

The Relationship Between Cognitive Bias and Logical Fallacies in Egyptian Society

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Abstract: Individuals are exposed on a daily basis to a vast amount of contradictory and misleading information. This puts them in a position where they must distinguish between accurate information and falsehoods, claims, and fallacies that have no basis in truth, in order to make appropriate decisions. *Purpose:* The current study aims to uncover common logical fallacies in Egyptian society and examine the relationship between cognitive bias and logical fallacies. In addition to investigating the role of the interaction between some demographic variables (sex, age and level of education) and cognitive bias in determining the type of logical fallacies. *Methodology:* The participants comprised 234 participants in Egyptian society aged between 15-60 years ($M=27.18$, $s.d=8.48$) years. The participants completed Cognitive Bias Scale and Informal Logical fallacies Questionnaire. *Results:* The results indicate that the most common logical fallacies in Egyptian society are manipulating through distraction (58%) and Manipulating through emotions (56%), the current study also indicates that There is a positive relationship between cognitive bias and logical fallacies and there are not differences between males and females in logical fallacies. Additionally, adolescents exhibit more logical fallacies compared to adults and elderly individuals. Furthermore, individuals with lower levels of education tend to have more logical fallacies compared to those with higher levels of education. Finally, the results indicate that an interaction effect between age and anchoring bias in determining the type and level of logical fallacies, as adolescents high in anchoring bias recognized their inductive fallacy.

Keywords: Cognitive Bias, Logical Fallacies, Demographic Variables, Egyptian Society

1. Introduction

We are exposed daily to a considerable amount of misconceptions without even realizing it. This happens through browsing social media sites, watching talk shows on television, listening to the radio, and even while reading daily newspapers. Sometimes, we also encounter such misconceptions when searching for information in books or educational websites. Consequently, our minds carry a significant number of erroneous ideas. Often, we tend to accept these ideas without valid reasons, mainly because those presenting them try to convince us using seemingly logical and persuasive arguments. However, in reality, these arguments are fallacious, and most philosophers and logicians have referred to them as 'logical fallacies.' These fallacies have a negative impact on our behaviour, true perception of things and crucial decision-making processes [1, 14, 25]. Over the course of centuries, researchers have

been driven to uncover the nature, types, and construction of these fallacious arguments based on logical principles. They found that these fallacies are the result of individuals' failure to employ correct reasoning rules. This failure becomes apparent when they present logically incorrect premises and subsequently draw erroneous conclusions, leading to serious consequences on the individual and societal levels [1, 14, 25].

At the individual level, logical fallacies have a detrimental impact on social interactions for several reasons. One significant consequence is the development of weak social relationships, especially when individuals resort to logical fallacies in their arguments and reasoning. This can lead to a skewed understanding of others' opinions and a decrease in trust between the individual and others. Consequently, misinterpretations, heightened conflicts, and disputes may arise, ultimately impeding the ability to establish meaningful and constructive social connections. Furthermore, the danger

of using logical fallacies at the societal level becomes evident through the dissemination and promotion of misleading ideas, particularly in the media. This can result in an increase in intellectual extremism, and even terrorism. Additionally, the use of such fallacies may further perpetuate superstitious beliefs that lack a foundation in sound logical thinking. Unfortunately, this phenomenon is noticeable and widespread in Egyptian society [21].

Despite the importance of studying logical fallacies due to their potential dangers at both individual and societal levels, it is noteworthy that philosophers and logicians have primarily focused on examining how these fallacious arguments are constructed in terms of form and content, using the rules of logical reasoning. However, they have not delved into answering several crucial questions, such as: "What are the psychological factors that contribute to the formation of logical fallacies? What motivates individuals to employ them or be persuaded by their content? And what are the methods to confront and minimize their negative effects?" Consequently, some psychologists, starting from the second half of the twentieth century, have taken the initiative to address one of these questions, while leaving others unexplored, by conducting further empirical studies. They have placed particular emphasis on identifying the various types of logical fallacies presented in information during discussions and debates. Additionally, they have sought to determine effective strategies to counteract these fallacies, aiming to help individuals make sound and

effective decisions in their daily lives. Among these essential strategies is the cultivation of critical thinking skills, understanding the criteria for proper argumentation, and training individuals to apply these skills [23, 24, 25].

Therefore, the current study aims to uncover some of the factors that contribute to the formation of logical fallacies, as an attempt to answer the previously mentioned important question that has not been fully addressed by philosophical and psychological studies. The current study assumes that cognitive bias plays a significant role in shaping logical fallacies. Cognitive bias refers to the individual's flawed processing of information, accepting it without rational examination, quickly encoding and storing it in memory [16]. This results in erroneous conclusions, which manifest as logical fallacies. In essence, logical fallacies are the product of an individual's cognitive bias towards the information presented to them about a particular issue. In other words, cognitive bias is the mental process, while logical fallacies are the outcome of this process. This bias can arise through the interaction of various factors. Some factors are related to the characteristics of the information presented, such as its quantity, type, clarity, and consistency. Other factors are related to certain demographic variables, which can play a crucial role in determining the level and type of cognitive bias, such as sex, age, education level, and more. Consequently, these factors contribute to the formation of illogical mental conclusions, leading to the adoption of erroneous and irrational decisions.

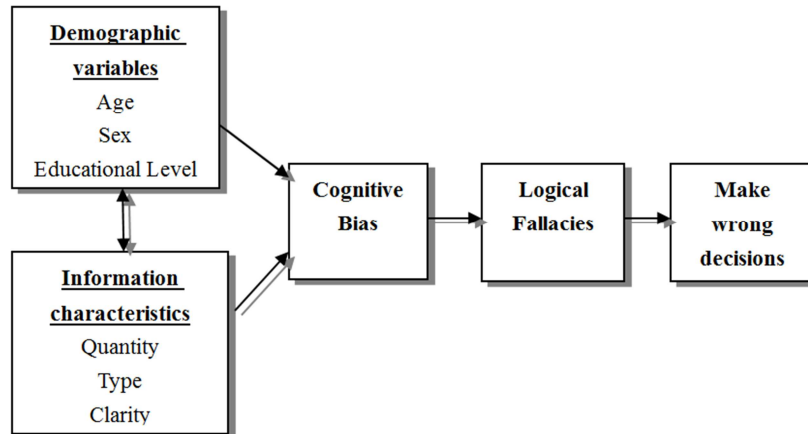


Figure 1. Shows the nature of the relationship between cognitive bias and logical fallacies.

The theoretical perspective presented aligns with the findings of some researchers [19], who assert that cognitive bias occurs when individuals are presented with abundant and complex information that is interconnected, unclear in meaning, and conflicting about a particular issue. This creates a state of tension, especially when the individual is in a decision-making situation concerning the presented matter. To alleviate this tension, "Leon Festinger" proposed the Cognitive Dissonance Theory [10], suggesting that individuals tend to bias towards information that supports or aligns with their existing beliefs, regardless of the accuracy or usefulness of other information in guiding their decisions.

Based on the biased processing of this information, individuals may reach erroneous and illogical conclusions, resulting in logical fallacies and ultimately leading to irrational decision-making. In the same context, "Victor Frohm" explained through his theory called the Expectancy Theory [27], that when individuals have multiple perspectives on a particular issue, they tend to bias towards the viewpoint that promises favourable outcomes or expected benefits upon adoption. Subsequently, they arrive at fallacious reasoning, leading to biased and illogical decision-making. These insights shed light on the crucial role cognitive biases play in the formation of logical fallacies and

the subsequent impact on decision-making processes, emphasizing the need to address and overcome these biases to make sound and rational judgments.

Regarding the role of demographic variables in the occurrence of cognitive biases, some researchers have assumed that all individuals have some level of cognitive bias, regardless of their age, sex, educational level. Cognitive bias is not limited to a specific age group, education, or sex; however, the prevalent type of cognitive bias may vary based on these demographic variables. For example, younger individuals may exhibit what is known as "anchoring bias," where they tend to rely heavily on pre-established plans set by older individuals. On the other hand, in later stages of life, the prevalence of "availability bias" and "confirmation bias" may increase. This is because older individuals may seek to confirm the validity of their perspectives, knowledge, and previous experiences [8, 11].

2. Literature Review

2.1. Cognitive Bias

Most of the researchers interested in studying the concept of cognitive bias [2, 5, 6, 26, 27] have unanimously adopted the definition presented by Amos Tversky and Daniel Kahneman [28]. These two pioneering researchers were the first to delve into the study of cognitive bias in the 1970s. According to their definition, cognitive bias is a mental process that leads to errors in processing information due to memory inaccuracies and faulty practices of mental inference. It involves an absolute acceptance of illogical information and ideas, processing them hastily, reducing them, and failing to examine them meticulously. As a consequence, this process distorts the perception of information. Individuals who exhibit cognitive bias tend to believe that the information stored in their cognitive structure is true, while considering any information that contradicts their existing beliefs as incorrect. As a result, they become prejudiced towards their preconceived notions, failing to consider appropriate adjustments when faced with new evidence that contradicts their views. This, in turn, leads to making erroneous and irrational decisions.

According to this definition, most researchers agree that cognitive bias is a natural mental process that occurs in everyone automatically, often without their awareness of its presence or its impact. Many individuals may exhibit bias towards a specific issue without prior notice, and this becomes evident when they face certain criticisms during discussions. The brain instinctively employs defensive mechanisms to respond to the criticisms directed at them. As a result, they tend to process information superficially, storing it inaccurately in memory, and relying on mental shortcuts that have formed due to simplifying information without thorough examination and verification of its accuracy. Furthermore, they cling to these mental shortcuts and show a preference towards them [3, 2, 5].

From here, researchers became interested in studying the

reasons behind the occurrence of cognitive bias. They found that it can be divided into three major factors: cognitive factors, affective factors, and socio-contextual factors [6, 9, 17, 19, 26].

1) Cognitive factors

Due to the limited capacity of memory for encoding and storing information, the amount of information presented may be too much to handle. Sometimes, the information provided can be vague and conflicting, leading to the following occurrences: Representation (Individuals make their future decisions based on preconceived expectations of situations or events, which are formed through existing stereotypical templates they possess. Consequently, a phenomenon known as confirmation bias arises, where individuals selectively observe information and seek out evidence that confirms their expectations while disregarding contradictory evidence), Availability (When an individual imagines what will happen in the near future, they tend to recall past situations and events that are similar to what they expect to occur, and then make decisions based on these expectations. As a result, the availability bias arises, wherein the individual prefers information that is easily recalled over new and useful information. This can lead to making decisions that are suboptimal), Anchoring (The reliance on initial information and impressions (as reference points) when making decisions, and the failure to adapt to new information despite its availability, gives rise to the anchoring bias).

2) Affective factors

It has been found that emotions and affective preferences play a pivotal role in decision-making and judgment. Individuals may make irrational decisions based on their emotions and feelings.

3) Socio-Contextual factors

The individual tends to make decisions that do not cause others to dislike them, and they feel a sense of consistency by conforming to the opinions and beliefs of others, thus aligning their decisions with theirs. Additionally, when the individual lacks life experience, they seek assistance from others in shaping his decisions.

2.2. Logical Fallacies

2.2.1. Historical Overview of the Concept of Logical Fallacies

The concept of logical fallacy dates back to ancient times (before the Common Era), where the word "fallacy" was used as a translation for the Latin word "fallax," meaning deceit. Greek philosophers like Aristotle, Socrates, and Plato began studying logical fallacies as "arguments that appear to be true, acceptable, and persuasive, making them seem as if they are verified facts, despite being logically flawed." These fallacies stem from errors in reasoning or inferences about the subjects being discussed. These errors may manifest when an individual introduces irrelevant ideas to the topic at hand or presents logically incorrect premises, leading to faulty conclusions based on these premises. For example, someone might argue, "People eat a lot of ice cream in the summer,

and crime rates increase in the summer, so ice cream must cause criminal behaviour." This is a fallacy because there is no causal relationship between ice cream sales and crime rates; rather, both are influenced by the hot weather. People consume ice cream in the summer to cool down, but the heat also increases tension and anger, leading to higher crime rates [1].

Sometimes, fallacies may be deliberately employed by individuals when arguing with others on various topics as a way to unethically convince them of their viewpoint and manipulate their minds. Additionally, the use of these fallacies can occur automatically, where the individual is unaware of committing such errors during their dialogue with others. Furthermore, they may be unable to recognize these fallacies in the conversations they have with others, and they may mistakenly believe these fallacious arguments to be valid. In reality, these arguments are logically incorrect [14].

Logical fallacies are sometimes considered unethical techniques used to win an argument or deceive a specific group of people. They represent a departure from the fundamental principles of critical thinking, such as accuracy, consistency, and logic. This can lead individuals to make incorrect decisions. As a result, there has been broader interest in studying logical fallacies in the fields of logic, philosophy of language, and during the Middle Ages. The Andalusian Islamic philosopher Ibn Rushd (Averroes) contributed to the development of the concept of fallacies and their detection in his book "Tahafut al-Tahafut" (The Incoherence of the Incoherence), where he provided an analysis of various types of logical fallacies [25]. In modern times, philosophers and logicians have extensively studied various types of logical fallacies. The book "Introduction to Logic" by the British philosopher John H. E. and Wilfrid Sellars is considered an important reference in the study of logical fallacies. In this book, they provided a famous classification of different logical fallacies and explanations on how to identify and correct them [28].

In the second half of the twentieth century, experimental psychologists began to take an interest in studying logical fallacies as errors in logical thinking. This shift brought about a radical change in the prevailing climate of psychological research at that time, which primarily focused on studying observable behaviour in response to external stimuli without addressing cognitive processes and internal mental activities, as they were considered unobservable and not amenable to objective measurement. This was due to the dominance of the behaviourist school of thought for a long period. Some experimental researchers expressed objections to the behaviourists' exclusion of any cognitive concepts when interpreting behaviour. Consequently, some psychologists agreed on the necessity of studying how logical fallacies impact decision-making, creative thinking, and problem-solving processes [14].

2.2.2. Concepts Overlapping with the Concept of Logical Fallacies

Through a review of researchers' efforts, it has become

evident that each of the logical fallacies and some other concepts, such as lying, error, opinion, claim, belief, and cognitive biases, represents independent constructs, yet they share certain characteristics. Consequently, the current study has focused on addressing several questions, including: What are the distinguishing aspects of these concepts? Is there any correlation between these concepts, and if so, what is the nature of this correlation? This exploration is conducted in the following manner:

1) Logical fallacies, Lying, and Error

The concept of lying differs theoretically from the concept of logical fallacy. Lying is defined as intentionally stating or believing something that contradicts the actual reality, without being supported by valid and factual evidence. For example, claiming to be 34 years old when you are not. On the other hand, a logical fallacy involves using invalid arguments or evidence about an idea or topic. It can be presented intentionally or unintentionally due to errors in reasoning, where a set of premises leads to a certain conclusion. For example, saying, "I am a frequent traveller, and most frequent travellers take the train," and then others assume that you always travel by train. The conclusion seems true on the surface, but it is logically flawed because the second premise indicates that only most, not all, frequent travellers take the train [4].

Indeed, you are correct. The term "logical error" is a broader concept that includes all errors in reasoning or faulty arguments. On the other hand, a "logical error" refers specifically to an error in reasoning that occurs automatically, without intentional deception. So, while all logical fallacies are errors, not all errors are considered logical fallacies. Logical fallacies can be either intentional or unintentional, but logical errors typically occur inadvertently and result in flawed or incorrect conclusions that lack sound logical principles [17].

2) Logical fallacies, Belief and Opinion

Belief differs conceptually from logical fallacy. Belief is defined as a deep-rooted conviction inherited across generations without any evidence, and its holder may not entertain any doubt about it, making its verification difficult (e.g., superstitious beliefs related to magic or envy). On the other hand, an opinion is a personal perspective on a particular matter, often formed based on personal convictions, values, and life experiences. Therefore, an opinion does not necessarily require strong logical support or evidence to prove its validity. The relationship between logical fallacy and opinion lies in the fact that an opinion can be logically fallacious. However, not all opinions are fallacious, and not all logical fallacies are related to opinions. Nonetheless, there can be overlaps between opinions and logical fallacies in certain cases, as individuals might rely on logical fallacies to form their opinions or use logical fallacies to support their personal views. Consequently, opinions can be analysed to detect and correct logical fallacies through logical critical thinking [21].

3) Logical fallacies and Cognitive Distortions

Logical fallacies and cognitive distortions are both forms

of errors in logical thinking, but they differ in their nature and implications. Cognitive distortions refer to a set of illogical beliefs and thoughts that are shaped by personal convictions, values, and negative life experiences. Individuals with cognitive distortions believe these thoughts to be true and realistic, and they are often accompanied by negative emotions that hinder their adaptation to the surrounding world. This can lead to psychological disorders, requiring psychological treatment [7].

On the other hand, logical fallacies do not necessarily involve negative emotions. They can be intentionally used by individuals to win an argument or discussion. Logical fallacies can arise from various sources, including the individual's level of critical thinking, cognitive biases, and personal traits, as well as societal and cultural factors (e.g., prevailing groupthink). Both logical fallacies and cognitive distortions can impact a person's reasoning and decision-making abilities. While cognitive distortions are more related to personal beliefs and emotional well-being, logical fallacies can influence the quality of arguments and the validity of conclusions. Addressing both cognitive

distortions and logical fallacies is essential for promoting critical thinking and rational decision-making [15].

2.2.3. Types of Logical Fallacies

Most researchers in the fields of logic and psychology believe that logical fallacies can be divided into two main types: Formal fallacies and non-formal fallacies [1, 22]. In the current study, the focus will be on non-visual fallacies as they are the most commonly used in everyday life. Non-formal fallacies are defined as errors in reasoning that result from flaws in the content of the argument, starting from the premises and ending with the conclusions. They do not concern themselves with the study of the structure or construction of the argument. Instead, they focus on the validity of the premises and their alignment with reality, the language used and its clarity, or the relationship between the presented information and the derived conclusion [24].

Meyfield (2010) attempted to classify non-formal logical fallacies into four major categories, including Manipulating through language, Manipulating through emotions, Manipulating through distraction, Inductive fallacy [16].

Table 1. Type of Fallacies by Mayfield (2010).

Types of Fallacies	Definition
<i>Manipulating through language</i>	
1. Word ambiguity	1. Uses imprecise or unspecified words
2. Misleading euphemism	2. conceals meaning by coining words that make an unfavorable idea seem positive
3. Prejudicial language	3. employs biased language to convey a particular viewpoint.
<i>Manipulating through emotions</i>	
1. Appeal to fear	1. aims to convince by evoking fear..
2. Appeal to pity	2. tries to influence by eliciting feelings of pity.
3. Appeal to false authority	3. attempts to convince by referencing a false or irrelevant authority.
4. Appeal to bandwagon	4. convince by leveraging the wisdom of the crowd or popular momentum.
5. Appeal to prejudice	5. a. Attacks a person's character on matters that are unrelated to the issue at hand.
a. Personal attack	b. bias others against a person, group, or idea in order to weaken their arguments.
b. Poisoning the well	
<i>Manipulating through distraction</i>	
1. Red herring	1. redirecting attention to different issues
2. Pointing to another wrong	2. asserts that similar actions went unnoticed and unpunished
3. Straw man	3. Attacks a minor point in an argument and then asserting that this undermines the entire argument.
4. Circular reasoning	4. Repeats the same conclusion using different wording or phrasing
<i>Inductive fallacy</i>	
1. Hasty generalization	1. Draws a conclusion based on a sample that is not representative or is insufficient in size or scope.
2. Either-or fallacy	2. claims that there are only two extreme choices when, in reality, there are multiple options or nuances to consider.
3. Inconsistencies and contradictions	3. Uses claims or statements that are contradictory and cannot both be true simultaneously.
4. Loaded questions.	4. Uses a biased question
5. False analogy	5. Ignores vital distinctions in comparing two things.
6. False cause	6. presents an unreasonable assertion of a causal link
7. Slippery slope	7. makes an unjustified claim that one event will trigger a chain reaction.

3. Methodology

3.1. Sample

The study sample consisted of 234 participants of both sex, and it was a non-probability sample drawn using the snowball sampling method. The ages of the study sample ranged from 15 to 60 years, with an average age of (27.18) years and a standard deviation of (8.48) years. Table 2 presents the distribution of sample characteristics.

Table 2. The Distribution of Sample Characteristics.

Variable	Total Number	percentage
Sex		
Male	57	24%
female	177	76%
age		
Adolescents (15-18 years old)	13	6%
Adults (18-40 years old)	202	86%
Aging (41-60 years old)	19	8%
Level of education		
Average or less (high school or less)	13	6%
Above average (graduate and	221	94%

Variable	Total Number	percentage
postgraduate)		
Marital Status		
Single	179	78%
married	55	22%

3.2. Tools

3.2.1. Cognitive Bias Scale (CBS)

In the current study, the researcher reviewed pre-existing measures for assessing cognitive bias, with one of the most important being the scale developed by [12, 13, 20]. Based on that, a new scale was designed to align with the cognitive bias concept adopted in the current study, which is expressed through three fundamental components.

The first component is "Confirmation Bias" which defined as selectively perceiving and gathering evidence that supports one's beliefs while ignoring contradictory evidence. It involves focusing on supportive information, neglecting irrelevant data, and reinforcing personal beliefs even when faced with opposing evidence. It represented by 9 items in the current scale (i.e., I selectively choose information that aligns with my beliefs).

The second component is "Availability Bias" which defined as "the tendency for individuals to rely on information or events that are readily available and vividly recalled in their memory. This information is often the easiest to retrieve, such as common or recent events, and their decisions are based on this readily available information without considering other potentially important, recent, or rare information." This is represented by 7 items (i.e., I tend to favor conventional solutions that are widely recognized for solving my problems).

The third component is "Anchoring Bias" which defined as "individuals setting an initial value and anchoring it when

making decisions. The initial value is then used as a reference point to assess the importance of new information presented to them, regardless of the accuracy or correctness of the initial value." This is represented by 6 items (i.e., I prefer to purchase products where prices are similar among different retailers, without considering the true value of the product).

The all items are evaluated on a 3-point Likert scale (1: Opposed – 2: Neutrel- 3: Agreed). The scores of the items are totalled to obtain an aggregate cognitive bias score. The scale is reported to have good reliability (measured Cronbach's alpha and Split- Half) and construct validity (measured through Exploratory) (Table 3).

3.2.2. Informal Logical Fallacies Questionnaire (ILFQ)

It was prepared by the researcher. is a 80-item self-report questionnaire that comprises four major subscales assessing different facets of informal logical fallacies. Each major subscale contains subcomponents that express it. The four major scales are: Inductive Fallacy (It includes Hasty generalization, Either-or fallacy, False analogy, False cause and Slippery slope; is represented by 35 items); Manipulating Through Emotions (It includes Appeal to fear, Appeal to pity, Appeal to false authority, Appeal to bandwagon and Poisoning the well; This is represented by 23 items); Manipulating Through Distraction (It includes Red herring, Straw man and Circular reasoning; is represented by 15 items); Manipulating Through Language (It includes Word ambiguity and Prejudicial language; This is represented by 7 items). The all items are evaluated on a 3-point Likert scale (1: Opposed – 2: Neutrel- 3: Agreed). The questionnaire is reported to have good reliability (measured Cronbach's alpha and Split- Half) and construct validity (measured through Exploratory) (Table 3).

Table 3. Reliability and validity of tests (CBS, ILFQ).

Variable	Alpha Cronbach Reliability N=234	Split- Half Reliability N=234	Exploratory Factor Analysis N=234	
			KMO	Saturation coefficient by the first factor (N. of Items=22) before rotating
Confirmation Bias	0.725	0.647	0.796	from 0.353 to 0.565
Availability Bias	0.729	0.637		0.300 to 0.687
Anchoring Bias	0.716	0.601		0.300 to 0.692
Total of Cognitive Bias	0.714	0.769		0.429 to 0.675
Inductive Fallacy	0.707	0.753	0.725	0.497 to 0.688
Manipulating Through Emotions	0.690	0.609		0.413 to 0.651
Manipulating Through Distraction	0.709	0.669		0.327 to 0.833
Manipulating Through Language	0.677	0.830		0.300 to 0.531

Table 3 indicates that the reliability coefficient and construct validity of all the measures were acceptable.

3.3. Data Collection

Before completing the measures, the participants were informed that participation was voluntary. Furthermore, they were assured of anonymity and confidentiality with regard to their responses and were not required to write their names on the forms. The application relied on the use of the Internet for

easy access to a large number of participants from different segments, as the tools were designed electronically using Google Form. In designing the electronic survey, it was taken into account that all responses to its items are obligatory and that the participant responds only once. The electronic survey begins by providing a definition of the nature of the research and urging participants to cooperate. The application took a month (September 2023), and answering the scales took approximately 15 minutes.

4. Results

4.1. Descriptive Statistics

Percentages were calculated for identifying the most common informal logical fallacies in Egyptian society. The results are displayed in Tables 4.

Table 4. The Most Common Informal Logical Fallacies in Egyptian society (N=234).

Types of Fallacies	Individuals who have this fallacy		Individuals who haven't this fallacy	
	N	Percentile (%)	N	Percentile (%)
Manipulating through language	99	42.3%	135	57.7%
1. Word ambiguity	71	30.3%	163	69.7%
2. Prejudicial language	108	46.2%	126	53.8%
Manipulating through emotions	131	56%	103	44%
1. Appeal to fear	122	52.1%	112	47.9%
2. Appeal to pity	124	53%	110	47%
3. Appeal to false authority	110	47%	124	53%
4. Appeal to bandwagon	91	38.9%	143	61.1%
5. Poisoning the well	76	32.5%	158	67.5%
Manipulating through distraction	136	58.1%	98	41.9%
1. Red herring	108	46.2%	126	53.8%
2. Straw man	90	38.5%	144	61.5%
3. Circular reasoning	90	38.5%	144	61.5%
Inductive fallacy	115	49.1%	119	50.9%
1. Hasty generalization	122	52.1%	112	47.9%
2. Either-or fallacy	100	42.7%	134	57.3%
3. False analogy	121	51.7%	113	48.3%
4. False cause	96	41%	138	59%
5. Slippery slope	115	49.1%	119	50.9%

An examination of Table 4 reveals the most common logical fallacies among participants were manipulating through distraction as 58.1% of participants have this type of fallacy (This was especially apparent in their falling into the red herring fallacy (46.2%) as one of the manipulating through distraction fallacies), followed by Manipulating through emotions (56%) as one of the manipulating through emotions, This was especially apparent in their falling into the Appeal to pity fallacy (53%) and the least of which are Inductive fallacy (49.1%) and Manipulating through language (42.3%).

4.2. Correlations

Pearson's product moment correlations were performed to reveal the relationships between the variables in the current study. The results are displayed in Table 5.

Table 5. Pearson correlation among Cognitive Bias and Logical Fallacies.

Independent variable	Dependent variable	R
Confirmation Bias	Manipulating Through Language	0.300**
	Manipulating Through Distraction	0.358**
	Manipulating Through Emotions	0.347**
	Inductive Fallacy	0.481**
Availability Bias	Manipulating Through Language	0.322**
	Manipulating Through Distraction	0.329**
	Manipulating Through Emotions	0.328**
	Inductive Fallacy	0.470**
Anchoring Bias	Manipulating Through Language	0.272**
	Manipulating Through Distraction	0.379**
	Manipulating Through Emotions	0.384**
Total of Cognitive Bias	Inductive Fallacy	0.523**
	Manipulating Through Language	0.362**
	Manipulating Through Distraction	0.430**

Independent variable	Dependent variable	R
	Manipulating Through Emotions	0.426**
	Inductive Fallacy	0.593**

** . Correlation is significant at the 0.01 level (2-tailed).

An examination of Table 5 reveals a weak positive and significant relationship between cognitive bias (Whether at the level of the total degree or the sub-components) and types of logical fallacies (Manipulating Through Language, Manipulating Through Distraction, Manipulating Through Emotions and Inductive Fallacy). In addition, it is clear that cognitive bias and its sub-components are most closely related to inductive fallacies, and this was known through the strength of the correlation coefficients between them compared to other types of fallacies.

To try to explain the weakness of the correlation coefficients, although they are significant, the current study tried to find out the role of the interaction between some demographic variables (sex, age and level of education) and cognitive bias in determining the type of logical fallacies by using analysis of variance in a tables 6, 7, 8.

4.3. Variance Analysis (ANOVA)

To further investigate the interaction between some demographic variables (sex: males and females; age: adolescents, adults and aging; level of education: average or less and high average) and cognitive bias and its three components in highlighting differences between groups in logical fallacies, reliance was placed on the use of two-way analysis of variance (see Tables 6, 7 and 8), by dividing cognitive bias and its components into Categorical variables

so that comparisons can be made between groups on logical fallacies, were divided into:

- 1) Calculating the length of the category (the difference between the lowest value and the highest value)

- 2) A Divide the difference by 2 (to designate two categories: high and low cognitive bias and its components)

Table 6. Two-way analysis of variance for differences Between Sex and The Cognitive Bias in Logical Fallacies.

Independent variable	Dependent variable	Type \\\ sum of square	F	df	Sig	Mean square
sex		0.781	0.13	1	0.718	0.781
Confirmation Bias	Manipulating Through Language	59.242	9.894	1	0.002	59.242
Sex * Confirmation Bias		1.079	0.18	1	0.672	1.079
sex		17.388	0.987	1	0.322	17.388
Confirmation Bias	Manipulating Through Distraction	368.263	20.904	1	0	368.263
Sex * Confirmation Bias		5.716	0.324	1	0.57	5.716
sex		6.724	0.177	1	0.674	6.724
Confirmation Bias	Manipulating Through Emotions	829.164	21.863	1	0	829.164
Sex * Confirmation Bias		0.192	0.005	1	0.943	0.192
sex		153.198	2.259	1	0.134	153.198
Confirmation Bias	Inductive Fallacy	2369.357	34.942	1	0	2369.357
Sex * Confirmation Bias		4.574	0.067	1	0.795	4.574
sex		1.397	0.234	1	0.629	1.397
Availability Bias	Manipulating Through Language	66.496	11.127	1	0.001	66.496
Sex * Availability Bias		2.236	0.375	1	0.541	2.236
sex		13.423	0.722	1	0.396	13.423
Availability Bias	Manipulating Through Distraction	155.476	8.366	1	0.004	155.476
Sex * Availability Bias		0.536	0.029	1	0.865	0.536
sex		7.393	0.187	1	0.666	7.393
Availability Bias	Manipulating Through Emotions	479.11	12.137	1	0.001	479.11
Sex * Availability Bias		8.891	0.225	1	0.636	8.891
sex		140.106	1.967	1	0.162	140.106
Availability Bias	Inductive Fallacy	1760.92	24.724	1	0	1760.92
Sex * Availability Bias		1.63	0.023	1	0.88	1.63
sex		2.643	0.452	1	0.502	2.643
Anchoring Bias	Manipulating Through Language	67.345	11.527	1	0.001	67.345
Sex * Anchoring Bias		0.498	0.085	1	0.771	0.498
sex		25.707	1.543	1	0.215	25.707
Anchoring Bias	Manipulating Through Distraction	319.984	19.212	1	0	319.984
Sex * Anchoring Bias		36.675	2.202	1	0.139	36.675
sex		1.227	0.034	1	0.853	1.227
Anchoring Bias	Manipulating Through Emotions	703.732	19.633	1	0	703.732
Sex * Anchoring Bias		115.173	3.213	1	0.074	115.173
sex		55.345	10.855	1	0.356	55.345
Anchoring Bias	Inductive Fallacy	249.228	38.48	1	0	249.228
Sex * Anchoring Bias		13.087	0.0202	1	0.653	13.087
sex		5.402	0.936	1	0.334	5.402
Total of Cognitive Bias	Manipulating Through Language	105.019	18.191	1	0	105.019
Sex * Total of cognitive bias		3.317	0.575	1	0.449	3.317
sex		41.202	2.409	1	0.122	41.202
Total of Cognitive Bias	Manipulating Through Distraction	391.599	22.892	1	0	391.599
Sex * Total of cognitive bias		1.573	0.092	1	0.762	1.573
sex		0.62	10.017	1	0.898	0.62
Total of Cognitive Bias	Manipulating Through Emotions	818.628	21.91	1	0	818.628
Sex * Total of cognitive bias		9.646	0.258	1	0.612	9.646
sex		22.899	0.361	1	0.549	22.899
Total of Cognitive Bias	Inductive Fallacy	315.361	49.673	1	0	315.361
Sex * Total of cognitive bias		3.689	0.058	1	0.81	3.689

The results of a two-way analysis of variance did not reveal an interaction effect between sex and cognitive bias and its subcomponents (confirmation bias, availability bias, and anchoring bias) in determining the type and level of logical fallacies. However, it appeared that there was an

effect of cognitive bias alone in identifying logical fallacies, as individuals high in cognitive bias recognized their logical fallacies (manipulating through language, manipulating through distraction, manipulating through emotions and inductive fallacy).

Table 7. Two-way analysis of variance for differences Between Age and The Cognitive Bias in Logical Fallacies.

Independent variable	Dependent variable	Type \\\ sum of square	F	df	Sig	Mean square
age	Manipulating Through	63.122	5.5	2	0.005	31.591
Confirmation Bias	Language	12.938	2.255	1	0.135	12.938
age * Confirmation Bias		12.439	1.084	2	0.34	6.219
age	Manipulating Through	213.01	6.295	2	0.002	106.505
Confirmation Bias	Distraction	172.643	10.205	1	0.002	172.643
age * Confirmation Bias		21.154	0.625	2	0.536	10.577
age	Manipulating Through	498.063	6.937	2	0.001	249.031
Confirmation Bias	Emotions	294.98	8.216	1	0.005	294.98
age * Confirmation Bias		88.08	1.227	2	0.295	44.04
age		401.442	3.016	2	0.051	200.721
Confirmation Bias	Inductive Fallacy	1318.932	19.815	1	0	1318.932
age * Confirmation Bias		292.847	2.2	2	0.113	146.424
age	Manipulating Through	30.546	2.645	2	0.073	15.273
Availability Bias	Language	17.481	3.027	1	0.083	17.481
age * Availability Bias		16.605	1.438	2	0.24	8.302
age	Manipulating Through	114.811	3.154	2	0.045	57.406
Availability Bias	Distraction	31.545	1.733	1	0.189	31.545
age * Availability Bias		0.749	0.021	2	0.98	0.375
age	Manipulating Through	178.984	2.343	2	0.098	89.492
Availability Bias	Emotions	108.185	2.833	1	0.094	108.185
age * Availability Bias		80.801	1.058	2	0.349	40.401
age		81.974	0.569	2	0.567	40.987
Availability Bias	Inductive Fallacy	525.934	7.302	1	0.007	525.934
age * Availability Bias		0.488	0.003	2	0.997	0.244
age	Manipulating Through	50.752	4.514	2	0.012	25.376
Anchoring Bias	Language	2.047	0.364	1	0.547	2.047
age * Anchoring Bias		19.933	1.773	2	0.172	9.967
age	Manipulating Through	126.51	3.875	2	0.022	63.255
Anchoring Bias	Distraction	308.714	18.912	1	0	308.714
age * Anchoring Bias		35.602	1.09	2	0.338	17.801
age	Manipulating Through	416.917	6.004	2	0.003	208.549
Anchoring Bias	Emotions	261.328	7.527	1	0.007	261.356
age * Anchoring Bias		82.69	1.191	2	0.306	41.345
sex		247.39	2.002	2	0.137	123.695
Anchoring Bias	Inductive Fallacy	1540.934	24.935	1	0	1540.934
age * Anchoring Bias		675.335	5.464	2	0.005	337.668
age	Manipulating Through	59.183	5.332	2	0.005	29.591
Total of Cognitive Bias	Language	9.582	1.727	1	0.19	9.582
age * Total of cognitive bias		14.971	1.349	2	0.262	7.486
age	Manipulating Through	157.801	4.759	2	0.009	78.9
Total of Cognitive Bias	Distraction	280.086	16.894	1	0	280.086
age * Total of cognitive bias		34.354	1.036	2	0.357	17.177
age	Manipulating Through	438.959	6.152	2	0.003	219.479
Total of Cognitive Bias	Emotions	255.016	7.148	1	0.008	280.086
age * Total of cognitive bias		104.016	1.458	2	0.235	52.008
age		273.933	2.196	2	0.114	136.966
Total of Cognitive Bias	Inductive Fallacy	1342.693	21.525	1	0	1342.693
age * Total of cognitive bias		212.273	1.702	2	0.185	106.137

The results of a two-way analysis of variance did reveal an interaction effect between age and anchoring bias in determining the type and level of logical fallacies, as adolescents high in anchoring bias recognized their inductive fallacy. On the other hand, the results of a two-way analysis of variance did not reveal an interaction effect between age and cognitive bias and its subcomponents (confirmation bias, availability bias, and anchoring bias) in determining the type and level of logical fallacies. However, it appeared that there was an effect of age and cognitive bias (each separately) in identifying logical fallacies, It is evident through:

1) The individuals high in Cognitive bias in general, and

confirmation bias in particular recognized their logical fallacies (manipulating through distraction, manipulating through emotions and inductive fallacy)

- 2) The individuals high in availability bias recognized their inductive fallacy
- 3) The individuals high in anchoring bias recognized their logical fallacies (manipulating through distraction, manipulating through emotions)
- 4) The adolescents only recognized their logical fallacies (manipulating through language, manipulating through distraction and manipulating through emotions).

Table 8. Two-way analysis of variance for differences Between Level of Education and The Cognitive Bias in Logical Fallacies.

Independent variable	Dependent variable	Type \\\ sum of square	F	df	Sig	Mean square
Level of education	Manipulating Through	30.437	5.231	1	0.023	30.437
Confirmation Bias	Language	0.328	0.056	1	0.813	0.328
Level of education * Confirmation Bias		12.727	2.187	1	0.141	12.727
Level of education	Manipulating Through	113.274	6.58	1	0.011	113.274
Confirmation Bias	Distraction	63.22	3.673	1	0.057	63.22
Level of education * Confirmation Bias		2.388	0.139	1	0.71	2.388
Level of education	Manipulating Through	168.464	4.569	1	0.034	168.464
Confirmation Bias	Emotions	48.265	1.309	1	0.254	48.265
Level of education * Confirmation Bias		89.17	2.418	1	0.121	89.17
Level of education		180.4	2.68	1	0.103	180.4
Confirmation Bias	Inductive Fallacy	274.687	4.08	1	0.045	274.687
Level of education * Confirmation Bias		113.788	1.69	1	0.195	113.788
Level of education	Manipulating Through	20.915	3.56	1	0.06	20.915
Availability Bias	Language	19.246	3.276	1	0.072	19.246
Level of education * Availability Bias		0.67	0.114	1	0.736	0.67
Level of education	Manipulating Through	85.909	4.725	1	0.031	85.909
Availability Bias	Distraction	70.21	3.861	1	0.051	70.21
Level of education * Availability Bias		6.045	0.332	1	0.565	6.045
Level of education	Manipulating Through	99.843	2.565	1	0.111	99.843
Availability Bias	Emotions	251.337	6.454	1	0.012	251.337
Level of education * Availability Bias		17.644	0.453	1	0.501	17.644
Level of education		81.045	1.138	1	0.287	81.045
Availability Bias	Inductive Fallacy	733.143	10.299	1	0.002	733.143
Level of education * Availability Bias		30.492	0.428	1	0.514	30.492
Level of education	Manipulating Through	29.372	5.149	1	0.024	29.372
Anchoring Bias	Language	4.01	0.703	1	0.403	4.01
Level of education * Anchoring Bias		8.034	1.408	1	0.237	8.034
Level of education	Manipulating Through	98.441	6.045	1	0.015	98.441
Anchoring Bias	Distraction	305.972	18.789	1	0	305.972
Level of education * Anchoring Bias		53.271	3.271	1	0.072	53.271
Level of education	Manipulating Through	153.918	4.317	1	0.039	153.918
Anchoring Bias	Emotions	218.114	6.117	1	0.014	218.114
Level of education * Anchoring Bias		10.273	0.288	1	0.592	10.273
Level of education		173.29	2.71	1	0.101	173.29
Anchoring Bias	Inductive Fallacy	429.912	6.724	1	0.01	429.912
Level of education * Anchoring Bias		88.744	1.388	1	0.24	88.744
Level of education	Manipulating Through	26.354	4.654	1	0.032	26.354
Total of Cognitive Bias	Language	4.567	0.807	1	0.37	4.567
Level of education * Total of cognitive bias		8.812	1.556	1	0.213	8.812
Level of education	Manipulating Through	90.129	5.401	1	0.021	90.129
Total of Cognitive Bias	Distraction	258.609	15.497	1	0	258.609
Level of education * Total of cognitive bias		42.684	2.558	1	0.111	42.684
Level of education	Manipulating Through	134.027	3.641	1	0.058	134.027
Total of Cognitive Bias	Emotions	181.484	4.931	1	0.027	181.484
Level of education * Total of cognitive bias		8.974	0.244	1	0.622	8.974
Level of education		125.294	1.993	1	0.159	125.294
Total of Cognitive Bias	Inductive Fallacy	599.284	9.532	1	0.002	599.284
Level of education * Total of cognitive bias		44.728	0.711	1	0.4	44.728

The results of a two-way analysis of variance did not reveal an interaction effect between level of education and cognitive bias and its subcomponents (confirmation bias, availability bias, and anchoring bias) in determining the type and level of logical fallacies. However, it appeared that there was an effect of level of education and cognitive bias (each separately) in identifying logical fallacies. It is evident through:

- 1) Less educated individuals recognized their logical fallacies (manipulating through language, manipulating through distraction and manipulating through emotions).
- 2) The individuals high in Cognitive bias in general, and three sub-components (confirmation bias, availability

bias, and anchoring bias) in particular recognized their manipulating through emotions and inductive fallacy.

- 3) The individuals high in Cognitive bias in general, and anchoring bias in particular recognized their manipulating through distraction.

5. Discussion

In this study, the most common logical fallacies in Egyptian society are manipulating through distraction and Manipulating through emotions fallacies. This may be due to several reasons, including:

Reasons for the spread of manipulating through distraction fallacies among the study sample: The absence of

a culture of critical thinking and argument skills in some individuals within Egyptian society has been evident for a considerable duration. This can be traced back to the way parents raise their sons. Some parenting methods emphasize submission to parental authority, and any attempt by sons to discuss certain matters with their parents is often perceived as a form of rebellion or defiance. Consequently, some children resort to using various tactics to defend themselves because they feel threatened. They may employ these fallacious arguments to introduce secondary issues into the conversation and discuss them, all in an effort to alleviate tension and safeguard their viewpoints. Parents, either intentionally or inadvertently, may employ these fallacies as a form of emotional manipulation, distorting their son's arguments and focusing on secondary issues that carry emotional weight in the discussion. This approach can trigger emotional responses that make sons more likely to align with their parents' opinions and arguments out of a sense of guilt, inadequacy, or due to feeling threatened and fear of negative evaluation by others. This problem is not limited to interactions between parents and sons, but can also extend to discussions in diverse contexts (for example, TV talk show, discussions between the manager and his employees, etc.). However, institutions such as schools and universities are making efforts to train children by developing curriculum and workshops aimed at promoting critical thinking and appropriate discussion skills.

Reasons for the spread of manipulating through emotions fallacies among the study sample: Social and cultural influences can play an important role in shaping how people express their feelings and engage in arguments. Some cultures may prioritize emotional expression over logical thinking. In addition to some individuals using emotional manipulation methods to achieve certain undeclared goals, in addition, logical fallacies related to emotions can occur when individuals have limited information or knowledge about a particular topic. They may rely on emotional appeals because they lack a strong factual or logical basis for their arguments.

The current study also indicates that there are not differences between males and females in logical fallacies. Additionally, adolescents exhibit more logical fallacies compared to adults and elderly individuals. Furthermore, individuals with lower levels of education tend to have more logical fallacies compared to those with higher levels of education. These results can be explained that Logical fallacies concern how arguments are formulated and constructed, not necessarily who commits them. Whether the person is male or female, it is possible for him to fall into logical fallacies if he does not have sufficient skills in critical thinking and evaluating arguments correctly, which rise across the age as a result of the accumulation of experiences, and their level is determined by the individual's level of education, so adolescents and less educated individuals showed higher levels of high risk of committing fallacies or falling into them [8, 11]. In addition, the current study showed that cognitive bias of its three types plays an

important role in the formation of logical fallacies, and this is consistent with the hypothesis of the current study, which suggests that cognitive bias encompasses the flawed way in which individuals process information. They tend to accept this information without subjecting it to rational scrutiny, promptly encoding and storing it in memory [16]. Consequently, this can lead to the formation of incorrect conclusions, which become evident in the form of logical fallacies.

Finally, the results indicate that an interaction effect between age and anchoring bias in determining the type and level of logical fallacies, as adolescents high in anchoring bias recognized their inductive fallacy. While anchoring bias is not inherently an inductive fallacy, it can contribute to the occurrence of inductive fallacies. Anchoring bias can lead individuals to fixate on an initial piece of information (the anchor) when making judgments or decisions. If this anchor is used as a basis for making inductive generalizations or predictions, it can result in faulty reasoning because the anchor may not be a representative or valid reference point. In other words, when people rely heavily on an anchor and use it as the primary basis for their inductive reasoning, they may commit inductive fallacies by drawing conclusions that are not well-supported by the available evidence. For example, if someone is given an initial price suggestion for a product (an anchor) and then uses that anchor to estimate the value of similar products without considering other relevant information, they may commit a hasty generalization in their inductive reasoning.

6. Conclusion

Due to the scarcity of studies that were concerned with studying the relationship between cognitive bias and logical fallacies, the purpose of this study was to shed light on the nature of logical fallacies and the rate of their spread in Egyptian society, and to know the nature of the relationship between cognitive bias and logical fallacies, in addition to the role of cognitive bias in interaction with some demographic variables (sex, age, level of education) in the occurrence of logical fallacies. The results showed that The findings reveal that the most prevalent logical fallacies in Egyptian society involve manipulation through distraction (58%) and manipulation through emotions (56%). Moreover, the current study suggests that there is a positive relationship between cognitive bias and logical fallacies. also there are no significant differences between males and females in terms of logical fallacies. Additionally, adolescents tend to exhibit a higher frequency of logical fallacies compared to adults and the elderly. Furthermore, individuals with lower levels of education are more prone to displaying a greater number of logical fallacies compared to those with higher levels of education. Lastly, the results highlight an interaction effect between age and anchoring bias in determining the type and severity of logical fallacies, with adolescents with a strong anchoring bias being more likely to recognize their inductive fallacies.

7. Limitations and Future Research

Although the study contributes to the existing literature, it has two limitations. First, the results may not apply to other Egyptian individuals because a non-random sample was used. Second, various factors such as Social cultural level was not taken into account in this study. This factor may have influenced the results. The results also suggest that there may be other variables that interact with cognitive bias that would increase levels of logical fallacies (e.g., Information characteristics: Quantity, type, clarity and consistency). It is recommended to explore this phenomenon in future studies.

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Conflicts of Interest

The authors declare no conflicts of interest.

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