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Strategies for Reducing Inherent Cognitive Biases in Educational Classrooms

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Abstract

While researchers have identified (a) innate cognitive and (b) implicit culturally mediated biases in all human beings and while medical, legal, and science educators have sought to mitigate such biases to increase better outcomes and decrease economic cost, cognitive debiasing reduction (CDR) strategies and research at the elementary, secondary, and tertiary general education levels is still in its infancy. This study is a result of a literature review and inquiry into bias mitigation in educational research, pedagogy, and andragogy. Having made a preliminary search of Psychinfo, PsycArticles, and ERIC, the author found no studies dedicated to examining cognitive biases for those levels of education. The author suggests adopting and adapting a medical, educational CDR for implementation and application.

Introduction

This paper is an exploratory inquiry into cognitive biases experienced by educators and educational researchers and an exploratory inquiry to discover ways to mitigate or compensate for the same. Cognitive biases are genetic, hardwired, pre-programmed, and inherent in every individual. They are, therefore, “transcultural” or “pan-cultural” and of a different type and kind of biases than the more often invoked and studied culturally mediated (or learned) biases like racism, ethnocentrism, SES biases or classism, and sexism. While the latter can be unlearned and individuals can be resocialized, cognitive biases, however, cannot be. Remediation and debiasing strategies for the former must start with the acknowledgement that we are powerless to change our cognitive biases in individuals or in the population. Instead, we must use strategies, structures, and processes to mitigate them when they involve high stakes, high-cost, and high-value situations and decision making. Unfortunately, there have been very few educational research studies on cognitive biases and cognitive debiasing reduction strategies in post-secondary general, secondary, and elementary educational settings. Consequently, most educators at the elementary to general education levels are, therefore, not aware of the differences between (1) cultural and personal biases on the one hand and (2) cognitive and transcultural biases on the other. The presentation of symptoms or the observable results (e.g., red eyes or racial and ethnic disparities) in several cases may appear to be the same when the geneses or origins of the underlying illnesses or problem may be different and require different remediation techniques (sleep and rest, an eye rinse, cessation of the substance being abuse, or physiological eye damage or illness requiring medical or surgical intervention, etc. and CRT for racism and ethnocentrism and CDR strategies for confirmation bias, familiarity bias, in-group bias, and halo bias, etc.). The different geneses of these biases require different remediation techniques and strategies.

This study is an inquiry into “transcultural” biases that are innate in all humans; it is an inquiry into what countermeasures are available for the classroom teacher and educator. These remediation techniques and countermeasures are different from and go beyond those associated with anti-racism, multicultural education, and Culturally Relevant Pedagogy training and approaches that focus primarily on cultural remediation and learning. We will be focusing on innate cognitive biases and the research that is being conducted on Cognitive Debiasing Remediation.

Literature Review and Cognitive Debiasing Reduction (CDR) Strategies

Having made a preliminary search of relevant databases for cognitive biases studies and Cognitive Debiasing Reduction (CDR) strategies in elementary, secondary, and general education in the post-secondary institutions (Psychinfo, PsycArticles, and ERIC), the author discovered no references to elementary, secondary, or tertiary general educational studies on the same. Most of the studies were focused on post-secondary graduate and continuing professional education primarily in the fields of science and psychology (e.g., observer bias), law (e.g., investigator, forensic and expert witness, judicial rulings, and jury biases), and medicine (e.g., in clinical diagnoses, prognoses, treatment, screening, or vaccination). Given the absence of relevant research directed toward CDR application at the elementary, secondary, and general education levels, the author searched for suitable CDR applications at the post-secondary and graduate levels that could be repurposed as a promising model for implementation. These will be discussed below.

Cognitive Biases and Macro Cognitive Biases

For this inquiry, I have borrowed social science terminology to speak of cognitive biases as the interaction of three related, but discernible levels or sources for these innate biases: the micro, meso, and macro levels. (See, for example, Davidheiser (2008).) We will be primarily concerned with the macro level. Each of these levels requires different remediation techniques.

The micro-level refers to cognitive biases that stem from our perceptual and sensual apparatuses (like the limitations of our visual sensory receptors to perceive specific wavelengths or of our sensory receptors for hearing to perceive specific frequencies of soundwaves, i.e., perceptual biases).

The meso level refers to the initial cognitive processing level or stage where sensory inputs are initially interpreted as meaningful visual or aural patterns and where, for example, the visual color cone receptors' stimuli (blue, green, and red) are "translated" at the mid-cortex and visual cortex levels into oppositional pairs (red versus green, and blue versus yellow, i.e., pattern and associational biases apart from and interacting with learned cultural schemas or patterns).

Cognitive Biases	**Implicit and Explicit Social-Cultural Biases**
1. Innate and Genetic	1. Learned
2. General and Universal to Humanity	2. Specific to Individuals and Groups
3. Biologically Grounded and Unchangeable	3. Changeable and Correctable
Three Levels **System One: Think Fast System** **Micro:** Perceptual System Visual Receptors (light wave) and Sensory Receptors (sound wave). **Meso:** Initial Cognitive Processing into Associated Patterns/Schemas. **System Two: Think Slow System** **Macro**: Higher Order Cognitive Processing: e.g., Assimilation and Accommodation.	**Problem** a. Flawed Socialization and Enculturation b. Flawed Individual Overgeneralization from Experience c. Flawed Individual Learning in Input or Processing of Output
4. Requires a Pessimistic and Complex Orientation: a. Knowledge ≠ Change b. Reasonable and Selective Changes only for High Risk and High Economic Situations c. Cognitive Debasing Reduction (CDR) Strategies Are Implemented Only for High Risk and High-Cost Situations d. CDR Strategies Must be Operationalized, Tested for Reliability, and Repeated.	4. Is Optimistic and Simplistic in Orientation: a. Knowledge = Change b. Single or Simple Interdiction or Intervention c. Resocialization, Re-enculturation, or Re-education i. Anti-Racism Training and Classes ii. Anti-Discrimination Training and Classes iv. Anti-Classism Training and Classes iii. HR Compliance Training and Testing d. Expectation of Lasting Changes

Table 1. Cognitive Versus Socially Mediated Biases

The last level, the macro level, refers to the biases that occur unconsciously at the highest, but still automatic, levels of cognition, i.e., the brain's command functions. (See Table 1 above.) Like the meso level, the macro level also interacts with learned cultural schemas or patterns; however, we will focus our inquiry on the transcultural aspects of this highest level that are more a function of cognition in general. It is at the highest level and for these types of cognitive biases that we will seek to discover cognitive and metacognitive mitigation or intervention strategies.[1]

In the language of Tversky and Kahneman (1971), Kahneman (2011), and Thaler and Sunstein (2009), these transcultural biases are the functional equivalents of the biases found in intuitive judgments, the think-fast system, or system 1. The think-fast system or system 1 has both positive and negative aspects as will be discussed below. In positive psychology and mindfulness research, individuals are taught how to employ and regulate their think fast system or system 1 for mindfulness and wellness goals. Individuals are taught how to initiate and employ approaches, exercises, relational behaviors, and techniques that will allow for the release of various neurochemicals used by the brain that are responsible for feelings of joy, happiness, connectiveness, and for calming or comforting oneself. (See e.g., (Csikszentmihalyi, 1974), (Csikszentmihalyi, 2009), (Seligman, Learned Optimism: A leading Expert on Motivation Demonstrates that Optimism Is Essential for a Good and Successful Life and Shows You How to Acquire It., 1990), (Seligman, 2011), (Seligman, 2019), and (Warner & Coursey, 2023).) Nevertheless, the think-fast system or system 1 is also responsible for negative aspects and outcomes as well (i.e., cognitive biases). In this study we will be focusing on the negative aspects, the cognitive biases that are inherent in the think-fast system or system 1.

While we cannot change or erase the cognitive biases in our think-fast system or system 1, we can bypass that system (or bypass its influence and affect) by making use of the think-slow system or system 2. Remediation, mitigation, and CDR strategies must be tailored to make use of and to access the higher control functions of rational judgments, i.e., the think slow system, or system 2, if we are to overcome the biases inherent in the think fast system or system 1.

Korteling et al. have proposed a neural network framework for the brain that "elaborates (partly) on the evolutionary viewpoint [of the origins of cognitive biases] by acknowledging that the functioning of our brain is based on universal mechanisms that helped us as a species to survive," these are the positive aspects. They go on to suggest how System 1 (pattern recognition, associative learning, and the affective "fight or flight" response) and System 2 (analytic and symbolic reasoning) mechanisms developed from this biological neural network. They believe that our brains are "less optimized for... cognitive functions that involve deliberate or analytic thinking... and that have... become essential for 'survival' in relatively modern civilizations" (A Neural Network Framework for Cognitive Bias, 2018, p. 4). Korteling et al. believe that four principal characteristics can account for System 1 and System 2 biases: Association, Compatibility, Retainment, and Focus. "All four principles may affect decision making and may contribute to cognitive biases, but the degree to which they do so may vary over different biases and situations" (pp. 5-10).

We presuppose that, in some situations, System 2 or reflective thinking can be primed in individuals to employ both cognitive and metacognitive strategies proactively. This priming is similar to how modern military personnel and first responders employ skills training and habituation exercises by activating System 2 control functions for overriding System 1's fight and flight mechanism. Kahneman and others caution, however, that we must be limited and judicious in the number and types of biases that we should seek to remediate or prevent.

> *Because System 1 operates automatically and cannot be turned off at will, errors of intuitive thought are often difficult to prevent. Biases cannot always be avoided, because System 2 may have no clue to the error.... Constantly questioning our own thinking would be impossibly tedious, and System 2 is much too slow and inefficient to serve as a substitute for System 1 in making routine decisions. The best we can do is a compromise: learn to recognize situations in which mistakes are likely and try harder to avoid significant mistakes when the stakes are high. The premise of this book is that it is easier to recognize other peoples' mistakes than our own. (Kahneman, Thinking, Fast and Slow, 2011, p. 28).*

Thaler and Sunstein argue that "One reason why adjustment is so often insufficient is that the Reflective System [System 2] is easily waylaid— it requires significant cognitive resources, and thus when resources are scarce (you are distracted or tired, for example) it can't adjust the anchor" (2009, p. 308).

Tversky and Kahneman define cognitive biases as systematic errors of intuition based on cognitive "rules of thumb," which are defined as heuristics or heuristic principles of probability (Tversky & Kahneman, 1974/2011). "The subjective assessment of probability resembles the subjective assessment of physical quantities such as distance or size. These judgments are all based on data of limited validity" and can be circumvented by distraction, inattentiveness, and the subjective feeling of familiarity and ease (p. 419). As such cognitive biases are systematic or universal errors in judgment and decision-making that are common to all human beings (Gunsalus, Burbules, & Wright, 2018; Wile & Mata, 2012).

Tversky and Kahneman described three such biases or heuristics (representativeness, availability of instances or scenarios, and adjustment from an anchor (p. 113/431). They also gave "thirteen reasons" using 20 different examples or illustrations why these three biases were made and incidentally how they could be corrected (a) if distracting considerations were eliminated (such as extraneous descriptions) and (b) if the System 2 thinking was primed and motivated.[2] A fourth heuristic, i.e., framing, was addressed in (Choices, Values, and Frames, 1984/2011).

Thaler and Sunstein describe seven biases: (1) status quo and default settings, (2) anchoring, (3) availability, (4) representativeness, (5) optimism and overconfidence (e.g., gambler effect), (6) loss aversion, and (7) framing (2009).

Unfortunately, because of the structural limitations of this inquiry, we will not be able to differentiate and sort the various lists of biases into various categories based on their cognitive sources, that is, their location on the micro, meso, or macro levels of cognition and the culturally mediated categories of implicit biases like racism,

ethnocentrism, and sexism, etc.[3] We will be looking at only a few of the cognitive biases that are related to the macro level; we will also be looking at various types of distractions that increase conditions of inattentiveness by System 2 cognitive and metacognitive processes, as will be explained below.

Cognitive bias	*Short description*
Confirmation bias	The tendency to selectively search for or interpret information in a way that confirms one's preconceptions or hypotheses
Conjunction fallacy	The tendency to assume that specific conditions are more probable than a single general one
Endowment effect	The tendency that people often demand more to give up on an object than they would be willing to pay to acquire it
Fundamental attribution error	The tendency to overemphasize personal factors and underestimate situational factors when explaining other people's behavior
Gambler's fallacy	The tendency to think that future probabilities are changed by past events when in reality they are unchanged (e.g., series of roulette wheel spins)
Halo effect	The tendency for a person's positive or negative traits to extend from one area of their personality to another in others' perceptions of them
Hot-hand fallacy	The expectation of streaks in sequences of hits and misses whose probabilities are, in fact, independent (e.g., coin tosses, basketball shots)
Illusory correlation	The tendency to identify a correlation between a certain type of action and effect when no such correlation exists
In-group bias	The tendency for people to give preferential treatment to others they perceive to be members of their own group
Mere exposure effect	The tendency by which people develop a preference for things merely because they are familiar with them

Table 2. Examples of Cognitive Biases
(Wilke & Mata, 2012, p. 532)

Given the absence of relevant research directed toward CDR application at the elementary, secondary, and general education levels as explained above in the literature review section, the author searched for suitable CDR applications at the post-secondary and graduate levels that could be repurposed as a promising model for implementation. We choose the medical educational model of CDR (1) because they sought to distinguish cognitive biases from implicit biases and (2) because their CDR strategies were implemented to support pedagogical or andragogic practices: i.e., to decrease the incidents of cognitive biases in future physicians' clinical decisions.[4] Having reviewed a representative sampling of studies on cognitive biases in medical clinical settings and the need for better physician education, this author suggests that researchers and educators adopt the research model employed by Croskerry, Singhal, and Mamede. They use the CDR strategies from ML Garber, H. Singh, A. Sorensen, et al. "Checklists to Reduce Diagnostic Error in Emergency Medicine" (Cognitive Debiasing 1: Origins of Bias and Theory of Debiasing, 2013a, p. 62).

Cognitive Debiasing Reduction Strategies

In table 2 above, Croskerry et al. (2013a) list high-risk situations for biased reasoning as they relate to physicians' ability to make initial assessments and clinical judgments correctly. In figure 1 below, they list the decision tree or steps in cognitive debiasing (p. 62). I am suggesting that elementary, secondary, and general education teachers use the same methods to prevent similar cognitive and implicit biases in their foundational assessments of students, especially for their new and incoming students, and again in their summative assessments. Table 3 represents our adaptation for elementary, secondary, and post-secondary educators to use that would eliminate both cognitive and implicit biases regarding the academic abilities of incoming or new students to their school, classroom, or major. Independent and authentic testing should be used to counteract "in-group" and "confirmation biases" based on collegial feedback and observations and implicit

personal biases based on race, ethnicity, nationality, gender, and SES.

Unfortunately, the guidelines as proposed require substantial cognitive training and praxis (A) to operationalize awareness of various biases that all individuals have, including teachers and researchers, and (B) to operationalize awareness of what counts as high-risk environments or situations. (See, for example, Table 2 above and Table 3 below.) Consequently, such practices should be limited to (a) formative and summative assessment and evaluations, (b) courses and exams that are used for admission testing, (c) course and exams that are used for acceptance and admission into a department or major, (d) formal and summative assessment for courses which serve as gateway classes for majors, or (e) formal and summative assessment for graduation exams and senior thesis, etc.

Extensive, proactive, and explicit training and praxis will need to be supplied if teachers are to employ CDR strategies effectively. Scholars, administrators, and teachers would need to ascertain the (1) types of instructions (regarding specific pedagogy/andragogy), (2) types of praxis (simulated, computer-assisted, classroom, internship, externship, etc.), (3) types of teacher to student interactions (one-on-one, small group, etc.), (4) the types of cognitive developmental and introspective reflection curricular designs that are employed, and (5) the time investment that are needed. Such considerations are outside the scope and goal of our inquiry. For a preliminary discussion of these issues, see (Croskerry, Singhal, & Mamede, 2013b).

High-risk situation	Potential biases
1.Was this patient handed off to me from a previous shift?	Diagnosis momentum, framing bias
2. Was the diagnosis suggested to me by the patient, nurse, or another physician?	Premature closure, framing bias
3. Did I just accept the first diagnosis that came to mind?	Anchoring, availability, search satisficing, premature closure
4. Did I consider other organ systems besides the obvious one?	Anchoring, search satisficing, premature closure
5. Is this a patient I do not like, or like too much, for some reason?	Affective bias
6. Have I been interrupted or distracted while evaluating this student?	All biases
7. Am I feeling fatigued right now?	All biases
8. Did I sleep poorly last night?	All biases
9. Am I cognitively overloaded or overextended right now?	All biases
10. Am I stereotyping this patient?	Representative vias, affective bias, anchoring, fundamental attribution error, psych out error
11. Have I effectively ruled out must-not-miss diagnoses?	Overconfidence, anchoring, confirmation bias

Table 3. High-Risk Situations for Biased Reasoning
Croskerry et al. (2013a, p. 61)

High-risk situation	Potential biases
1. Is this a new student from another school or class?	Previous assessment momentum, framing
2. Was the assessment suggested to me by the student, parent, or another teacher?	Premature closure, framing bias
3. Did I just accept the first diagnosis or assessment that came to mind?	Anchoring, availability, search satisficing, premature closure
4. Did I consider other alternatives for the students learning challenges besides the obvious one?	Anchoring, search satisficing, premature closure
5. Is this a student I do not like, or like too much, for some reason?	Affective bias; halo effect
6. Have I been interrupted or distracted while evaluating or assessing this student?	All biases
7. Am I feeling fatigued right now?	All biases
8. Did I sleep poorly last night?	All biases
9. Am I cognitively overloaded or overextended right now?	All biases
10. Am I stereotyping this student?	Representative bias, affective bias, halo effect, anchoring, fundamental attribution error, psych out error
11. Have I effectively ruled out must-not-miss diagnoses?	Overconfidence, anchoring, confirmation bias

Table 4. High-Risk Situation in Education

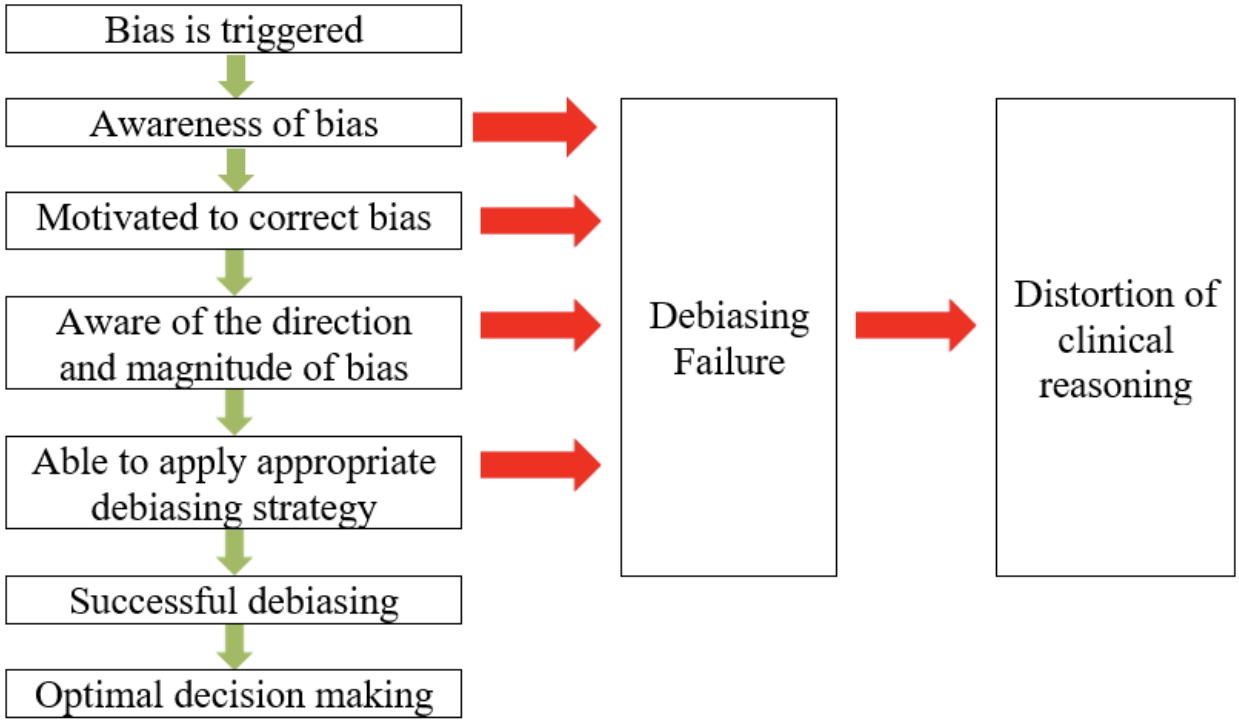

Figure 1. Successive steps in cognitive debiasing

(Croskerry, Singhal, & Mamede, 2013a, p. 62). **Green arrows = yes** ; Red arrows = no.

Teachers and other educators can avoid assessment and attributional biases by following table 3 above and following the decision tree represented in figure 1 above. If the teacher answers yes to any of the items in table 3, he or she has probably triggered a cognitive bias. The teacher would then be primed to follow the Cognitive Debiasing Reduction (CDR) decision tree to employ the steps and procedures needed to eliminate the assessment and attributional biases detected. (These will need to be adapted from medical CDR sources for each of the biases uncovered.) Each of those steps should be documented and placed in the

student's assessment folder.

Since double-blind assessments are not available, teachers should at least have independent (and blind--if possible) peer assessments of a representative sampling of their students. Neither the teachers' nor the students' names and other identifying indicators should be indicated; that is, they should be hidden by coding or code conversion, for example, student X, Y, and Z and teachers 1, 2, and 3. By having two additional teachers assess random, representational samples of students, educators and administrators will be able to increase the accountability of the assessment process. Using multiple assessors would at least reveal coding or assessment differences between all three of the teachers or educators (teachers 1, 2, and 3) that are responsible for assessing the same students (students x, y, and z). All the teachers should use a standard assessment rubric and should have had the opportunity to participate in assessors' calibration activities in the manner of SAT and ACT compositional judges.

Conclusion

The express purpose of this paper was to make an exploratory inquiry into Cognitive Debiasing Reduction (CDR) strategies for use in elementary, secondary, and general education classrooms. The author of this inquiry wanted to review strategies used by elementary, secondary, and post-secondary teachers and administrators to mitigate or compensate for the cognitive biases of classroom educators as opposed to mitigating only cultural or learned biases like racism, ethnocentrism, SES biases or classism, and sexism.

The author wanted to discover CDR strategies for "transcultural" biases that are innate in all humans; he also wants to focus on those that occur on the macro as opposed to the micro and meso levels of cognition. Unfortunately, after the author made a preliminary search of representative databases for peer-reviewed studies on CDR at the elementary, secondary, and general education levels, he was not able to find any relevant literature. Consequently, the author proposed that educational researchers should begin producing such studies and that educators adapt and modify the same for their elementary and secondary students and general education students at the tertiary level. He proposed that researchers and educators start with and adapt the CDR andragogy used to educate medical interns. Administrators and educators at all three levels should adapt medical CDR strategies in their identified high-risk situations. (See Table 3 above.) Teacher trainers can employ the CDR strategies and heuristic training in preservice and in-service, continuing education courses to train teachers on how to implement CDR strategies and research for use in their formal assessments at the start and end of each unit or semester. Future research will need to be undertaken to operationalize CDR training for the same. Additional empirical studies will also need to be made to assess CDR effectiveness and the long-term successes of the diverse types of andragogy, praxis, and strategies that are used.

Footnotes

[1] It is interesting to note that humans have developed heuristic tools to remediate our sensual and perceptual biases: from the development of geometry and the optical refinements showcased by the ancient ruins of the Parthenon to the use of modern telescopes and satellite imaging techniques which allow humans to map aspects and features of the universe beyond our perceptual abilities. Researcher has determined that the same processes and procedures are needed for the higher control functions of cognition.

[2] Those thirteen reasons are (1) insensitivity to prior probability of outcomes (1974/2011, p. 420), (2) insensitivity to sample size (p. 421), (3) misconceptions of chance (p. 422), (4) insensitivity to predictability (p. 422), (5) the illusion of validity (p. 423), (6) misconceptions of regression (p. 424), (7) biases due to the retrievability of instances (e.g., subjective familiarity and salience) (p. 425); (8) biases due to the effectiveness [or ease] of a search set (p. 425), (9) biases of imaginability (p. 425), (10) illusory correlation (e.g. subjective availability of associative bonds—e.g., negative profiling) (p. 426), (11) insufficient adjustment (p. 427), and (12) biases in the evaluation of conjunctive and disjunctive events (p. 428), and (13) anchoring in the assessment of subjective probability distribution (p. 428). See also Kahneman's summary in (Thinking, Fast and Slow, 2011, p. 8).

[3] Other sources and authors list various numbers of cognitive biases, heuristics, categories and hierarchies. For example,*Decision Lab* lists over fifty cognitive biases (2020). John Manoogian's "Cognitive Bias Codex" lists over180 (Manoogian, III, 2018). None of the sources have categorized whether the source of the biases is peculiar to the micro, meso, or macro levels of cognition and/or if they are culturally mediated as implicit biases too. Because of time constrain, I was not able to undertake a systematic review of the cognitive biases listed by various authors and sources to categorize them based on whether they were implicit biases that were primarily influenced by cultural considerations or whether they represented system 1 or system 2 macro level, meso level, or micro level cognitive biases, etc. Future inquiries and studies will have to study systematically the various biases to determine their features and types, categories, and sub-categories.

[4] For a critical review of cognitive and implicit biases found in medical research and clinical practice, see for example (Blumenthal-Barby & Krieger, 2014).

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