DOWNLOAD PDF SCIENCE OF DECISION MAKING

Chapter 1 : Lesson: The Science of Decision Making and Peer Pressure | Scholastic: NIDA

The Science Of Decision-Making: 5 Surprising Ways We Make Life Choices Jun 11, AM By Susan Scutti Emotion is not just part of, but necessary to decision-making, researchers say, and our own expectations determine the choices we make.

Twitter Neuroeconomics What happens when you choose between taking that summer vacation to Rome or a cruise to the Caribbean? What happens in your brain at these moments when choices are being made? The field of neuroeconomics investigates how decision making works in the brain. Making decisions is not always easy, but for young people it can be even more difficult than for adults. The main part of the brain involved in decision making, the prefrontal cortex , is the last part of the brain to mature. We can give our students the tools necessary to help navigate the terrain of tough choices. Emotional Climate The prefrontal cortex is the biological home to executive function. Unlike what we were once led to believe, decision making is not a cold, rational activity. Emotions play a great role in making choices. A tolerant, low-threat, welcoming atmosphere is key. What about the idea excites you? What more information do you need before you proceed? By breaking an idea or proposition up into this compass, students will be able to see what thoughts go into making a decision and learn more about their own thinking process. This activity gives students a practical and metacognitive way to understand their thinking and emotions, both of which come into play when they make decisions. Students who think critically about the choices they make will learn to make better choices in school and in life. She explains that choices are hard because the alternative is not better than, worse than, or even equal to the other option. Choices are about value. Making choices, even difficult ones, should be embraced as a way toward building ourselves and exercising our humanity. Diffuse Mode Thinking Dr. In diffuse mode thinking, the brain continues to work on a problem subconsciously. Neuroscientists tell us that you can only be in one mode at a time. An answer can also be reached in diffuse mode thinking, not just focused mode. Sometimes, an answer or solution can only be reached in diffuse mode. When faced with a difficult decision, it is important to allow for both focused and diffuse mode thinking. Focused thinking gives us the material with which we may arrive at the decision during diffuse mode. Giving students time to ponder information is important, especially when it comes to making a decision. We can activate diffuse mode by playing our favorite sport or taking a walk around the block. It does not necessarily mean we must consciously try not to think, we just need to give our minds a break from intently concentrating on the problem. Sometimes, we may venture into situations where the emotional climate may be high-stakes and may not be able to be controlled. Sometimes, we might have to make quick decisions, and using Compass Points or allowing time for diffuse mode thinking may not be relevant. This is what Dr. They shut down their conscious system and instead rely on their well-trained intuition, drawing on their deeply ingrained repertoire of chunks. This creates a neural pattern that is recalled automatically. Instead of thinking about how to do something in steps, one simply does it. This way can be much more efficient and effective in certain instances, just as the examples above illustrate. Learning how to chunk and think about things in terms of the big picture, as opposed to constantly focusing on the smaller steps, is also important in the process of decision making. Different types of decisions require different approaches. Different people require different strategies. By weaving these approaches into your classroom material, you are giving your students the tools to succeed in the classroom and in life.

Chapter 2 : NPR Choice page

But decision science has shown that people faced with a plethora of choices are apt to make no decision at all. The clearest example of this comes from studies of financial decisions.

The anxiety you felt might have been just the well-known consequence of information overload, but Angelika Dimoka, director of the Center for Neural Decision Making at Temple University, suspects that a more complicated biological phenomenon is at work. Bidders consider a dizzying number of items that can be bought either alone or bundled, such as airport landing slots. As the number of items and combinations explodes, so does the quantity of information bidders must juggle: Even experts become anxious and mentally exhausted. In fact, the more information they try to absorb, the fewer of the desired items they get and the more they overpay or make critical errors. This is where Dimoka comes in. She recruited volunteers to try their hand at combinatorial auctions, and as they did she measured their brain activity with fMRI. As the information load increased, she found, so did activity in the dorsolateral prefrontal cortex, a region behind the forehead that is responsible for decision making and control of emotions. But as the researchers gave the bidders more and more information, activity in the dorsolateral PFC suddenly fell off, as if a circuit breaker had popped. They start making stupid mistakes and bad choices because the brain region responsible for smart decision making has essentially left the premises. For the same reason, their frustration and anxiety soar: The two effects build on one another. For earlier generations, that mean simply the due diligence of looking things up in a reference book. Today, with Twitter and Facebook and countless apps fed into our smart phones, the flow of facts and opinion never stops. That can be a good thing, as when information empowers workers and consumers, not to mention whistle-blowers and revolutionaries. Maybe you consulted scores of travel websites to pick a vacation spotâ€"only to be so overwhelmed with information that you opted for a staycation. If so, then you are a victim of info-paralysis. The problem has been creeping up on us for a long time. But as information finds more ways to reach us, more often, more insistently than ever before, another consequence is becoming alarmingly clear: And nowhere are those effects clearer, and more worrying, than in our ability to make smart, creative, successful decisions. The research should give pause to anyone addicted to incoming texts and tweets. The booming science of decision making has shown that more information can lead to objectively poorer choices, and to choices that people come to regret. It has shown that an unconscious system guides many of our decisions, and that it can be sidelined by too much information. And it has shown that decisions requiring creativity benefit from letting the problem incubate below the level of awarenessâ€"something that becomes ever-more difficult when information never stops arriving. Decision science has only begun to incorporate research on how the brain processes information, but the need for answers is as urgent as the stakes are high. Thad Allen, the incident commander, estimates that he got to pages of emails, texts, reports, and other messages every day. There were eight near midair collisions. A comparable barrage of information assailed administration officials before the overthrow of the Egyptian government, possibly producing at least one misstep: Total Failure to Decide Every bit of incoming information presents a choice: But decision science has shown that people faced with a plethora of choices are apt to make no decision at all. The clearest example of this comes from studies of financial decisions. In a study, Sheena Iyengar of Columbia University and colleagues found that the more information people confronted about a k plan, the more participation fell: People felt overwhelmed and opted out. Those who participated chose lower-return optionsâ€"worse choices. Similarly, when people are given information about 50 rather than 10 options in an online store, they choose lower-quality options. So a decision is harder if the amount of information you have to juggle is greater. For mustard or socks, this may not be a problem, but the proliferation of choices can create paralysis when the stakes are high and the information complex. Many Diminishing Returns If we manage to make a decision despite info-deluge, it often comes back to haunt us. The more information we try to assimilate, the more we tend to regret the many forgone options. In a study, Iyengar and colleagues analyzed job searches by college students. The more sources and kinds of information about a company, an industry, a city, pay, benefits, corporate culture they collected, the less satisfied they were with their decision. They knew so much, consciously or unconsciously, they could easily imagine why a job not taken would have been better. In a world of limitless information, regret over the decisions we make becomes more common. We chafe at the fact that identifying the best feels impossible. It can hold roughly seven items which is why seven-digit phone numbers were a great idea. Anything more must be processed into long-term memory. That takes conscious effort, as when you study for an exam. Ignoring the repetitious and the useless requires cognitive resources and vigilance, a harder task when there is so much information. The ceaseless influx trains us to respond instantly, sacrificing accuracy and thoughtfulness to the false god of immediacy. The notion that the quick decision is better is becoming normative. An arriving email that pops to the top of your BlackBerry qualifies as a change; so does a new Facebook post. We are conditioned to give greater weight in our decision-making machinery to what is latest, not what is more important or more interesting. People give the less predictive info more weight than it deserves. In contrast, a constant focus on the new makes it harder for information to percolate just below conscious awareness, where it can combine in ways that spark smart decisions. One of the greatest surprises in decision science is the discovery that some of our best decisions are made through unconscious processes. There are at least two ways an info-glut can impair the unconscious system of decision making. The latter reaped more than twice the returns of the info-deluged group, whose analytical capabilities were hijacked by too much information and wound up buying and selling on every rumor and tipâ€”a surefire way to lose money in the market. The more data they got, the more they struggled to separate wheat from chaff.? The prefrontal cortex that waves a white flag under an onslaught of information plays a key role in your gut-level, emotional decision-making system. It hooks up feelings about various choices with the output of the rational brain. In one classic experiment, when volunteers focused on the attributes of various strawberry jams they had just rated, it completely scrambled their preferences, and they wound up giving a high rating to a jam they disliked and a low rating to one they had found delicious. How can you protect yourself from having your decisions warped by excess information? Experts advise dealing with emails and texts in batches, rather than in real time; that should let your unconscious decision-making system kick in. Avoid the trap of thinking that a decision requiring you to assess a lot of complex information is best made methodically and consciously; you will do better, and regret less, if you let your unconscious turn it over by removing yourself from the info influx. Some people are better than others at ignoring extra information.

Chapter 3 : Heuristics and Biases â€“ The Science Of Decision Making - Communities & Collaboration

The science of decision making is not well understood, especially the mechanics of it, however, scientists know the regions of the brain that are responsible for the decision-making processes.

Maximization psychology Herbert A. Further psychological research has identified individual differences between two cognitive styles: Maximizers tend to take longer making decisions due to the need to maximize performance across all variables and make tradeoffs carefully; they also tend to more often regret their decisions perhaps because they are more able than satisficers to recognise that a decision turned out to be sub-optimal. System 1 is a bottom-up, fast, and implicit system of decision-making, while system 2 is a top-down, slow, and explicit system of decision-making. In his analysis on styles and methods, Katsenelinboigen referred to the game of chess, saying that "chess does disclose various methods of operation, notably the creation of predisposition-methods which may be applicable to other, more complex systems. Both styles are utilized in the game of chess. According to Katsenelinboigen, the two styles reflect two basic approaches to uncertainty: The combinational style is characterized by: In defining the combinational style in chess, Katsenelinboigen wrote: The objective is implemented via a well-defined, and in some cases, unique sequence of moves aimed at reaching the set goal. As a rule, this sequence leaves no options for the opponent. This approach is the crux of the combination and the combinational style of play. In playing the positional style, the player must evaluate relational and material parameters as independent variables. The positional style gives the player the opportunity to develop a position until it becomes pregnant with a combination. The terminal points on these dimensions are: For example, someone who scored near the thinking, extroversion, sensing, and judgment ends of the dimensions would tend to have a logical, analytical, objective, critical, and empirical decision-making style. However, some psychologists say that the MBTI lacks reliability and validity and is poorly constructed. For example, Maris Martinsons has found that American, Japanese and Chinese business leaders each exhibit a distinctive national style of decision-making. Several brain structures, including the anterior cingulate cortex ACC , orbitofrontal cortex and the overlapping ventromedial prefrontal cortex are believed to be involved in decision-making processes. A neuroimaging study [40] found distinctive patterns of neural activation in these regions depending on whether decisions were made on the basis of perceived personal volition or following directions from someone else. Patients with damage to the ventromedial prefrontal cortex have difficulty making advantageous decisions. A study of a two-alternative forced choice task involving rhesus monkeys found that neurons in the parietal cortex not only represent the formation of a decision [42] but also signal the degree of certainty or "confidence" associated with the decision. Emotions in decision-making Emotion appears able to aid the decision-making process. The somatic marker hypothesis is a neurobiological theory of how decisions are made in the face of uncertain outcome. Barbey and colleagues provided evidence to help discover the neural mechanisms of emotional intelligence. Please help improve this article by adding citations to reliable sources. Unsourced material may be challenged and removed. May Learn how and when to remove this template message During their adolescent years, teens are known for their high-risk behaviors and rash decisions. Recent research[citation needed] has shown that there are differences in cognitive processes between adolescents and adults during decision-making. Researchers have concluded that differences in decision-making are not due to a lack of logic or reasoning, but more due to the immaturity of psychosocial capacities that influence decision-making. Examples of their undeveloped capacities which influence decision-making would be impulse control, emotion regulation, delayed gratification and resistance to peer pressure. In the past, researchers have thought that adolescent behavior was simply due to incompetency regarding decision-making. Currently, researchers have concluded that adults and adolescents are both competent decision-makers, not just adults. Recent research[citation needed] has shown that risk-taking behaviors in adolescents may be the product of interactions between the socioemotional brain network and its cognitive-control network. The socioemotional part of the brain processes social and emotional stimuli and has been shown to be important in reward processing. The cognitive-control network assists in planning and self-regulation. Both of these sections of the brain change over the course of puberty. However, the socioemotional network changes quickly and abruptly, while the cognitive-control network changes more gradually. Because of this difference in change, the cognitive-control network, which usually regulates the socioemotional network, struggles to control the socioemotional network when psychosocial capacities are present. Because teens often gain a sense of reward from risk-taking behaviors, their repetition becomes ever more probable due to the reward experienced. In this, the process mirrors addiction. Teens can become addicted to risky behavior because they are in a high state of arousal and are rewarded for it not only by their own internal functions but also by their peers around them. Adults are generally better able to control their risk-taking because their cognitive-control system has matured enough to the point where it can control the socioemotional network, even in the context of high arousal or when psychosocial capacities are present. Also, adults are less likely to find themselves in situations that push them to do risky things. For example, teens are more likely to be around peers who peer pressure them into doing things, while adults are not as exposed to this sort of social setting.

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Chapter 4 : Decision theory - Wikipedia

How You Decide: The Science of Human Decision Making is rated out of 5 by

Use this if you just want the body text! Printer-friendly format, with images Removes other content, and advertising, but images remain. Use this if you want to print out pictures alongside the body text! Your classmates start making fun of her. Or suppose a friend wants you both to audition for a play, but you feel too shy. He pleads with you to do it, so you agree. As a teen, you can be especially sensitive to peer influence, better known as peer pressure. Science helps explain why. But during our teen years, our brains have unique characteristics that impact this calculation. Dopamine helps transmit signals in the brain that make people feel happy. The number of brain receptors interacting with dopamine is higher in adolescence than at any other time of life. This means that when a teen is exposed to a rewardâ€"such as a complimentâ€"the reward center reacts more strongly than it would for an adult or a child. Thus, the presence of peers makes the already sensitive reward system even more sensitive to potential rewards. This can be positive, by encouraging peers to take on new challenges. But it can also lead to dangerous decisionsâ€"such as using alcohol or drugs, or getting into other high-risk situations. In a study conducted by Steinberg, teens and adults played a driving video game in which they would make more money the faster they arrived at the end of a road. Driving through yellow lights could speed up their time, but could also cause an accident. Alone, teens took no more risks than adults. But when their friends were with them, teens took more risks and ran more yellow lights. Real life is not much different. Statistics show that teenage drivers are 2. Be aware that your brain works differently in groups than when you are alone. Pause and exercise a little extra caution in those situations.

Chapter 5 : The Science of Making Decisions

This book is a practical, accessible, engaging, and deeply penetrating introduction to the science of decision making. It is a successful fusion of problem-based learning and spreadsheet computation with decision science.

The practical application of this prescriptive approach how people ought to make decisions is called decision analysis , and is aimed at finding tools, methodologies and software decision support systems to help people make better decisions. In contrast, positive or descriptive decision theory is concerned with describing observed behaviors under the assumption that the decision-making agents are behaving under some consistent rules. These rules may, for instance, have a procedural framework e. The prescriptions or predictions about behaviour that positive decision theory produces allow for further tests of the kind of decision-making that occurs in practice. There is a thriving dialogue with experimental economics , which uses laboratory and field experiments to evaluate and inform theory. In recent decades, there has also been increasing interest in what is sometimes called "behavioral decision theory" and this has contributed to a re-evaluation of what rational decision-making requires. Expected utility hypothesis The area of choice under uncertainty represents the heart of decision theory. Petersburg paradox to show that expected value theory must be normatively wrong. He gives an example in which a Dutch merchant is trying to decide whether to insure a cargo being sent from Amsterdam to St Petersburg in winter. In his solution, he defines a utility function and computes expected utility rather than expected financial value see [7] for a review. The phrase "decision theory" itself was used in by E. The work of Maurice Allais and Daniel Ellsberg showed that human behavior has systematic and sometimes important departures from expected-utility maximization. The prospect theory of Daniel Kahneman and Amos Tversky renewed the empirical study of economic behavior with less emphasis on rationality presuppositions. Kahneman and Tversky found three regularities â€” in actual human decision-making, "losses loom larger than gains"; persons focus more on changes in their utility-states than they focus on absolute utilities; and the estimation of subjective probabilities is severely biased by anchoring. Intertemporal choice Intertemporal choice is concerned with the kind of choice where different actions lead to outcomes that are realised at different points in time. If someone received a windfall of several thousand dollars, they could spend it on an expensive holiday, giving them immediate pleasure, or they could invest it in a pension scheme, giving them an income at some time in the future. What is the optimal thing to do? However even with all those factors taken into account, human behavior again deviates greatly from the predictions of prescriptive decision theory, leading to alternative models in which, for example, objective interest rates are replaced by subjective discount rates. Interaction of decision makers[edit] Some decisions are difficult because of the need to take into account how other people in the situation will respond to the decision that is taken. The analysis of such social decisions is more often treated under the label of game theory , rather than decision theory, though it involves the same mathematical methods. From the standpoint of game theory most of the problems treated in decision theory are one-player games or the one player is viewed as playing against an impersonal background situation. Individuals making decisions may be limited in resources or are boundedly rational have finite time or intelligence ; in such cases the issue, more than the deviation between real and optimal behaviour, is the difficulty of determining the optimal behaviour in the first place. One example is the model of economic growth and resource usage developed by the Club of Rome to help politicians make real-life decisions in complex situations[citation needed]. Decisions are also affected by whether options are framed together or separately; this is known as the distinction bias. In , Dwayne Rosenburgh explored and showed how decision theory can be applied to complex decisions that arise in areas such as wireless communications. Heuristic The heuristic approach to decision-making makes decisions based on routine thinking, which, while quicker than step-by-step processing, opens the risk of introducing inaccuracies, mistakes and fallacies, which may be easily disproved in a step-by-step process of thinking. Another example is that decision-makers may be biased towards preferring moderate alternatives to extreme ones; the "Compromise Effect" operates under a mindset driven by the belief that the most moderate option, amid extremes, carries the most benefits from each extreme. Advocates for the use of probability theory point to:

Thus, for every decision rule, either the rule may be reformulated as a Bayesian procedure or a limit of a sequence of such , or there is a rule that is sometimes better and never worse. Alternatives to probability theory[edit] The proponents of fuzzy logic , possibility theory , quantum cognition , Dempsterâ€"Shafer theory , and info-gap decision theory maintain that probability is only one of many alternatives and point to many examples where non-standard alternatives have been implemented with apparent success; notably, probabilistic decision theory is sensitive to assumptions about the probabilities of various events, while non-probabilistic rules such as minimax are robust , in that they do not make such assumptions. Ludic fallacy A general criticism of decision theory based on a fixed universe of possibilities is that it considers the "known unknowns", not the " unknown unknowns "[citation needed]: This line of argument, called the ludic fallacy , is that there are inevitable imperfections in modeling the real world by particular models, and that unquestioning reliance on models blinds one to their limits.

Chapter 6 : The Science of Decision Making and Peer Pressure | Scholastic: NIDA

LKS: One of your marquee programs is the Science of Decision Making. Can you tell us about that course and why it's important? BL: We tend to think about decision makers as being people in leadership positions, but every person who works in your organization, every member of your family, every member of the community is a decision maker. You have to decide what to buy, who to partner with, what government regulations to anticipate.

July 14, 2 Minutes Are you a decision maker? Of course you are. If not for a major corporation or start-up, at least for your family or your own life. Do you want to get face-to-face with the big decision maker who can improve your life and business? Look in the mirror. This blog is dedicated to all those who want to take charge by being a more effective decision maker. I look forward to conversations about techniques and stumbling blocks. What kinds of decisions do you struggle with? What makes them so hard? What techniques have you found to leap over those hurdles? Being an effective decision maker helps you make the best choices, but more than that, it lets you decide what the choices are and, in fact, what problem is being solved. More than anything else, it puts you in charge of your life and your business. It is probably the most important skill for success. So why does everybody hate making decisions? I have a decision to make! Decision-making is both art and science. There is an entire discipline of decision science. You can get a degree in it. Decision science teaches you how to maximize the expected value of your utility function. What does that mean? How does this apply to real people making real decisions? I hope to cut through the mumbo-jumbo and pull out techniques that you can really use. Decision science often focuses on making a choice among alternatives, yet being an effective decision maker requires much more than this. This is where the art comes in. What is the most important problem to be solved? What are the alternatives? What does the future hold? What about all these conflicting goals? To do this well requires both courage and imagination. Pep talks help, but specific tools and techniques are better. I hope to hear from you.

Chapter 7 : Game Theory: The Science of Decision-Making - Educational Hours

Decision making is part of the executive functions of the brain, those which manage higher order cognitive processes. Making decisions is not always easy, but for young people it can be even more difficult than for adults.

Have you ever wondered why you feel inclined to go with your gut feelings when making a decision? The affect heuristic is a swift, involuntary response to a stimulus that speeds up the time it takes to process information. Researchers have found that if we have pleasant feelings about something, we see the benefits as high and the risks as low, and vice versa. As such, the affect heuristic behaves as a first and fast response mechanism in decision-making Heuristic processing assumes that affective processing, or emotional processing, occurs outside our awareness, with people simply making sense of their emotional reactions as they happen. As situations become more complicated and unanticipated, mood becomes more influential in driving evaluations and responses. A key assertion of AIM is that the effects of mood tend to be exacerbated in complex situations that demand substantial cognitive processing. People in a positive mood will interpret the environment as benign. Hence, they process information globally and heuristically. In contrast, those in a negative mood will interpret the environment as problematic and they will process information locally and diagnostically. People tend to use Affect-as-Information heuristic when the evaluation objective is affective in nature, when information is too complex, or when there are time constraints Clore et al. In simple terms, the affect heuristic works as follows: The former child will associate dogs with pleasant feelings, and will unconsciously judge the risk in saying hello to the new dog as low and the benefit as high. The latter child will associate dogs with fear and pain, and will judge the risk in getting close to the strange dog as high and the benefit as low. Without thinking about it, the former will probably approach the dog in question, while the latter will not. Both children display the affect heuristic in actionâ€”an involuntary emotional response that influences decision-making. Other Heuristics The previous sections described the more commonly used heuristics. The following heuristics are also noted, but without detailed descriptions or examples. Included here for completeness. With an educated guess a person considers what they have observed in the past, and applies that history to a situation where a more definite answer has not yet been decided. This particular heuristic is applied when a claim or a belief seems silly, or seems to defy common sense. It is a practical and prudent approach that is applied to a decision where the right and wrong answers seem relatively clear cut. For example, when eggs are recalled due to a salmonella outbreak, someone might apply this simple solution and decide to avoid eggs altogether to prevent sickness. This approach suggests that if something is scarce, then it is more desirable to obtain. It is a simple heuristic that allows an individual to make an approximation without having to do exhaustive research. Summary and Conclusion We make hundreds, if not thousands of decisions each day, from what shirt to wear, to which train to catch to work, what to read, who to smile at, or who to ignore. Some decisions are limited to our own actions; some decisions may affect other people, either directly or implicitly. For example, we might make a decision about who to assign to a particular project â€” which will directly affect that person and their subsequent behaviour. Alternatively, the fact that we did not acknowledge a smile or greeting from someone â€” even though we saw it â€” may effect the subsequent behaviours and attitudes of that person e. Many of these decisions are made intuitively, or to be more precise, using one or more of the heuristics previously described. For example, there are masses of information reaching our senses before we cross the road. The distance and estimated speeds of cars and cyclists, the presence of other people who may or may not be obstructing our progress, etc. The fact that we got to the other side of the road safely justified our decision to cross when we did. But what if that time is not available? For example, the surgeon undertaking a routine operation where the patient suddenly goes into cardiac arrest. Heuristics will enable the surgeon to instantly make â€” in all probability â€” the right decisions, e. But at the same time, relying on precedent and recall will sometimes trip us up when we come across the unique. This article merely touches on some of the social psychology research that underpins how we make decisions. Being aware of how we make decisions gives us some insight into the inherent biases we might use â€” often unconsciously â€” in making those decisions. In particular, the tendencies towards stereotyping, prejudice and discrimination. Just because something has worked in the past does not mean that it will work again, and relying on heuristics can make it difficult for us to see alternative solutions or come up with new ideas. We will always tend towards saving our brains from doing any extra work in cognitively analysing vast amounts of data if we think there is a shortcut to the answer. Fortunately the application of heuristics make this work more often than not, but the consequence of getting it wrong have to be taken into account. Perhaps heuristics is best summed up by this quote from Daniel Kahneman: References and Further Reading Cervone, D. Anchoring, efficacy, and action: The influence of judgmental heuristics on self-efficacy judgments and behavior. The more you ask for, the more you get: Anchoring in personal injury verdicts. Applied Cognitive Psychology, 10, Chapman, L. The limits of anchoring. An interpretation in terms of the availability heuristic. Journal of Experimental Social Psychology. 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Journal of Experimental Social Psychology, 37, A new look at anchoring effects: Basic anchoring and its antecedents. Journal of Experimental Psychology: Effects of situation familiarity and financial incentives on use of the anchoring and adjustment heuristic for probability assessment. Organizational Behavior and Human Decision Processes, 44, Author Biography Stephen Dale is a freelance community and collaboration ecologist with experience in creating off-line and on-line environments that foster conversations and engagement. He is both an evangelist and practitioner in the use of collaborative technologies and Social Media applications to support personal learning and development, and delivers occasional training and master-classes on the use of social technologies and social networks for improving digital literacies.

Chapter 8 : The Science of Decision Making: In the Classroom and Beyond | The Learning Mind

Decision Quality. There is great importance in learning how to make decisions through the implementation of a process. Decision Quality ensures decisions are benefited from the development and use of a process.

I turned to decision making because it is among the most important functions that we have. We make countless numbers of decisions every single day. I finished my PhD, and then went back to medical school and clinically trained as a psychiatrist. After completing psychiatric training, I turned back to the field of cognitive neuroscience with a particular interest in how emotions and cognition are represented in the brain and how they interact. Clearly emotional factors affect how we make decisions all the time. And for many psychiatric disorders, patients that are symptomatic are frequently making poor decisions about numerous things throughout the day, such as how they handle their anxiety and other emotional states. So there clearly has to be dysfunction in the neurocircuits of psychiatric patients affecting their decisions, and we need to understand this better in order to come up with better treatments for mental disorders. So you can see that I come at this field a little bit as a psychiatrist and a little bit as a neuroscientist. What are the Big Questions? Lee, you were trained in economics before you ventured into neuroscience as a graduate student. How did you end up getting involved in this area of research? My ultimate goal or desire to study neuroscience was to understand the physical substrates of mental phenomenaâ€"how our thoughts are generated by brain processes; what happens in your brain when you are thinking. These give you some clues about possible and likely outcomes of your actions, and you can do this mental simulation for many different actions before you actually make a choice. Having studied economics, I knew the mental simulations involved in decision making could be studied using economic models and a rigorous mathematical approach. Such a quantitative approach is really important for studying biologically-based thoughts, because thoughts have a lot of subjective components that could get in the way of studying something scientifically. Thoughts mean very different things to different people, which makes them hard to quantify. But economic theories show that you can assign numerical values called utilities to outcomes. You can assign the same numerical values to both real outcomes and mentally simulated outcomes, whether they are juice or money so you have something concrete to work with that you can measure and connect to neuronal activity. Wang, why have you focused on this field? I am interested in understanding basic neural processes and computations that underlie cognitive functions. Decision making opens a window to cognition. It bridges neurobiology and cognitive science. What makes this field exciting is that it really is cross disciplinary. I trained in theoretical physics and about 10 years ago got into the field of neurobiology of decision making accidentally. Before that, using biologically based neural circuit modeling, we had been studying the activity of neurons in the parts of the brain that play a role in working memoryâ€"the ability to hold and manipulate information in your mind in the absence of direct sensory stimulation. When people started to uncover the neuronal correlates of decision computations, I realized that the neurocircuit computer model we developed for working memory could also explain behavioral and neurophysiological observations seen with decision-making. This realization there may be a shared neural circuit mechanism for working memory and decision making led us to study all kinds of decision processes. This is a young field. How did it take root and what is new? In many ways, this area picked up steam a little over 20 years ago with research on perceptual decision making. Monkeys were trained to report the direction of motion they were seeing on a visual displayâ€" whether the dots were going up or down. During these experiments, we were aware the monkeys were doing this for one reason: We are using our perceptual system while at the same time kicking in parts of the brain that are more specialized for placing a value on what we are seeing. And that leads into the whole economic decision making that Daeyeol was talking about. What is new is that, using experimental decision tasks, people like Daniel and Daeyeol and others are now recording neuronal activity from brain areas that are downstream from sensory areas, and these downstream brain areas are probably where decisions or choices are made. That is new researchâ€"it started about 10 years ago. There definitely has been a change in the culture and the minds of the neuroscientists that study decision making. This occurred somewhere between 10 to15 years ago. Daniel is looking at how desirable and aversive information is integrated into decision making. This knowledge was a prerequisite to understanding how the brain makes a decision because now when we test animals in our experiments we can distinguish changes in neuronal activity due to perception and motor control from those related to mental simulations and decisions. About 10 years ago there was a paradigm shift when people realized they could ask more complicated questions related to thinking and decision making. Often, the main parameter being manipulated in an experiment nowadays is rewards. Your decisions are typically really about some aspect of rewards, whether immediate or delayed into the distant future, and researchers are in a position where they can actually study how neurons are representing rewards, and how information on rewards may be integrated over time in order to reach a decision. Researchers have also come up with formal neurocircuit models of neurons to show how signals that are representing information about the sensory world are integrated over time and accumulated. You can really watch and see how your choice behavior adapts and changes from trial to trial, according to environment and task design, and such changes are reflected in the recorded activity of single neurons. And are we starting to understand how that adaptability comes about at the neural level? One of the important ingredients is reinforcement learning and its neural implementation. Reinforcement learning occurs when you are not explicitly taught what you are supposed to learn, but rather learn it by trial and errorâ€”by getting feedback about how well you predicted the outcomes of your behavioral choices. There is a substantial body of work showing that the neurotransmitter dopamine plays a central role in reward signaling, and that it can greatly affect changes in the synaptic connections between neurons in a way consistent with reinforcement learning. There is a lot of movement in the field to figure out what theoretical framework is useful and should be used by investigators in the field to study decision making, and one of them is reinforcement learning theory. This theoretical framework, which has roots in many different disciplines, including psychology, artificial intelligence and machine learning, computer science, and economics, is actually playing a central role in neurobiological studies of decision making. Such an economic framework draws a lot of people doing neuroscience studies at multiple levels, including people doing neuroimaging studies in humans and those doing single neuron recordings in animals. To do research in decision making neuroscience, you can do multiple single-neuron recordings to detect which neurons are active during a decision making task, or you can do PET scanning or functional MRI to show heightened activity in larger swathes of the brain during a decision making task. How do the two types of techniques complement each other? A minority of people look at the decision-related signals at the level of single neurons. The majority of people studying neurobiology of decision making are using noninvasive neuroimaging techniques like PET and fMRI in humans. Looking at the signals you get from the human brain and trying to relate those to the signals you observe at the single-cell level in animals has been very fruitful and taught us a lot of things about the neural basis of decision making. Has the research using noninvasive neuroimaging techniques for the human studies confirmed what you are finding on the single-cell level with the monkey studies? Research is revealing how neurons code the value of different options when people make decisions. These MRIs show brain areas whose activities increased according to how much human subjects valued the option they chose between two different alternatives researchers presented to them. The type of questions you can ask in humans versus animals studies are different due to the different level of resolution in an imaging study compared to recording from single neurons in brain. Functional imaging is not looking at single neurons, but thousands of neurons. You are also not looking at the activity of those neurons with millisecond resolution, but looking at the activity of those neurons averaged over the course of about a second. So they are complementaryâ€”functional imaging looks at the whole brain, while Daeyeol can look at only a handful of neurons at a time. For example, you can have two groups of neurons anatomically close to each other with opposite response properties. If you were imaging the area of the brain that houses those two neuronal groups, you would only be able to record the average activity, so you will not see the fact that one group of neurons signals one thing, and the other group of neurons signals something completely opposite. You might conclude that the brain area does not encode the parameter you manipulated, because the activity across the entire group of neurons is the same in both conditions as far as an imaging experiment can tell. But if you could record from these neurons individually, you would see that you have two groups of neurons doing opposite things right next to each other in the brain and they do encode the parameter of interest. One of the puzzling things is that in humans, if you have a lesion in one part of the brain that causes a certain deficit, and then you compare that to deficits that you get from another lesion in a different part of the brain, often you get very clear behavioral differences. But when you try to then go and measure the neural activities in the corresponding two different areas in monkey brains, often times you get neuronal signals that are very similar. So trying to characterize the unique functions of different brain areas is one of the most important challenging questions we face. To do that we have to improve the quality and resolution of the measurements we are making, as well as think a lot harder about the task that you need to use to elicit certain kinds of cognitive processes during decision making. What are some of the other current driving questions? The field is still in its infancy, but one of the driving forces behind the field now is to try to understand more precisely what are the computations performed in different brain areas, and how they are similar or different. Also how do they communicate with each other, and how is information transformed as it moves around in the brain. How do these different representations about important variables for decision making come together and allow you to form a decision? When someone makes a decision, this involves pulling up a memory and a value system and an emotional response. Many of the questions so far have been addressed by focusing on local circuits. For example, there is a lot of outstanding work on understanding how neurons in the primary visual cortexâ€"the part of the brain where visual signals are processedâ€"become selectively active in response to specific visual stimuli, such as the orientation of lines seen. You can study the local circuit mechanisms when you try to answer these kinds of questions. But a decision involves many processes--you need to accumulate evidence for or against different choice options, evaluate their possible outcomes and risks, suppress certain learned responses and biases, etc. So when you are interested in decision making, you cannot avoid looking at how the different parts of the brain do different computations in a coordinated way. There are no good theories about the operation of a larger-scale brain system with many interactive modules. How can we figure out such a complex scenario? In these two different view of the monkey brain, three areas thought to play a key role in making decisions are highlighted dorsal anterior cingulate cortex, lateral intraprietal cortex and dorsolateral prefrontal cortex. Researchers are trying to decipher how such far-flung regions of the brain work together in decisionmaking. We study very specific tasks so we can study the different encoding process of neuronsâ€"how information is represented in different brain centers. But ultimately, if you want to study functional interactions between brain structures, you have to do experiments that target specific neuronal subtypes in specific locations and manipulate their activity while you are studying the effects on other parts of the neural systems that are mediating the behavior. Hopefully all of us in 10 or 20 years will have gotten to the point where we can start to manipulate the neurons that we have studied, and predict their effects on processing in other neurons in other brain structures, as well as their effects on behavior. That makes it more important for us to try to figure out how these anatomical structures in the brain actually coordinate their activity and work together. In physics, there is a pursuit to identify simple, universal laws of nature. Do you think this is possible in neuroscience--to find some underlying simplicity to all the complexity? It comes back to the notion of building blocks. The hope is that if we can understand with our magnifying lens the mechanisms for some very important basic computations, such as how neuronal circuits accumulate and value information about different choices, then this understanding will become the basic building blocks that we can put together to explain all kinds of possible complex thinking and behaviors. In my lab we are currently putting those things together in a larger-scale brain circuitry model to explain how your brain switches from task to task, which is rather complex and involves a number of different processes. We and other researchers in the field are testing the idea that when you put those building blocks together in a circuit, you may be able to explain more complex behavior. Since the design of the toolbox may not be completely rational, it may not be easy to come up with one set of equations for how the tools are collected in the first place. Another one of the real challenges in terms of understanding decision making is figuring out how the brain represents new situations in order to understand how the brain makes decisions about such new situations. So what do you envision as the practical applications of this research?

Chapter 9 : The Art and Science of Decision Making â€“ Take Charge

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