Engineering Psychology

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Week-06

Lecture-14

Decision Making - 2

Namaskar. In the last class, we discussed the concept of decision-making and examined two distinct models of decision-making. The expected utility model is a mathematical framework that evaluates expected values resulting from specific choices. In contrast, the descriptive model explores the shortcuts individuals use when making decisions. This model emphasizes how people typically do not calculate the probabilities of events occurring or the utility of various options.

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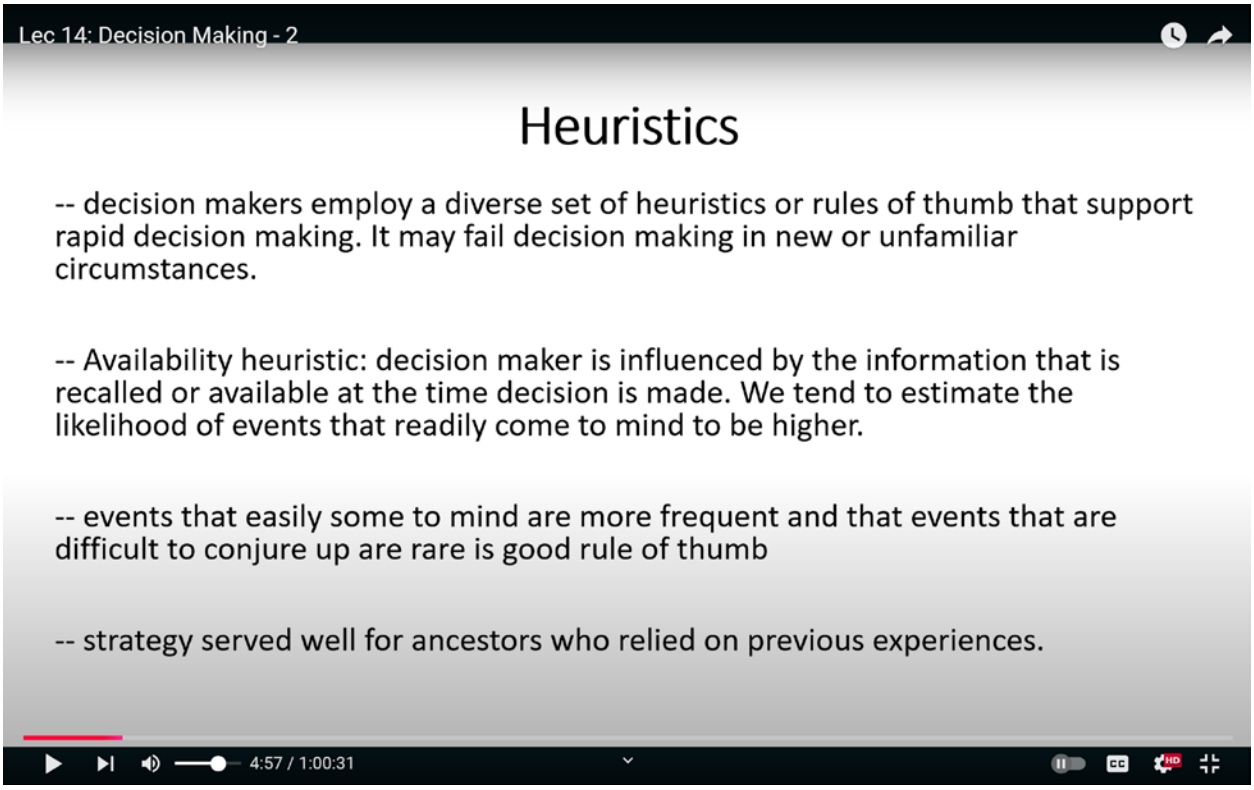

This limitation arises because most individuals lack sufficient information or the computational

capacity necessary for making well-informed decisions. To compensate for these shortcomings, people rely on rules of thumb or certain shortcuts when making choices. The normative model, on the other hand, is based on an evaluation of how valuable something is to an individual and the likelihood of that outcome occurring. Here, "something" is defined in terms of the alternatives available for making a decision. The descriptive model challenges this perspective, proposing that people draw upon past experiences and their memory to inform their decision-making processes.

Within the descriptive model, there are two methods of making decisions: compensatory and non-compensatory strategies. The compensatory strategy, as indicated by its name, involves compensating for weaknesses with the strengths of various options. In this approach, the strengths of one option can offset the weaknesses of another, allowing individuals to arrive at a decision. In contrast, non-compensatory methods do not allow for the compensation of weaknesses with strengths. We also discussed two specific decision-making strategieselimination by aspect and satisficingboth of which involve the use of mental shortcuts in real-world scenarios.

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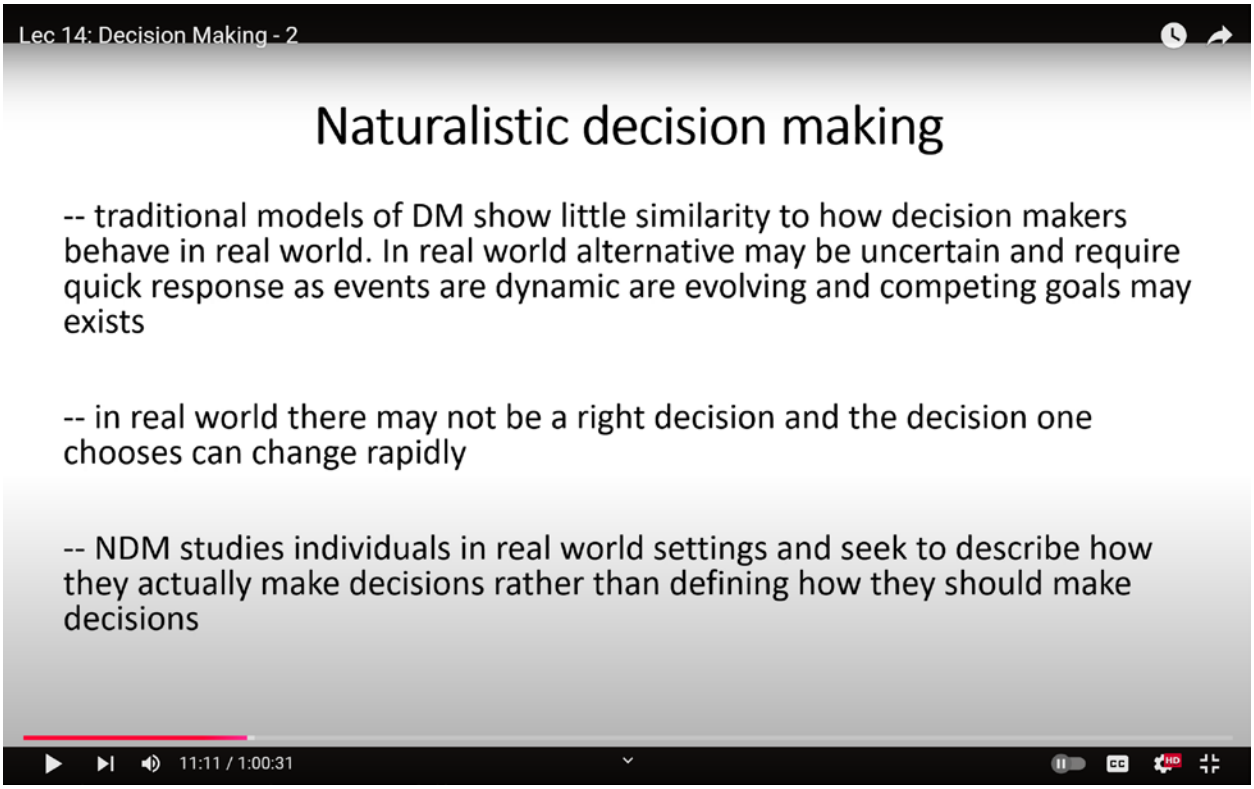

Today, we will explore a third type of decision-making known as naturalistic decision-making, and we will also examine some biases that can occur during the decision-making process. Towards the end of the session, I will introduce some helpful techniques that can assist you in making better decisions.

As previously mentioned, we discussed the mental shortcuts individuals utilize for decision-making within the descriptive model. These shortcuts are referred to as heuristics. Heuristics are methods of arriving at solutions without following all the potential steps that could lead to a resolution. When utilizing heuristics, individuals often rely solely on their past experiences or memories to derive solutions. Decision-makers employ a variety of heuristics or rules of thumb to facilitate rapid decision-making; however, these may not be effective in new or unfamiliar situations.

For decisions that individuals frequently encounter, over-investing cognitive resources can become problematic. If too many resources are devoted to a particular decision, it can limit the ability to allocate those resources to other tasks. A simple illustration of this is when one divides attention between two activities. For instance, while driving a car and conversing, if one concentrates solely on driving, the conversation may not occur. Thus, one of the tasks must become automatic. When tasks are routine, individuals often resort to shortcuts to complete them.

Consider a scenario in which I need to open a tin can but lack a can opener. In this situation, I might use pliers or another pointed object to create incisions in the can, thereby enabling me to open it. This type of solution exemplifies the use of a heuristic. Alternatively, I might use the back of a spoon to pry open the lid of the tin can. All these methods of opening the can that I have described represent the application of heuristics.

Numerous heuristics exist, and one of the most commonly employed is the availability heuristic. The availability heuristic refers to a situation where decision-makers are influenced by information that is readily recalled or accessible at the time of making a decision. Individuals tend to estimate the likelihood of events based on how easily they come to mind. This heuristic suggests that information that quickly surfaces while making rapid decisions biases our choices in favor of that information's availability. When attempting to make quick decisions, individuals tend to search their memories for relevant experiences.

The decision-making examples that come to mind most readily are often the ones that individuals utilize most frequently in their choices, a phenomenon known as the availability heuristic. People have been known to report experiences that never actually occurred in their lives. Upon investigation, it was found that these individuals claimed to have encountered such events due to media portrayals that suggest such experiences are common. The presence of media can sometimes create an environment that leads individuals to believe it is more likely that they have experienced similar events.

Recalling information suggested by the media at the moment of making a decision serves as an example of the availability heuristic. Events that are easily recalled and frequent are often viewed as more likely, while those that are difficult to remember are considered rare. The functioning of the availability heuristic hinges on how quickly and easily an individual can recall an event.

The quicker you can recall an event, the greater the likelihood that you will utilize the availability heuristic. Events that occur infrequently, or solutions that you have rarely employed in decision-making, are less likely to come to mind and therefore do not form part of the availability heuristic. The use of the availability heuristic suggests that events or solutions that you have encountered recently, or those characterized by features such as saliency or frequency of use, become more accessible in your memory and are thus remembered more easily.

This strategy served our ancestors well, as they relied on previous experiences. Although the availability heuristic is applicable in various situations and is commonly used by many individuals, it is of diminishing relevance in today's information-rich environment. The primary reason for this is the widespread availability of information; accessing data is no longer a challenge. The availability heuristic, which once facilitated decision-making during times when accessing information was difficult, faces scrutiny in the contemporary world where information is rapidly and readily accessible.

Today, I will discuss the third type of decision-making model known as the naturalistic decision model. Traditional models of decision-making bear little resemblance to how decision-makers operate in the real world. In reality, alternatives may be uncertain, requiring swift responses as events are dynamic and ever-evolving, and competing goals may exist. The proposals of the descriptive and normative theories describe how people make decisions, but these are theoretical

models that cannot account for the changes that frequently occur in real-world decision-making.

While developing theoretical models, I can identify numerous situations that might influence goals or impact our decision-making processes. However, these situations may not unfold as planned when actual decision-making occurs. This discrepancy can arise because, in real life, alternatives may not manifest as anticipated or may evolve unexpectedly. Furthermore, the quick responses required in certain situations may not be feasible, and the goals we aim to achieve may also change. The interplay of shifting goals, alternatives, and circumstances can hinder our ability to apply the predictions made by the normative or descriptive models.

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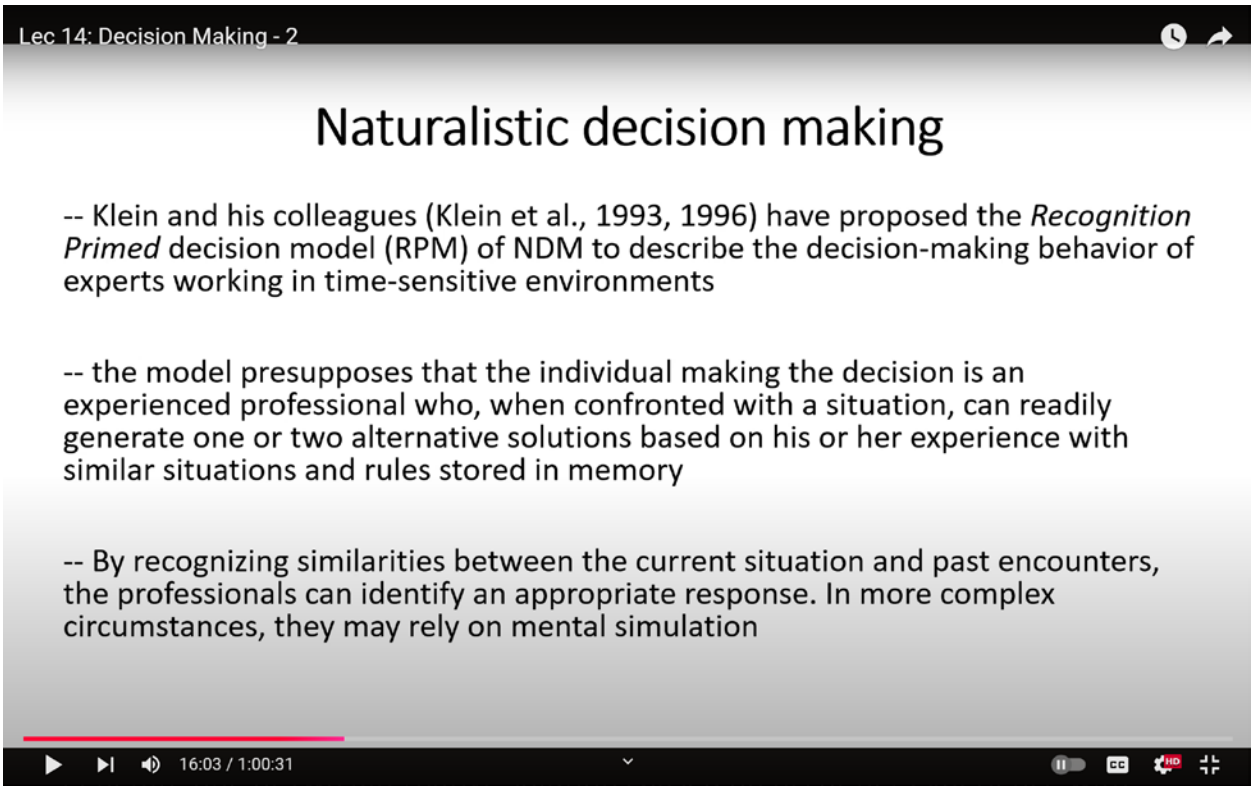

As a result, a new model was proposed by Klein et al., known as the naturalistic decision-making model. In the real world, there may not be a singular "right" decision, and the choice one makes can change rapidly. While the descriptive and normative models focus on identifying what constitutes the right or wrong decisionor what is beneficial versus non-beneficialin reality, losing can sometimes equate to gaining, and maintaining a status quo that is neither a loss nor a gain can

be preferable to actual loss. Such nuanced predictions cannot be derived from the previously discussed descriptive and normative models.

In real-life scenarios, losing may not truly be a loss and can, in fact, result in a gain. Therefore, the predictions generated by the earlier models may not hold in practical situations. For this reason, the naturalistic decision-making model adopts a different approach to elucidate decision-making processes. It examines individuals in real-world contexts, aiming to describe how they actually make decisions rather than prescribing how they should make decisions.

This approach resembles the principles of user-centric design, where the focus is on observing users within their actual work environments to develop solutions or mental models for problem-solving. Klein and his colleagues proposed the recognition-primed decision-making model as part of the naturalistic decision-making framework, which aims to describe the decision-making behavior of experts operating in time-sensitive environments.

The recognition-primed decision-making model specifically studies individuals making decisions in real-life settings, particularly under stress and time constraints. In real-life scenarios, there is no opportunity for a "retake"; decisions must be made on the spot, and time is of the essence. Consequently, the propositions from the earlier two models may not function as intended in practice.

This model presupposes that the decision-maker is an experienced professional who, when faced with a situation, can readily generate one or two alternative solutions based on their experience with similar scenarios and rules stored in memory. One key proposition of the recognition-primed decision-making model is that the individuals making decisions are experts in their respective fields, possessing sufficient experience and knowledge.

When confronted with a challenging situation, these experts can quickly devise several alternative solutions based on previous successes. Such solutions are prioritized in their memory due to past effectiveness. Thus, when faced with a problem, these individuals can easily recall and implement the most optimal solution.

This principle applies to professionals in various fields, including those working in emergency services, management, or manufacturing environments. However, it is important to note that while

there are guidelines for real-life decision-making, these guidelines may not always be effective. Consequently, experienced professionals draw on a range of solutions based on their accumulated experience in different contexts, assessing these solutions in terms of effectiveness to address problems as needed. This forms a fundamental presumption of the naturalistic decision model.

How do these experienced professionals arrive at alternative solutions? The answer lies in their ability to recognize similarities between the current situation and past encounters. The greater the similarity between the present situation and previous experiences, the more likely it is that a solution that proved effective in the past will also work in the present. These professionals can thus identify appropriate responses. By reflecting on past successes and analyzing the effectiveness of previous solutions, they select a response and determine a course of action.

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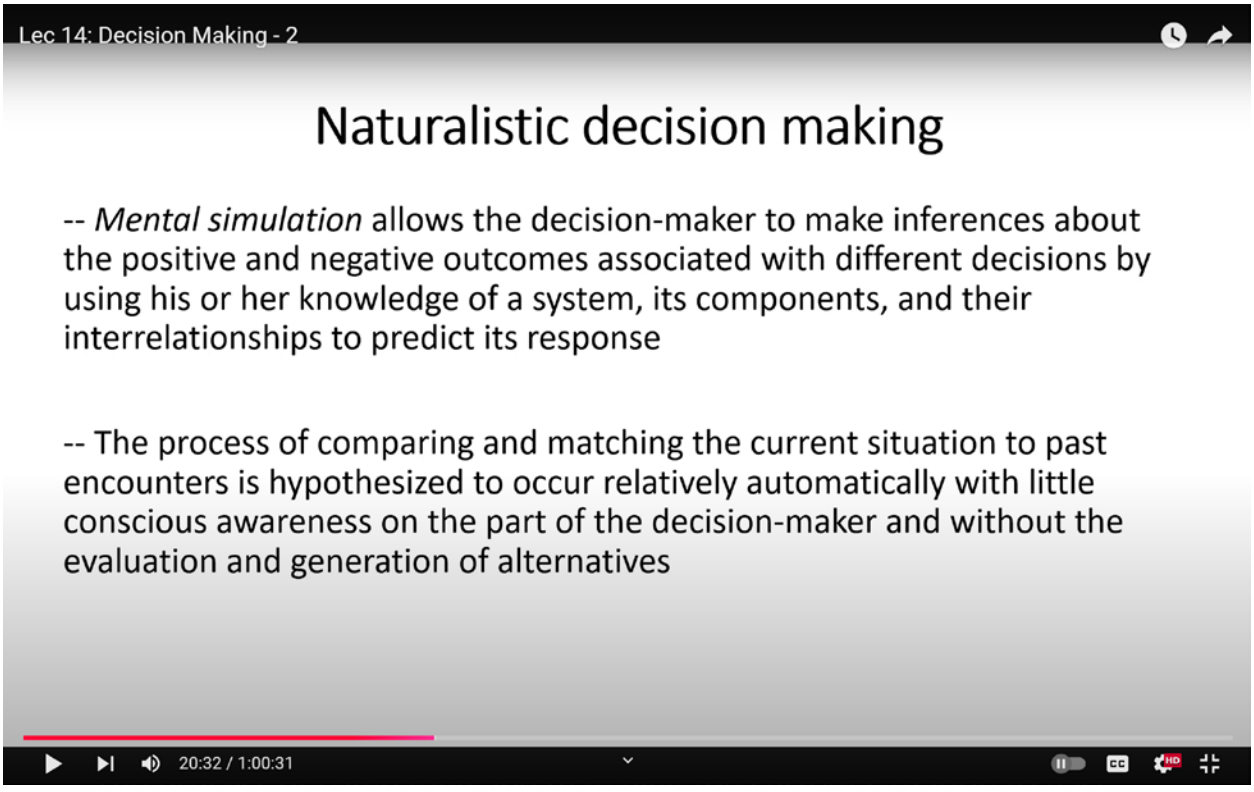

In more complex circumstances, they may depend on mental simulation. When faced with complicated situations where an easy solution may not be apparent, experienced professionals employ mental simulations. Through these simulations, they can develop solutions by mentally

manipulating various scenarios. They then assess the probability that these scenarios will be effective and consider the potential solutions they may yield. So, what exactly is a mental simulation?

A mental simulation allows decision-makers to infer the potential positive and negative outcomes of different choices. In this context, individuals mentally generate various options and scenarios to evaluate how each solution might perform. This process involves not only examining the outcomes but also considering the positive and negative aspects of each potential solution. Professionals utilize their past knowledge of the system, its components, and their interrelationships to predict responses.

Moreover, they do not rely solely on their memories regarding whether a solution has been effective. Instead, they observe the system in operation, striving to understand how the system and its components relate to one another. Based on this understanding, they generate multiple solutions and assign value to each one, ultimately identifying optimal solutions in real-world contexts.

The process of comparing and matching the current situation to past experiences is hypothesized to occur relatively automatically, with little conscious awareness from the decision-maker, and without the need to evaluate and generate alternatives explicitly. This rapid matching process, which involves assessing a present scenario and relating it to earlier solutions, becomes largely automatic. It is important to note that when a process becomes automatic and requires less attention, it tends to drift from our conscious awareness, becoming unconscious. In this manner, when experts engage in naturalistic decision-making, the search for alternatives and the generation of solutions become partly unconscious and partly automatic.

Experts do not need to deliberately contemplate how a solution should be formulated. Instead, the process of mapping the current situation onto a past one, identifying similarities between the two, and generating a list of effective solutions occurs automatically. In summary, naturalistic decision-making is a process through which individuals derive solutions from memory and apply them in real-life situations. These solutions may align with those proposed by the earlier models or could represent unique solutions, or a distilled version of the solutions from the previous two models.

Having explored the three distinct decision-making models, we now turn our attention to some

common challenges associated with decision-making, referred to as biases. How do biases originate? Biases arise when individuals encode certain information in a specific manner. Stereotypes and prejudices serve as prime examples of biases.

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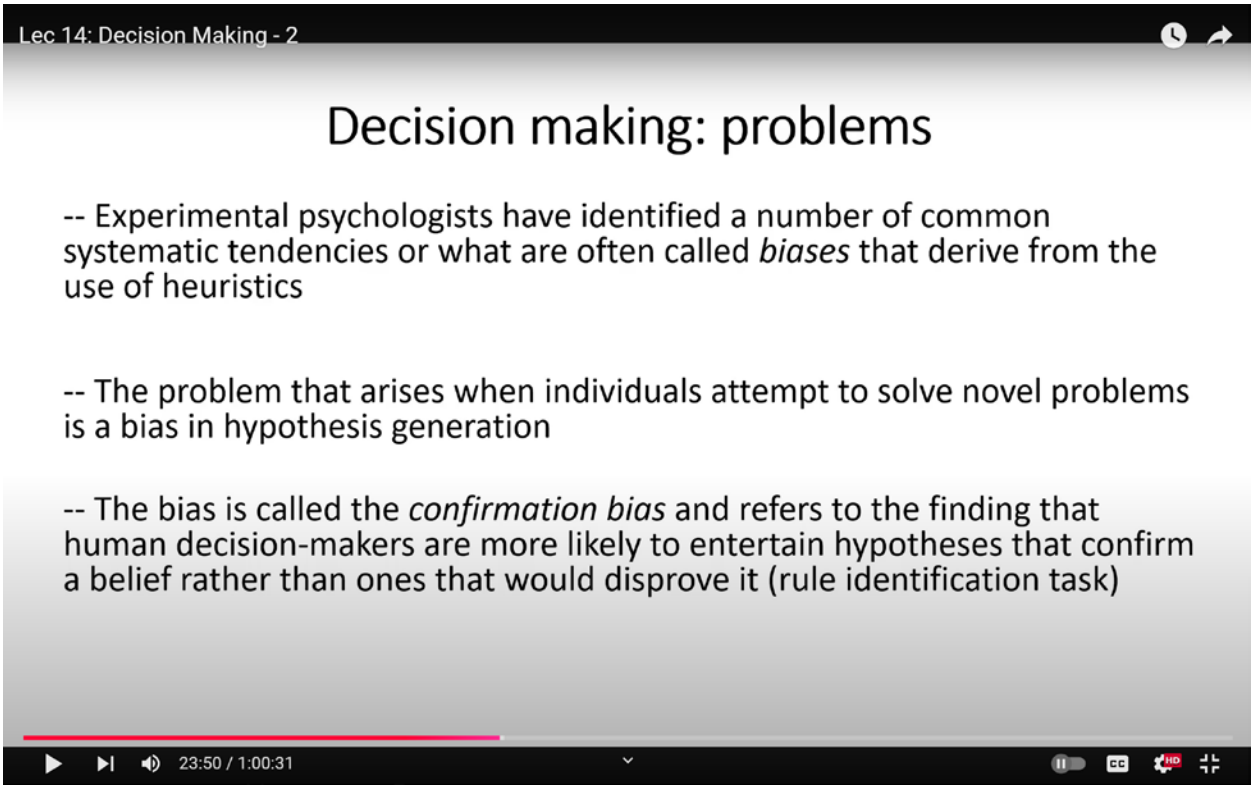

The information available to individuals often undergoes mental manipulation. When we encode information, we tend to do so in a way that is preferential and beneficial to ourselves. This preferential encoding process is referred to as bias. A notable example of bias is known as the first information effect. If a person is presented with a list of adjectives intended to define an individual, and the first adjective on the list is negative, that initial negative impression significantly influences how the individual evaluates the hypothetical person based on the list. The presentation of information shapes how individuals perceive it and how they process other related information regarding the object or event in question. Thus, bias presents a significant problem in decision-making.

There are various methods to mitigate bias. Let us examine some of the biases that can emerge

during decision-making. Experimental psychologists have identified several common systematic tendencies, often referred to as biases, that stem from the use of heuristics. When we employ heuristics, we utilize shortcuts that may lead to biased conclusions.

For example, consider a news article that reports illegal activities associated with a particular community, and the media continues to circulate this information over time. When you subsequently meet an individual from that community, the initial impression that comes to mind may reflect those negative qualities. As a result, people are categorized based on the characteristics that the media has made salient. This tendency to quickly categorize individuals into specific groups is known as biasing, and it can also significantly influence decision-making.

I will define and explain some of these biases. One notable issue that arises when individuals attempt to solve novel problems is a bias in hypothesis generation. The hypotheses individuals formulate for problem-solving can themselves be biased, leading to biased solutions if the hypothesis generation process is flawed. This particular bias is termed confirmation bias.

Confirmation bias refers to the tendency for human decision-makers to favor hypotheses that confirm their existing beliefs rather than those that might contradict them. When individuals succumb to confirmation bias, they tend to accept solutions that align with their beliefs and predictions, filtering information in a way that supports their hypotheses. This selective processing can lead to biased conclusions. Consequently, when individuals take sides, one faction often opposes another.

Taking sides is itself an example of confirmation bias. When two individuals engage in a conflict, each person tends to see their own merits and seeks information that supports their perspective, which can lead to confrontations between teams. One illustrative example of confirmation bias is the rule identification task conducted by Wasson. In this task, participants were presented with a sequence of numbersspecifically, 2, 4, and 6and were encouraged to ask questions to discover the rule governing these numbers. The responses to their questions were limited to "yes" or "no." Participants repeatedly inquired whether 4, 6, and 8 were the next numbers, receiving affirmative responses.

When they asked whether the next number could be 8, 10, or 12, the answer was again "yes."

Throughout this process, students continued to propose that the underlying rule for the sequence 2, 4, 6 was that each subsequent number was derived by adding 2 to the previous one; for instance, 4 is equal to 2 plus 2, and 6 is equal to 4 plus 2. However, the actual rule that students should have recognized was that the numbers were simply arranged in ascending order. In other words, whether it was 2, 4, 6, or 6, 8, 10, they all followed an ascending order. Most students focused on the fact that the numbers differed by a value of 2, and thus they continued to test this hypothesis. If they had challenged their hypothesis by asking whether the numbers 10, 9, and 8 also followed the same rule or posed another question that contradicted their assumption that adding 2 yielded the next number, they would have discovered the actual rule. Therefore, confirmation bias is a principle whereby individuals find support for their beliefs, leading to biased or incorrect solutions.

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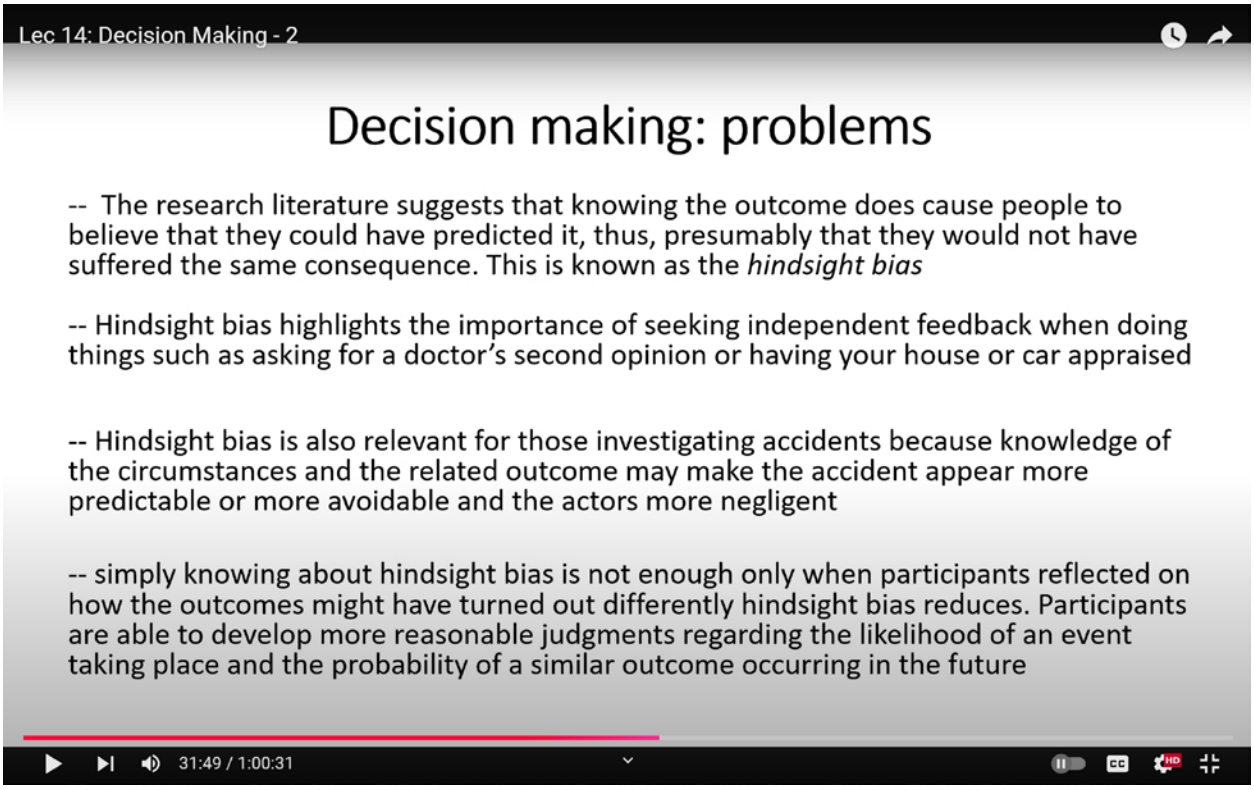

Literature suggests that knowledge of an outcome can lead individuals to believe they could have predicted it, a phenomenon known as hindsight bias. Hindsight bias refers to the common belief that one "knew it all along" after an event has occurred. For example, consider a scenario in which an accident takes place, and the investigative team produces a detailed report. This report outlines

various factors such as the driver’s condition, the environmental circumstances, the car's condition, and the driver's actions. The report ultimately suggests that the accident occurred. In this context, it is easy to assert, "I knew the driver had a problem," failing to recognize that the information provided was not available to the driver at the time.

For instance, imagine that there was a malfunctioning traffic light that changed too quickly. The driver, unaware of this malfunction, proceeded forward as the lights turned green. If two green lights activated simultaneously, this could lead to an accident. The information regarding the malfunctioning light is provided only after the incident, allowing observers to claim that the driver failed to notice the light. However, had they been in the driver's position, they might have encountered the same problem, as they would not have known the light was malfunctioning.

This tendency for individuals to assert that they would have acted better if they had known the outcome of a decision is characteristic of hindsight bias. Hindsight bias underscores the importance of seeking independent feedback in various situations, such as obtaining a second opinion from a doctor or having a car assessed by a different company. Since knowledge of an outcome can bias one’s thinking, it is advisable to avoid disclosing the first opinion when seeking a second opinion. If the second doctor is aware of the first doctor's conclusions, they may unconsciously align their judgment with those conclusions, thereby compounding the hindsight bias.

Hindsight bias is also significant in accident investigations, as knowledge of the circumstances and the resulting outcome can make an incident appear more predictable or avoidable, and the individuals involved seem more negligent. As previously explained, without comprehensive details, one might believe that the accident was solely the result of the driver's negligence. However, in reality, other factors may have contributed to the incident. If those factors become apparent only after the accident has occurred, and are unknown at the time, people often unjustly attribute negligence to the driver.

Simply being aware of hindsight bias is insufficient. Research indicates that this bias diminishes when participants reflect on how outcomes might have differed. One effective strategy for reducing this bias is to encourage evaluators to consider alternative scenarios and possible outcomes that could have occurred. When individuals are presented with this additional context, the prevalence of hindsight bias is significantly reduced. As a result, participants are more likely

to make reasonable judgments regarding the likelihood of events occurring and the probability of similar outcomes happening in the future. Providing all potential outcomes related to a particular incident can help individuals gain a fresh perspective on the event, further diminishing the influence of hindsight bias.

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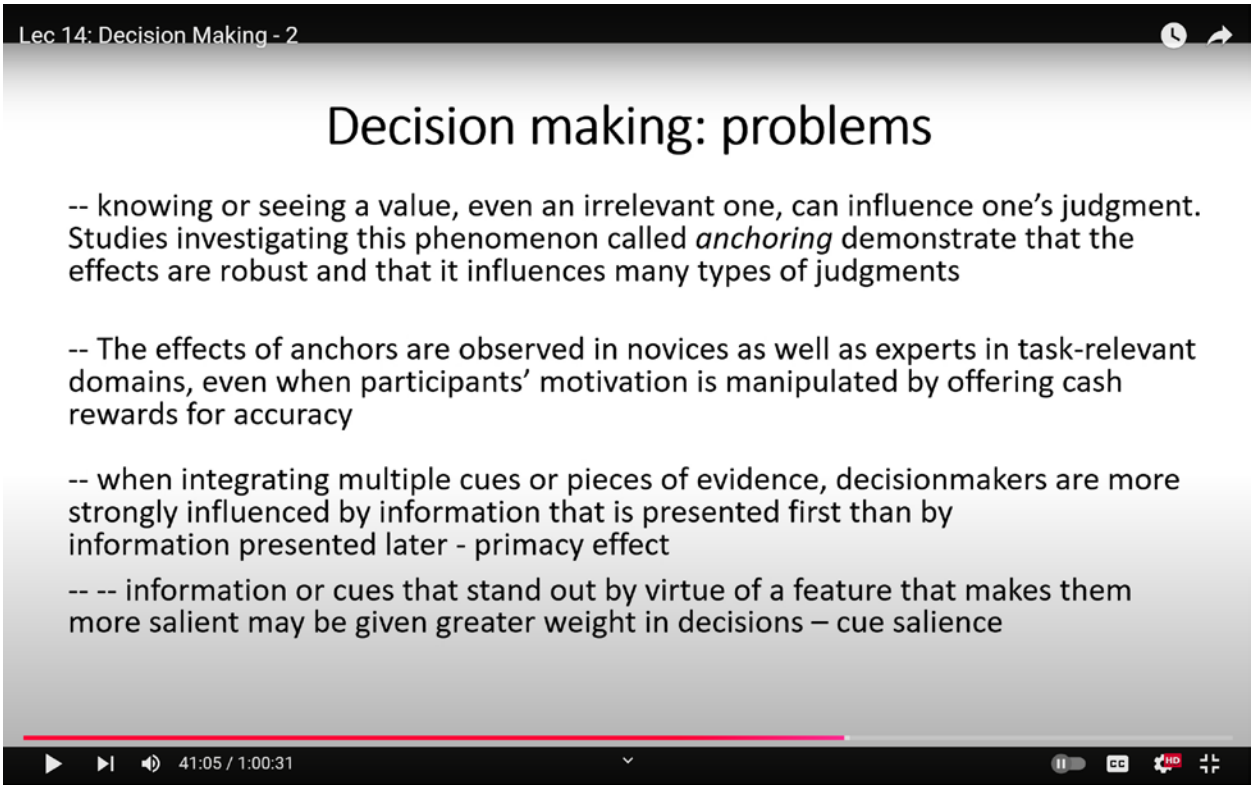

Individuals will have a greater number of options, and as a result, their judgments will be more reasonable. When judgments are reasonable and acknowledge the probability of alternative outcomes, the combination of these factors will help reduce the occurrence of hindsight bias in people. Another well-known bias that affects decision-making is referred to as anchoring bias, also known as anchoring and adjustment bias. This bias signifies that wherever we anchor our decision, that anchor influences how conclusions can be drawn from it. Let me explain further.

For instance, if you ask your grandfather for money to buy ice cream and he hands you a 10 rupee note, telling you to enjoy the ice cream and return whatever change you have, you might laugh and think, “With 10 rupees, you won't even get anything; forget about returning the money.” You might

wonder why he gave you just 10 rupees, concluding that he is a miser. However, this is not the case. In his time, 10 rupees represented a substantial amount of money. Ice cream used to cost only 1 rupee, meaning that 10 rupees would be nine times more than the price of ice cream.

Your grandfather's thinking created an anchor based on the historical price of 1 rupee for ice cream during his youth. He adjusted his perception of the current price of ice cream accordingly. He likely considered various factors, such as inflation and the anticipated price increase of ice cream, concluding that, at most, the price would rise to 5 rupees from its original price of 1 rupee. Thus, he thought you would still have 5 rupees left to return to him. However, in reality, the world has changed, and with 10 rupees, you may not be able to buy anything.

This difficulty in your grandfather's decision-making illustrates the anchoring and adjustment bias. Similarly, you may have observed lawyers arguing cases where they request the maximum possible sentence. They understand that the judge is unlikely to impose the maximum penalty, so why do they do this? The reason is straightforward: by starting high, even if the judge reduces the proposed sentence significantly, the outcome will still be more favorable than if they had initially requested a lower sentence. For example, if a lawyer asks for a 40-year prison term, they may end up securing at least a 10-year term; if they had started with a request for just 10 years, the final term would likely be even lower.

This method of biasing is referred to as anchoring bias. Research has shown that the mere presence of a value, even if it is irrelevant, can influence one’s judgment. Studies examining this phenomenon, known as anchoring, demonstrate its robustness; it affects various types of judgments.

Recall an experiment in which participants played a casino game where they had to throw a ball, and the needle would always land on either 10 or 60. Following this game, participants were asked two questions: one about the percentage of African nations in the United Nations and another regarding the presence of representatives from African nations. Those who landed on 60 used that number as an anchor and suggested that approximately 45% of African nations were represented. In contrast, those who landed on 10 estimated that around 25% of African nations were represented in the United Nations. Neither of these estimates was accurate, as the actual representation is only 24%. This illustrates how anchoring on certain values can lead to miscalculations and faulty

decision-making.

The effects of anchoring are observed in both novices and experts. It is not only inexperienced individuals who are susceptible to biases; experts are also affected in their relevant domains. Even when participants' motivations are manipulated through monetary rewards or incentives for accuracy, anchoring biases persist. This indicates that these biases are rigid and can influence decision-making regardless of motivation.

When integrating multiple cues or pieces of evidence, decision-makers are more strongly influenced by information presented first than by information presented later, a phenomenon known as the primacy effect. In the context of anchoring biases, the primacy effect plays a significant role. The first piece of information is often more memorable and tends to be the basis for further information processing. This is similar to the concept of first impressions.

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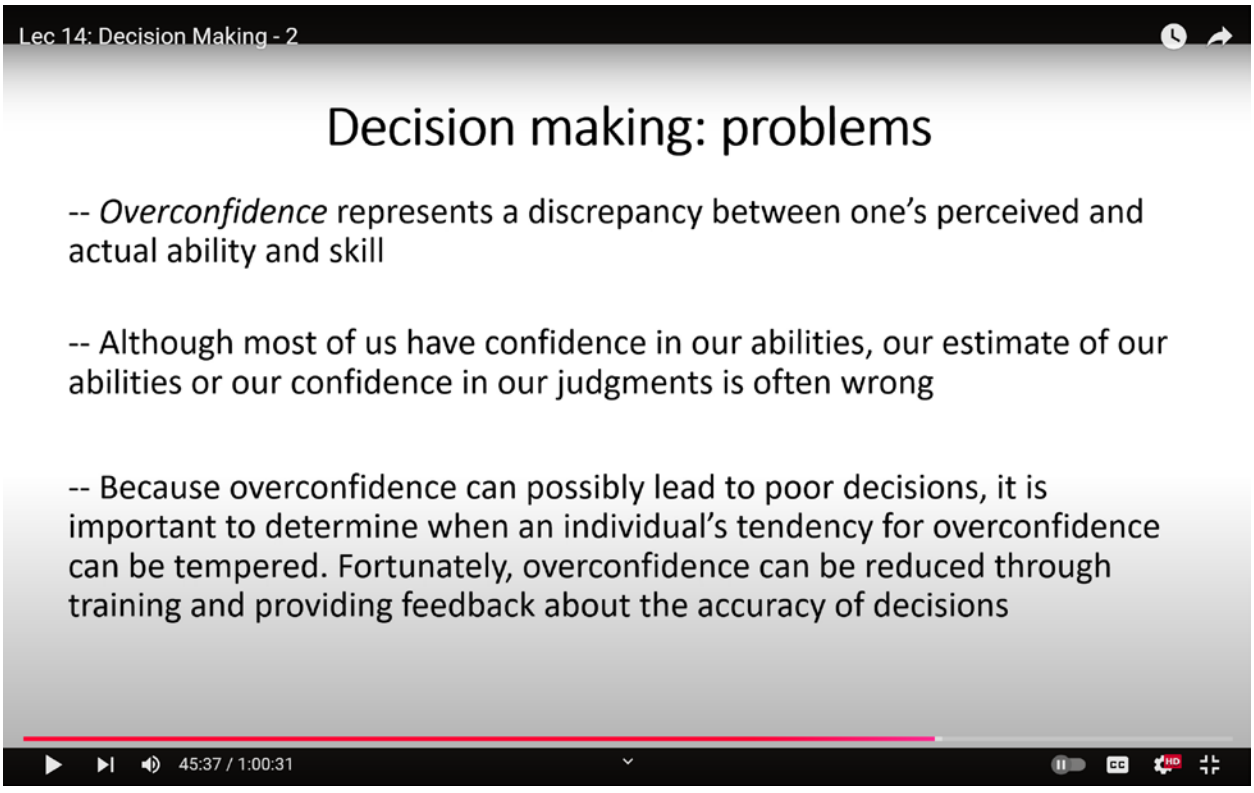

Moreover, information that stands out due to certain characteristics, making it more salient, may be given greater weight in decision-making. In anchoring and decision-making, both cue saliency

and the primacy effect significantly influence how decisions are made.

Another type of bias is known as overconfidence bias, which occurs when individuals have an inflated sense of their own abilities. For example, if you ask any driver how skilled they believe they are, most will rate their driving ability higher than their actual competency. If this were not the case, there would be significantly fewer accidents. Thus, overconfidence in certain situations can lead to biased judgments and decisions.

Overconfidence represents a discrepancy between an individual's perceived abilities and their actual skill level. While most of us possess confidence in our abilities, our self-assessment of these abilities or our confidence in our judgments is often misplaced. This overconfidence arises from a tendency to trust ourselves excessively and to believe that we can perform significantly better than others in similar situations. Consequently, this overconfidence bias manifests in various contexts.

A clear example of this bias can be observed in NASA's early predictions for their first space missions. Initially, NASA estimated the Apollo mission's failure rate to be 1 in 100,000. However, after the first accident occurred, they adjusted this failure rate to 1 in 1,000. This shift demonstrates that NASA's initial overconfidence led them to underestimate the potential for mission failures. Following the incident, their calculations reflected a significant reduction in the perceived success rate.

Given that overconfidence can lead to poor decision-making, it is crucial to recognize when an individual's propensity for overconfidence needs to be mitigated. Overconfidence can cause individuals to trust their instincts excessively, leading to drastic decisions. Therefore, implementing checks to monitor overconfidence is advisable. Fortunately, overconfidence can be reduced through training and feedback regarding the accuracy of decisions.

One effective method for decreasing overconfidence is providing training. This is why many medical professionals undergo extensive trainingto prevent overconfidence in their diagnoses. By seeking second opinions from colleagues, such as pathologists or radiologists, they can arrive at more reliable solutions for their patients. Additionally, continuous feedback during the decision-making process can further help reduce the overconfidence bias.

Now, let us discuss decision quality and strategy. How can one improve decision quality?

Decision-makers often rely on various shortcuts, which can lead to biases. The use of less systematic decision strategies, such as heuristics, tends to yield less satisfactory outcomes. When shortcuts are employed, the resulting decisions are often suboptimal because they may not perform well in novel situations or provide solutions that are appropriate for specific contexts.

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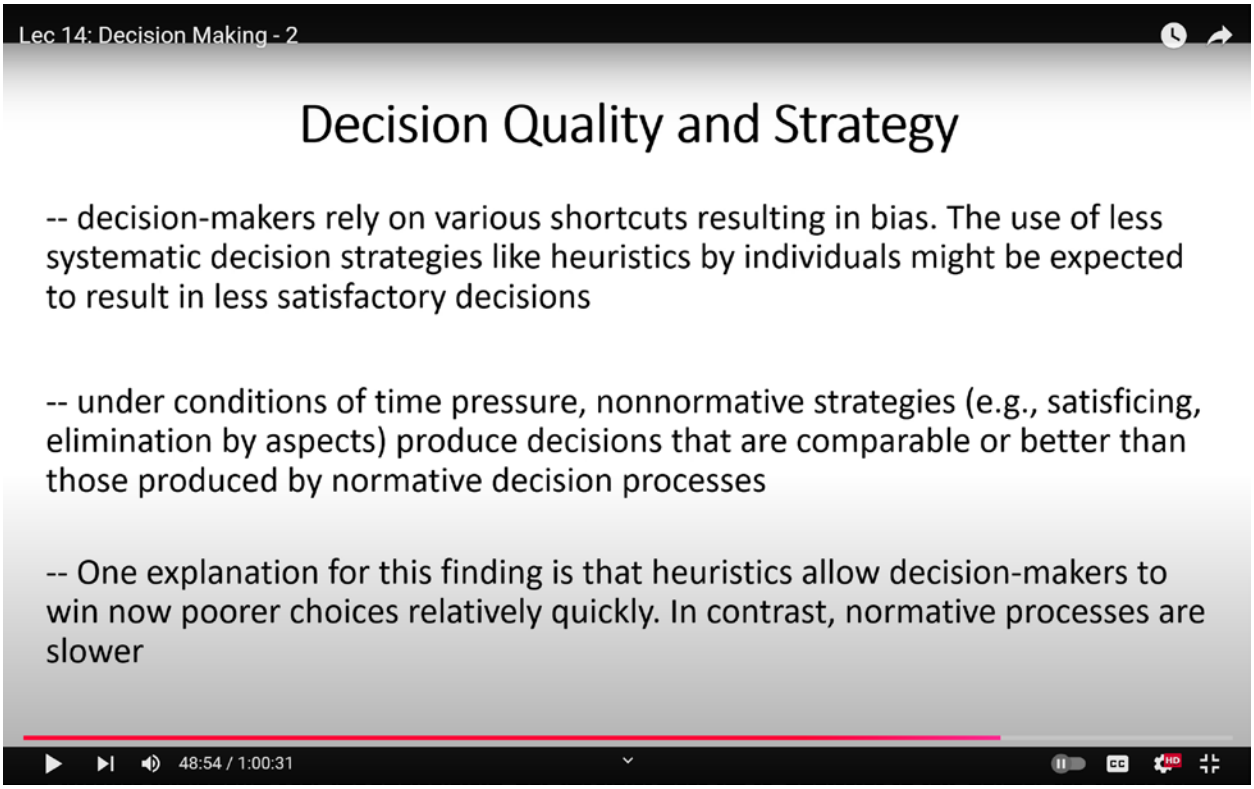

In time-pressured scenarios, however, normative strategies, such as satisfying and elimination by aspects, can produce decisions that are comparable to, or even better than, those derived from normative approaches. One explanation for this finding is that heuristics allow decision-makers to arrive at poorer choices relatively quickly, while normative processes tend to be slower. Thus, in situations requiring rapid responses, it is beneficial to use heuristics, as they can lead to faster and more probable successful solutions, albeit not always ideal or satisfying.

Let us now examine how experts and novices approach decision-making. Experts are believed to possess the skills necessary to quickly and reliably identify correct and efficient alternative solutions. They achieve this proficiency through superior methods of storing knowledge in long-

term memory and utilizing strategies based on their experiences that apply to various situations. However, the advantage that experts derive from their skills and shortcuts may not be effective in all circumstances.

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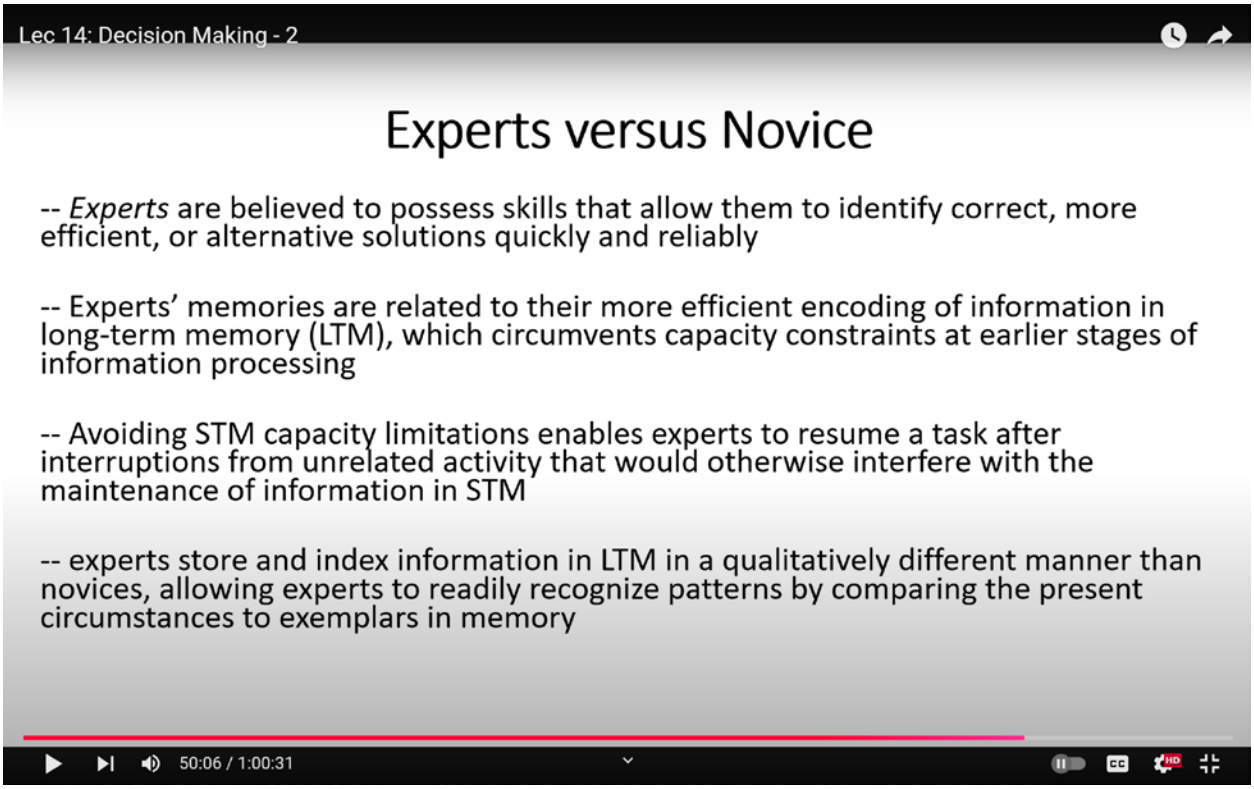

Experts' memories are characterized by their more efficient encoding of information in long-term memory. They employ strategies such as mnemonics, which streamline the way information is stored and accessed, thus mitigating the capacity constraints encountered in the early stages of information processing. By utilizing these additional strategies, experts can bypass the limitations of short-term memory (STM) or working memory.

Avoiding the constraints of short-term capacity allows experts to resume tasks after interruptions from unrelated activities that would typically disrupt the maintenance of information in STM. By employing shortcuts, experts can encode information more effectively and circumvent these limitations. When interrupted, they can pause their information processing at a certain point, and once the interference is removed, they can continue from where they left off. This strategy allows

for a flexible approach to information processing.

Experts store and index information in long-term memory (LTM) qualitatively differently than novices, enabling them to readily recognize patterns by comparing current circumstances to examples stored in memory. For instance, chess experts remember board moves and store them in such a way that when they see a board position, they can quickly identify the most appropriate move.

Experts learn numerous moves through mental stimulation, allowing them to encounter various situations. As a result, they perform better when adhering to the rules. However, their expertise becomes less valuable when rules are violated. Their skills are particularly crucial when time-consuming deliberation of options is not feasible, enabling them to perform under stress and manage competing tasks effectively. Experts excel in making relevant decisions that require immediate attention.

The improved memory skills of experts appear to be domain-specific and do not easily transfer to other tasks. Experts are specialized in one field, and this expertise cannot be generalized to other areas. Their ability to select only task-relevant information helps them manage multiple demands without overloading their memory with less important details. When faced with a problem, experts focus solely on the elements that contribute to the solution, rather than processing the entire problem.

Experts also employ various metacognitive skills to monitor their thought processes. Metacognition refers to the awareness and regulation of one’s cognitive activities. By utilizing metacognition, experts can effectively determine how to encode information, where to store it, how to retrieve it, and how to execute their plans. This self-awareness enhances their ability to make quicker and more accurate decisions.

Despite their strengths, experts do have limitations. They are not infallible and often do not achieve optimal performance. When tested against computers or statistical models, experts may not always outperform these systems. While experts are skilled at generating hypotheses and developing sophisticated decision rules, their performance can sometimes be surpassed by simple statistical models.

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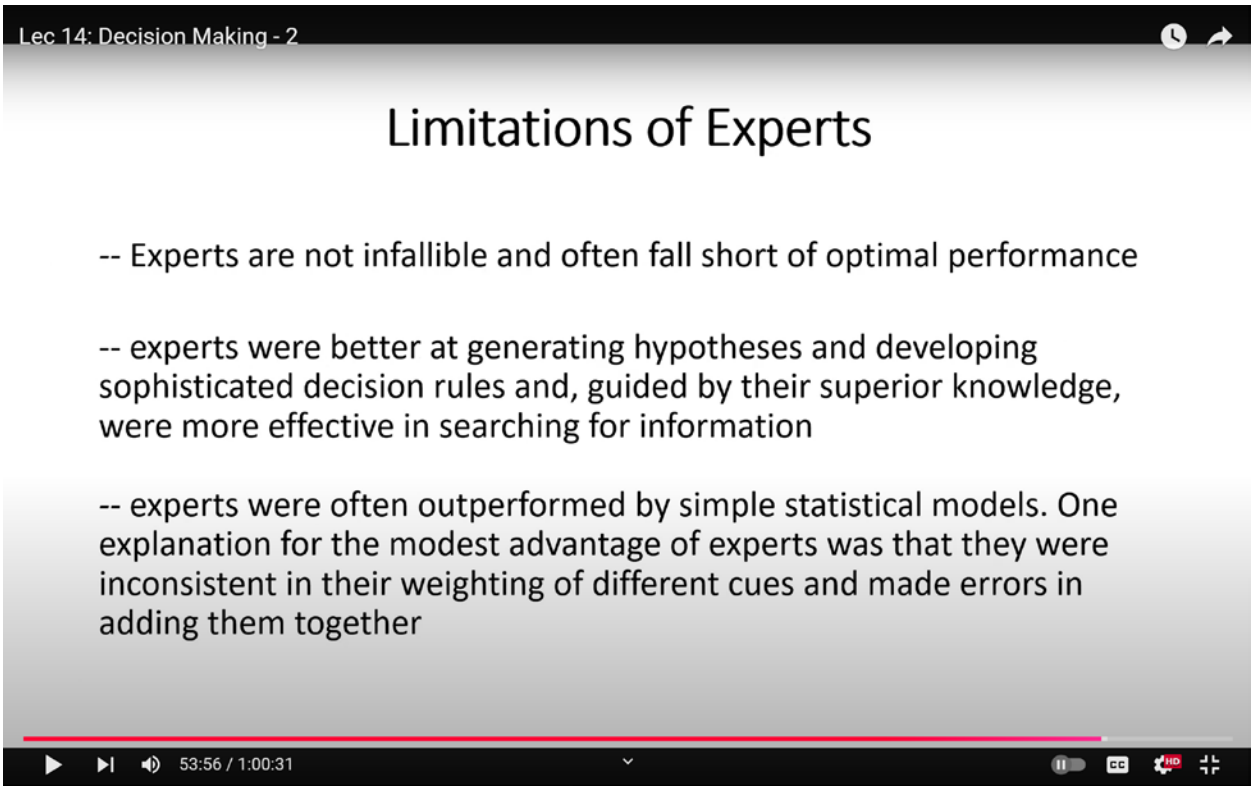

One reason for the modest advantage of experts is their inconsistency in weighing different cues, which can lead to errors when aggregating this information. In extracting relevant data from available cues, experts may occasionally falter, giving computers an edge. Furthermore, in novel situations where experts lack experience, they may also struggle.

To improve decision-making, two primary approaches can be taken: training and decision aids. Extended practice is necessary for individuals to reach performance levels comparable to experts within specific domains. Consistent practice and training are essential for developing the sophistication required to solve complex problems.

Another effective method for enhancing human decision-making is to provide support in the form of decision aids. Decision aids are tools that assist decision-makers in evaluating two or more options. These aids can take various forms, including simple protocols or computer-generated suggestions that outline the potential outcomes of different actions. For instance, if one is repairing a car, a decision aid might indicate the possible consequences of different repair methods, detailing

what may go wrong and the benefits associated with each approach. By comparing these options, individuals can make more informed decisions.

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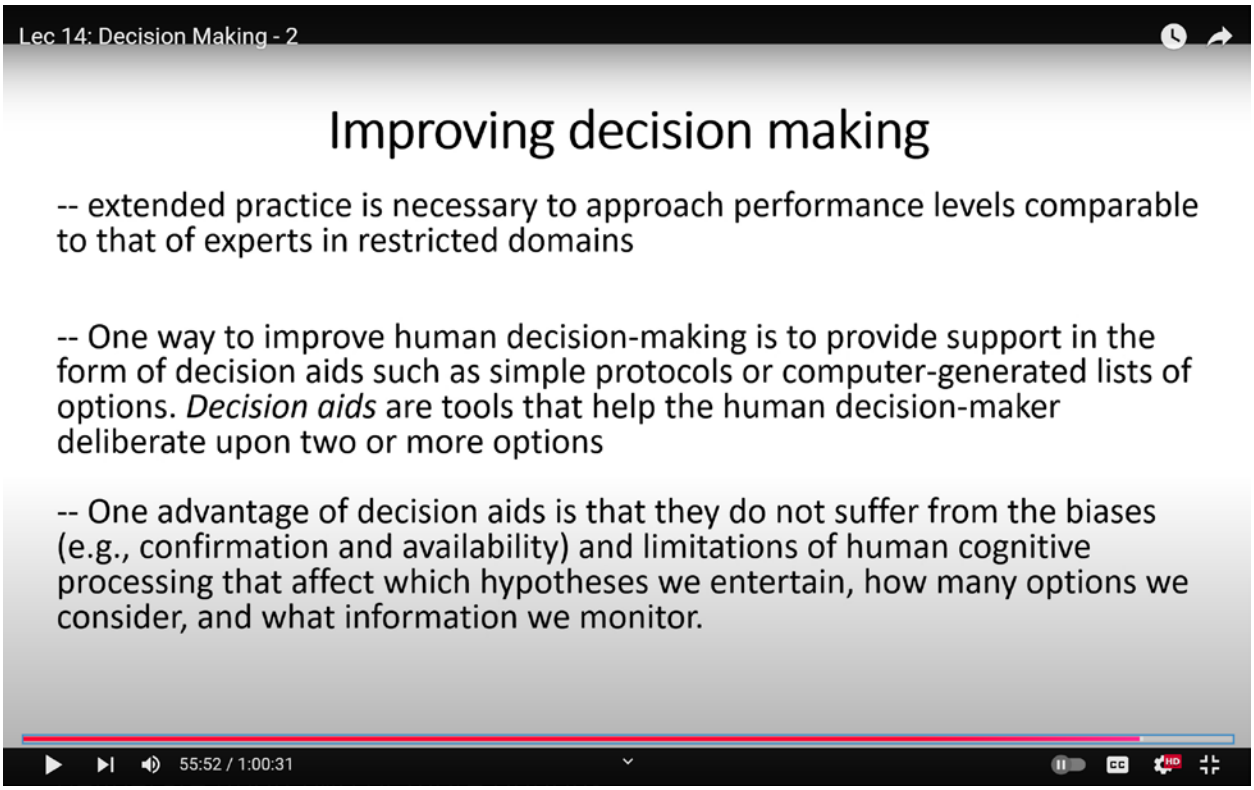

One significant advantage of decision aids is that they do not suffer from cognitive biases. Being computer-generated, these aids are free from human cognitive biases, such as confirmation bias or availability bias. They also avoid the cognitive limitations inherent in human processing. By providing clear options along with their associated advantages and disadvantages, decision aids help to eliminate or reduce various biases in decision-making.

Trusting decision aids excessively can lead to problematic outcomes. When humans rely too heavily on these aids, they may delegate all decision-making responsibilities to them. This is exemplified by a pilot who uses autopilot for all aspects of flying. While autopilot can assist with various tasks, there are scenarios where it may not make the appropriate decision. For instance, if the autopilot is tasked with landing in conditions that are not permissible or in snowy weather, it may not take the necessary precautions that a pilot would. A skilled pilot would likely resist the

urge to land in such conditions, even if the autopilot indicates it is possible. Therefore, higher-level decision-making must always involve human judgment. Humans should utilize decision aids to support their decision-making processes, but the final decision should rest with them.

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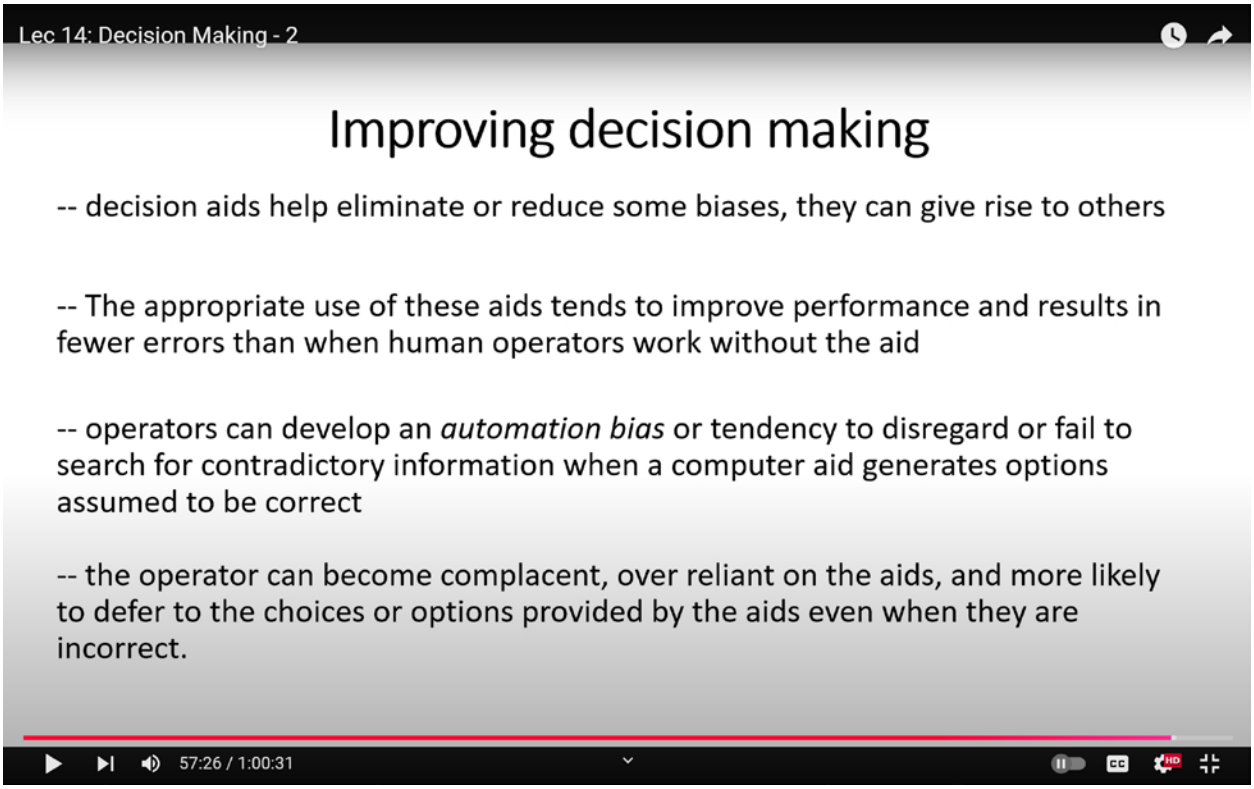

While decision aids can enhance performance and reduce errors compared to situations where human operators work independently, they can also introduce challenges. The effective use of these aids generally leads to improved outcomes; however, it may also foster automation bias. This bias occurs when operators become overly reliant on computer-generated options and fail to seek out contradictory information. When a computer performs tasks for them, individuals may become complacent and neglect to investigate alternatives that oppose the solutions suggested by the decision aids. This tendency to trust computer systems excessively is evident in the current reliance on AI systems such as Gemini and ChatGPT. For example, when students use automated AI tools to write papers, they may encounter problems due to the AI's specific response generation methods, which may not be adequate in all contexts.

Operators may become complacent and overly reliant on these aids, leading them to defer to the choices provided, even when those choices are incorrect. If someone trusts ChatGPT to compose their paper, they may overlook errors in the response, believing that the system is more intelligent and has superior knowledge. Consequently, they might avoid correcting errors due to this misplaced trust. When operators relinquish control to decision aids, they risk poor decision-making, leading to incorrect choices and potential problems. This concludes today's lecture, and we will reconvene in the next session to continue our discussion.