more reflective decision making, and has high correlation with cognitive ability (Spearman correlation = 0.637) was used to examine the relationship between cognitive ability and anchoring effect (e.g. Bergman et al., 2010; Oechssler et al., 2009). However, it has been criticized by Bergman et al. (2010) as a bad predictor for anchoring due to the limited dimensions of cognitive skills covered. It may, therefore, be suggested that anchoring effect involves not only the difference between impulsive and reflective judgments but also more general cognitive skills in reasoning and information processing. Nonetheless, there are mixed results found on the influence of cognitive abilities and anchoring effect. It seems that researchers have failed to identify any cognitive or trait variables that have a systematic and explicable effect on anchored decisions.

## 8. Information processing styles

The attitudes and persuasion perspective on anchoring proposed by Wegener et al. (2001) have suggested that both effortful

and non-effortful information processing can lead to the assimilation of answers toward anchor cues. This proposes that the influence of the anchoring effect could be due to the thinking styles adopted by judges in decision making. Low-elaboration anchoring results especially during non-thoughtful processes, where the motivation and the ability to make the correct judgment is lacking, and thus judges treat the anchors as a “hint” to a reasonable answer (Schwarz, 1994, as cited in Wegener et al., 2010). On the other hand, high-elaborative anchoring, where motivation and thorough thinking engages judges in more elaborate information processing with existing knowledge, and activation of the anchor-consistent information that bias judgments (Wegener et al., 2010). This is empirically supported by Blankenship et al. (2008), who demonstrated that participants engaged in deeper thinking and elaborated more on background knowledge to generate answers when their cognitive load was low (leading to high ability to think). Blankenship et al. (2008) further discovered that an individual’s information processing ability has different consequences on the lasting impact of anchoring. These findings suggest that anchor values have a more durable influence and more resistant to future change when initial anchored judgments are made under low level of cognitive load, where an elaborate information processing was operating. In short, different levels of information processing across conditions generate different consequences of the anchors. This outcome may be manipulated and may affect the applications of anchoring effect in judgmental decisions.

## 9. Applications

Research in the field demonstrates that anchoring is a pervasive and robust effect in human decisions regardless of factors such as types of anchors, relevance of anchor cues, expertise, motivation and cognitive load. Therefore, can anchoring effects be reduced or prevented? Based on the selective accessibility model, Mussweiler et al. (2000) argued that consider-the-opposite strategy could mitigate the magnitude of the anchoring effect. The consider-the-opposite strategy requires judges to provide an anchor-inconsistent argument that may increase the accessibility of anchor-inconsistent knowledge leading the final judgment to be unbiased. It sounds logical and practical, however, studies have found that the effects of anchor-inconsistent argument on debiasing the effect of anchoring to be ineffective (Mussweiler et al., 2000). In addition, studies have demonstrated that judgmental anchoring has indeed durable effects, lasting up to one-week (Blankenship et al., 2008; Mussweiler, 2003). These findings suggest that the influence of anchoring is exceptionally robust, pervasive and ubiquitous.

In their popular book on behavioural economics Belsky and Gollwitzer (1999) warn people that they may be prone to confirmation biases and anchoring if they make spending and investment decisions without research. They are especially loyal to certain brands/investments for the wrong reasons; they find it hard to see investments for less than they paid for them and they rely on the sellers price rather than assessing the value themselves. They advise people to avoid the pitfall of anchoring by broadening their board of advisors; doing more thorough research before making economic decisions; look at trends, be realistic and take the longer view; and show a little more humility when it comes to one’s own judgement.

Recently, the practical applications of anchoring received great attention in the business world. For example, in the negotiation process, an initial offer may serve as an anchor to assimilate final judgment toward it (Galinsky and Mussweiler, 2001). Based on the durability of the anchoring effects, the initial offer would substantially influence the negotiation outcomes over time. Nevertheless, Galinsky and Mussweiler (2001) discovered a few tips that could eliminate the robust influence of the anchoring effects.

They discovered that considering the opponent’s best alternative to a negotiated agreement (BATNA), which is the lower boundary value for an agreement that should not settle, the opponent’s reservation price or the own target can eliminate the influence of the first offer. These are only beneficial if the negotiator was aware of the influence of anchor values and, therefore, likely to compensate for the assumed effect. However, negotiators may be subliminally affected by an anchor value and assimilate their judgments toward the initial reference. Furthermore, pricing policy, or more specifically reference pricing, has been adopted by retailers as a marketing practice to affect consumer’s purchase decisions based on the concept of anchoring. Reference prices are the anchor values presented for consumers to judge the offers.

A meta-analysis conducted by Biswas et al. (1993) on 12 out of 26 relevant studies found significant effects of reference pricing on consumer’s value estimations in most of the studies. Moreover, research by Wolk and Spann (2008) investigating the mechanism of online auction, a popular manner of purchasing among consumers, indicated that reference pricing affects consumers’ bid values and purchase intentions. These demonstrate the robust influence of anchoring in practical decision situations, which affects the benefits and rights of an individual. Therefore, further research is needed to investigate the factors that may reduce the susceptibility towards an initial value in order to protect decision makers from exploitations of the pervasive psychological trick in decision making-anchoring.

Clearly sales individuals and organisations have an understanding of the anchoring effect which plays a role in pricing and negotiations. Both, no doubt, experiment with using anchors to encourage others to make decisions though little work has been done to uncover their “lay theories” or data on the subject which may inform academic research and practice.

## 10. Conclusion

There is now nearly 40 years worth of research on the anchoring effect which has proved to be extremely robust. It can be demonstrated over a wide array of decisional tasks, with different groups and in different settings. It is unusual in experimental settings *not* to be able to demonstrate it. There exist different, but not contradictory models, to account for the process. Anyone working in the area become aware of the fact that there exist considerable individual differences in the extent to which individual judgements are effected by anchors. Thus an interest in affective, background, motivational and trait correlates of anchoring decisions. The work in this area, particularly cognitive ability (intelligence), personality trait and mood, has yield contradictory and equivocal findings.

The literature on the effects of specialist knowledge and experience is more consistent and in line with common-sensical beliefs. However the work investigating the effects of motivation (i.e. incentives) and forewarnings remains inconsistent. This suggests that individual differences and situational factors play only a small role on anchored judgements. Future work may take a more social approach by considering how anchoring effects work on group (vs. individual) decisions. More importantly given the obviously widespread knowledge of the anchoring effect by sales and marketing people and organisations as well as those in negotiations it would benefit academic research by examining “real-world data” as well as the personal theories of those whose livelihoods depend in part on the anchoring effect.

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