Cognitive Skills

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Human Factors in Information Design

HF 700: Foundation of Human Factors

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April 21, 2025

Introduction

   Examining the interaction between metacognition and decision-making is essential to comprehending how people maneuver cognitive processes to guide their decisions and behaviors. Metacognition involves understanding and regulating one's cognitive processes, while decision-making pertains to evaluating information and making choices. Within the context of online applications, these cognitive processes influence user interactions and outcomes significantly as well as enhance usability and effectiveness. John H. Flavell (1979) was an eminent psychologist renowned for his pioneering work in the field of developmental and cognitive psychology, particularly in the study of metacognition. John H. Flavell (1979) defined metacognition as "The active monitoring and consequent regulation and orchestration of these processes in relation to the cognitive objects or data on which they bear, usually in service of some concrete goal or objective" (Chen & McDunn, 2022). Metacognition plays a multifaceted role in daily tasks, contributing to self-awareness, strategic planning, problem-solving, decision-making, emotional regulation, and self-reflection. By cultivating metacognitive skills, individuals can enhance cognitive abilities, which complements executive functioning processes related to goal-directed behavior and self-regulation. While metacognition focuses on thinking about thinking, executive functioning encompasses the cognitive control processes necessary for behavior regulation and goal achievement. Together, these related but distinct processes improve performance and achieve greater success in various aspects of life. This paper explores how metacognition and decision-making help us evaluate and examines how online web applications Morningstar (Morningstar, n.d.) integrates principles of metacognition and decision-making psychology to empower investors to navigate the complexities of the financial markets. This case study will emphasize the significance of integrating metacognitive principles into investment platforms.

Metacognition

First, it is imperative to discuss the many components of metacognition. The first component is "Metacognitive knowledge defined as stored world knowledge that has to do with people as cognitive beings and with their diverse cognitive tasks, goals, actions, and experience" (Moritz & Lysaker, 2018). Studies have provided supporting evidence for these factors, with meta-analyses showing that explicit metacognitive instruction improves learning outcomes across various domains (Hattie, 2009), and longitudinal research demonstrating that metacognitive skills can be developed through targeted interventions (Schraw, 1998). Mortiz and Lysaker (2018) continue "Metacognitive experiences, are conscious reflections about cognitive processes (e.g., worry that you may fail an exam because you are not good enough; the thought that you have just given a very good presentation). Lastly, Mortitz and Lysaker (2018) conclude with the latter of metacognitions, a "Metacognitive strategy aimed at the metacognitive *goal* of assessing one's knowledge, which will give rise to subsequent metacognitive experiences (e.g., surprise, relief, frustration about performance)". Fundamentally, this overlaps the component earlier but what makes it cognitive is the fact that we are trying to obtain knowledge through questioning. Metacognitive regulation involves the

planning, monitoring, and control of cognitive processes to achieve specific goals or objectives. It includes setting goals, selecting, and applying appropriate strategies, monitoring progress and comprehension, and adjusting as needed to optimize performance. Finally, Metacognitive skills are the practical abilities or strategies that individuals use to regulate their own cognitive processes. These skills include planning, monitoring, evaluating, reflecting, and adapting strategies based on feedback and performance. Effective metacognition requires the development and refinement of metacognitive skills.

Elements of Metacognition

According to Ali (2016), "Metacognition involves three fundamental stages: planning, monitoring, and evaluation". During the planning phase, individuals formulate a strategy by considering their prior knowledge, desired direction of thinking, initial steps, time constraints, and purpose of the task (Ali, 2016). Throughout the monitoring stage, they assess their progress, ensure alignment with the intended course, decide on the relevance of information, consider alternative approaches, adjust the pace as needed, and address comprehension challenges (Ali, 2016). In the evaluation phase, individuals reflect on their performance, compare outcomes with expectations, contemplate alternative strategies, explore broader applications of their approach to thinking, and identify any gaps in understanding that require further clarification (Ali, 2016). These prerequisite steps include assessment of task requirements, self-assessment of current knowledge and skills, identification of learning objectives, analysis of experience, awareness of metacognitive strategies, and alignment with task demands and goals.

Metacognitive Strategies

Ali (2016) asserts "In the process of metacognitive learning strategies, three key stages are highlighted: awareness, planning, and monitoring/reflection. In the awareness stage, individuals consciously identify their existing knowledge, set learning goals, assess available resources, understand task requirements, evaluate performance criteria, gauge motivation levels, and manage anxiety levels (Ali, 2016). In the planning phase, individuals estimate task completion time, schedule study sessions, prioritize tasks, create checklists, organize materials, and implement learning strategies such as outlining or mnemonic devices (Ali, 2016). In the regulation phase, individuals can exercise conscious control over mental functions including memory, problem-solving, and attention. Modifying goals or action plans in response to progress, setbacks, or changing priorities. This conceptualization aligns with Schraw and Moshman's (1995) framework, which emphasizes the importance of knowledge of cognition (declarative, procedural, and conditional knowledge) and regulation of cognition (planning, monitoring, and evaluation). Schraw and Moshman argue that metacognitive strategies develop gradually and are influenced by both domain-specific knowledge and general metacognitive abilities. Lastly, in the monitoring and reflection stage, individuals reflect on their learning process, evaluate effectiveness, self-test, provide self-feedback, and maintain high levels of concentration and motivation throughout the learning endeavor (Ali, 2016). Ali (2016) concludes, "These metacognitive strategies enhance self-regulated learning and promote effective acquisition and retention of knowledge." Expanding on this perspective, Zimmerman (2002) proposes a cyclical model of self-regulated learning that incorporates metacognitive strategies within three phases: forethought (task analysis and self-motivation), performance (self-control and self-observation), and self-reflection (self-judgment and self-

reaction). Zimmerman's research demonstrates that effective learners employ specific metacognitive strategies during each phase to optimize their learning outcomes.

Decision Making

Referring to the previously addressed decision-making process, there is a theory of three foundational principles which occur during decision-making. According to Sebora and Cornwall (1995), "Expected utility theory is based on three fundamental tenets about the processes that occur during decisions made under risk and uncertainty: (1) consistency of preferences for alternatives; (2) linearity in assigning of weights to alternatives; and (3) judgment in reference to a fixed asset position."

The assignment and evaluation of decision weights are significantly influenced by metacognition. Research by Yeung and Summerfield (2012) supports this connection, demonstrating that metacognitive processes including monitoring and regulation allow individuals to reflect on their decision-making processes, evaluate the suitability of choice weights, and modify strategies in response to feedback and results.

While expected utility theory has been influential, Prospect theory has emerged as a compelling alternative. Developed by Kahneman and Tversky (1979), this theory directly addresses risk aversion, proposing that "losses loom larger than gains" and explaining why individuals typically prefer certain gains rather than larger but riskier gains. This risk aversion stems from several psychological mechanisms: loss aversion (where losses hurt more than equivalent gains feel good), diminishing marginal utility (where each additional unit of gain provides less satisfaction), and reference point dependence (where outcomes are evaluated relative to a subjective reference point rather than final states). Tversky and Kahneman's (1992) cumulative prospect theory further refined these concepts, showing how probability weighting functions differ for gains versus losses and explaining apparent inconsistencies in decision behavior.

The naturalistic decision-making model, as described by Klein (2008), provides another critical perspective by examining how decisions occur in real-world contexts characterized by time pressure, uncertainty, ill-defined goals, and high stakes. This model demonstrates bounded rationality—a concept introduced by Simon (1955)—which recognizes that human rationality is limited by cognitive constraints, available information, and time. Klein's research shows that expert decision-makers often use pattern recognition and mental simulation rather than comparison of alternatives, particularly in complex, dynamic environments.

These decision-making frameworks naturally align with metacognitive processes. For example, Fleming and Dolan (2012) demonstrated that effective metacognitive monitoring allows decision-makers to recognize when their intuitive judgments might be biased, while metacognitive control enables them to adjust strategies based on environmental feedback—creating a dynamic system where metacognition can both influence and be influenced by decision processes.

Decision-Making Strategies

Making decisions can be difficult. It takes time and many options in order to choose what may be best in a given situation. The first strategy in deciding is optimizing. This is choosing the best option among the identified alternatives, which aligns with expected utility theory's premise of maximizing overall utility (Plous, 1993). The effectiveness of this strategy relies on the importance of the problem, time limit, availability of resources, cost of other alternatives, and psychology of the decision maker.

While optimization is theoretically ideal, Simon's (1956) concept of bounded rationality challenges this approach by recognizing that humans face cognitive limitations, incomplete information, and time

constraints that prevent true optimization. Simon argued that people lack the cognitive capacity and resources to evaluate all possible alternatives and their consequences, making "perfect" decisions nearly impossible in complex situations.

The next strategy which we can consider is Satisficing, a term coined by Simon (1956) to describe how individuals make decisions in practice. This strategy involves considering the first satisfactory alternative rather than seeking the objectively best option. The word satisficing was derived from two words: satisfied and sufficient. Simon proposed this as a more realistic model of human decision-making, observing that people typically set an aspiration level and accept the first option that meets it rather than exhaustively evaluating all possibilities. This is applicable in many small and quick decisions such as where to park, what to wear, and what to eat (Ahmed & Omotunde, 2012).

The Maximax strategy, examined by Gigerenzer and Gaissmaier (2011), involves selecting the option that maximizes the maximum possible outcome or payoff. This connects with expected utility theory but focuses specifically on best-case scenarios rather than weighted probabilities. Decision-makers following this strategy select the alternative with the highest potential gain, regardless of the associated risk or uncertainty—a behavior observed in certain high-risk entrepreneurial contexts.

The Optimizer strategy, also known as the "expected value" strategy, involves selecting the option that maximizes the expected value or average payoff. Decision-makers following this strategy consider both the potential gains and the associated probabilities of different outcomes. Research by Kahneman and Tversky (1979) demonstrates that humans often deviate from this mathematically optimal approach due to cognitive biases, particularly overweighting low probabilities and underweighting high probabilities.

One of the most used strategies is Maximin, which is also known as maximizing the minimum. This strategy is considered to be that of a pessimist as it considers the worst possible outcome of all alternatives and selects the one with the highest minimum. Prospect theory research suggests humans are indeed inclined toward this strategy in many situations due to loss aversion—the tendency to prefer avoiding losses over acquiring equivalent gains (Kahneman & Tversky, 1979). This tendency is particularly pronounced when people face potentially severe negative consequences, explaining why this type of strategy is used when failure is expensive and can't be tolerated (Ahmed & Omotunde, 2012).

These decision strategies are significantly influenced by cognitive biases and heuristics. For example, the availability heuristic leads people to overestimate the likelihood of events that are easily recalled, affecting risk assessment in real-world scenarios like health decisions or financial planning. Similarly, the anchoring bias causes decisions to be unduly influenced by initial information, creating reference points that distort subsequent judgments in contexts ranging from negotiations to product valuations. The confirmation bias leads individuals to favor information that confirms existing beliefs, creating echo chambers that can reinforce polarization in social and political domains. Additionally, framing effects demonstrate how the same decision can yield different responses depending on how options are presented (Tversky & Kahneman, 1981), which explains why marketing strategies and public policy communications are carefully crafted to elicit specific responses. Research by Gigerenzer and Todd (1999) suggests these mental shortcuts evolved as adaptive responses to complex environments with limited cognitive resources. These biases often operate unconsciously but can substantially impact which decision strategy a person employs in a given situation, highlighting the importance of metacognitive awareness in recognizing and potentially mitigating their influence.

Case Study - Morningstar Web Application (investor.morningstar.com)

In this case study, we will examine how Morningstar integrates principles of metacognition and decision-making psychology to empower investors to navigate the complexities of the financial markets.
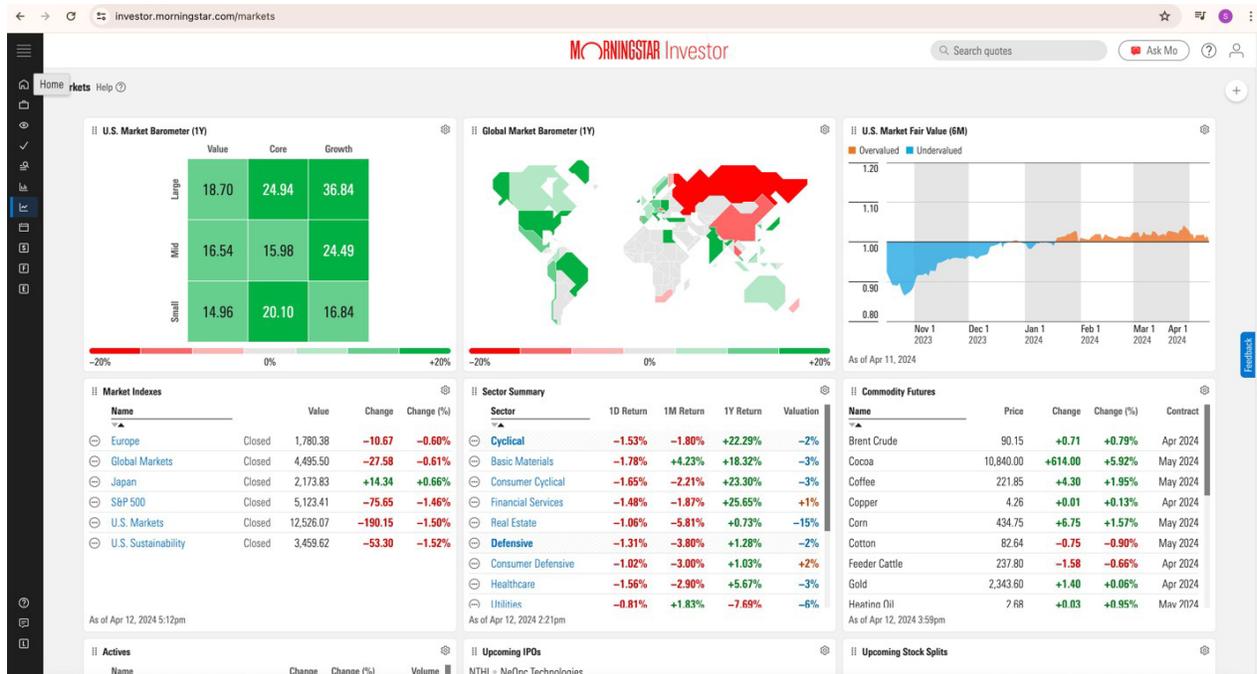
Figure 1: MorningStar Dashboard

Morningstar's platform promotes metacognitive engagement among investors through various features and strategies. Effective decision-making is essential in the investment process, requiring individuals to evaluate complex information, assess risks, and weigh potential outcomes. The first strategy is goal setting where Morningstar allows investors to set personalized investment goals, such as retirement planning, wealth accumulation, or education funding. Next is portfolio analysis where the platform offers comprehensive portfolio analysis tools, including asset allocation analysis, risk assessment, and performance tracking. Specifically, the X-Ray tool *(Figure 2)* effectively visualizes portfolio diversification across sectors and asset classes, while the Portfolio Manager provides detailed performance metrics against benchmarks, helping investors recognize patterns in their investment decisions that might otherwise go unnoticed.
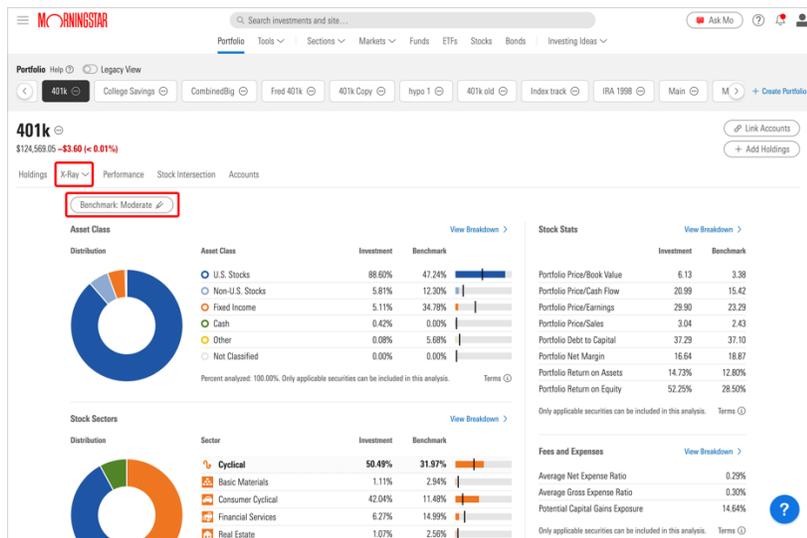

Figure 2: X-Ray tool

Morningstar also provides in-depth research reports, analyst ratings, and fund evaluations to help investors make informed investment decisions. The platform offers risk management tools, such as risk tolerance

assessments and portfolio stress testing. The Fund Analyst Reports particularly stand out by combining quantitative data with qualitative analysis through their "5 Pillars" methodology (Process, Performance, People, Parent, and Price), giving investors a structured framework for metacognitive evaluation of investment options. The Learning Center provides educational resources that guide investors through reflective processes, with interactive modules on risk assessment demonstrating how emotional biases can impact decision quality under uncertainty.

As much as these features are important, it is essential to examine potential drawbacks and disadvantages that investors may encounter. First, there is an overreliance on ratings. Morningstar's star ratings and analyst ratings may lead to investors' overreliance on these metrics when making investment decisions.

Second, investors may experience cognitive overload, leading to decision fatigue and impaired decision-making quality. The platform's data-rich environment can trigger several decision biases, including recency bias (overweighting recent performance data) and anchoring (fixating on initial information like star ratings). Morningstar's research reports and analysis may inadvertently reinforce investors' existing beliefs and biases, leading to confirmation bias. There is also a lack of customization. The Premium Screener tool, while powerful, requires significant expertise to maximize its utility, creating a barrier for novice investors seeking to align screening criteria with their specific investment philosophy and risk tolerance.

Based on my analysis of the Morningstar platform, its rating system significantly impacts investor behavior. Morningstar rates mutual funds from one to five stars based on past performance (adjusted for risk and sales charges) compared to similar funds. "Within each Morningstar Category, the top 10% of funds receive five stars, the next 22.5% receives four stars, the next 35% receives three stars, the next 22.5% receives two stars, and finally, the bottom 10% receives one star" (Morningstar, 2023). This distribution system creates a potential metacognitive challenge as investors may overweight these backward-looking quantitative metrics without engaging in deeper critical analysis. From a user experience perspective, Morningstar generally receives positive reviews for its comprehensive features, intuitive interface, and valuable insights. However, there are also some areas where users have provided feedback for improvement. Some of the positive aspects are comprehensive data analysis, intuitive interface, educational resources, portfolio management tools, and ratings and recommendations. Some areas for improvement are cost, mobile app experience, learning curve, and customer support.

Conclusion

The integration of metacognition and decision-making principles into human factors interaction design plays a crucial role in enhancing the user experience and effectiveness of investor web applications. In understanding how individuals think, evaluate information, and make decisions, designers can create interfaces that align with users' cognitive processes and support their decision-making goals. By prioritizing user-centered design principles and leveraging insights from cognitive psychology and behavioral economics, designers can create intuitive, engaging, and personalized experiences that enhance users' financial well-being and investment success.

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