RESEARCH STATEMENT

I study how people make judgments and decisions and how these processes shape behavior at the individual, group, and organizational level. I am also interested in using this process level understanding of decision making to help people make better judgments and decisions. I investigate these questions with computational modeling and methods from the behavioral, cognitive, and neuro - sciences. Below I describe my three lines of research that I have developed around these interests.

DELIBERATION

How do people form a belief or a preference and ultimately make a judgment or a decision? That is, how do people deliberate? I have investigated this question from many different angles including how people make perceptual decisions (Liu & Pleskac, 2011), economic decisions (Zeigenfuse, Pleskac, & Liu, 2014), confidence judgments (Pleskac & Busemeyer, 2010), and probabilistic forecasts (Pleskac, 2012). What my colleagues and I have discovered is that across this wide array of judgments and decisions, people appear to use the same or a similar deliberation process where samples of information are sequentially sampled about the object or event in question. The information and the source of the information differ depending on the decision. For example, sometimes it comes from perceptions and other times from evaluative judgments. Regardless, this information is accumulated over time forming the basis for people's beliefs and preferences and ultimately determining the judgments and decisions they make. Our understanding of deliberation is precise enough that we have developed sophisticated mathematical models of this process. The models predict the distribution of choices or judgments people will make about a set of options, how fast they will make those responses, and the confidence they will have in them.

This ability to model this wide array of human performance is simply not present in most economic and psychological models of choice. My colleagues and I have used these models in several different areas. For instance, knowing the dynamics of the deliberation process has proven quite insightful in characterizing the confidence people have in their choices and predictions (Pleskac & Busemeyer, 2010). We often think of confidence as some static variable that reflects our state of mind at the instant a choice or prediction is made. However, my work has shown that confidence is a dynamic variable. Because the same deliberation process used to make a choice drives confidence and this process continues even after a choice is made, confidence changes. It does so quickly and systematically. In contrast to what is sometimes thought, over time a person's confidence actually grows to better reflect the true state of the world (i.e., whether the person is correct or not). What we have shown is that if people would take just a little more time to make their confidence judgment (even just a second) the accuracy of their confidence judgments can improve in some cases by almost 30% (Yu, Pleskac, & Zeigenfuse, 2015). We are now applying this work to see if we can improve confidence judgments in facial recognition similar to what might occurs in eyewitness identification (Zdziarska, Yu, & Pleskac, under revision), and how we can use this boost in accuracy to improve forecasts of all types.

Knowing the dynamics of deliberation is also a crucial aspect for understanding what I call rapid decision making. These are decisions people have to make when time is of the essence, and the information is flowing fast, such as when deciding when to sell or buy a stock. What we have found in these types of decisions is that risk taking takes a different form. Instead of being risk averse for gains and risk seeking

for losses as is often found, risk preferences flip. This is because although people appear to be integrating most of the information coming past them, during rapid economic decisions they are especially sensitive to extreme values. As such, they exhibit a proclivity to take the risky option when a large potential payoff comes by and to avoid it when a large potential loss comes by (Pleskac, Yu, Hopwood, & Liu, submitted; Zeigenfuse, Pleskac, & Liu, 2014).

There are many more doors that these models of deliberation open up including questions about the neural processes underlying them (Liu & Pleskac, 2011), how these processes develop and change both with practice and across the lifespan (Cabaco, Pleskac, et al., in prep), how attention and other psychological processes enter the decision process (Pleskac, Liu, & Yu, in prep), and alternative approaches to modeling deliberation including the use of quantum theory (Kvam, Pleskac, & Busemeyer, in prep; Kvam, Pleskac, Yu, & Busemeyer, 2015). These are some of the decisions I am currently pursuing in my research.

CHOICE ENVIRONMENTS

My second line of my research complements the first and asks how in the face of uncertainty people learn about and use their choice environments to make decisions especially when information, time, and computational resources are limited? That is, how does the choice environment impact the decisions people make? Answering this question is an important step to not only understand how people make decisions but also to help design better choice environments.

In some situations, when information is limited, all that people can do is learn from experience with the options, and as a result they make what we call decisions from experience. My colleagues and I have worked to show there is a difference or a gap between decisions made from experience and decisions made from a description of the very same options (Hau, Pleskac, Kiefer, & Hertwig, 2008; Hau, Pleskac, & Hertwig, 2010; Hertwig & Pleskac, 2010). The gap is such that in some cases people are risk seeking when they make decisions from a description (where all the information about payoffs and their probabilities are provided to them), yet they become risk averse when making decisions from experience (and in others, the opposite pattern occurs). This gap brings a new perspective to many economic decisions such as understanding when and why people purchase insurance or even those small repeated decisions we all make from experience like choosing a traffic route. It also raises new challenges. For instance, to model these experience-based decisions one has to model the choice environment, the processes people use to learn from experience, and how they make a choice. The challenge is that these are not independent components: how we sample also determines what we choose and vice versa. We are now working on a more complete model of these interdependent processes; a model that predicts how people search for information, learn from experience, and when they stop to make a choice (Markant, Pleskac, Diederich, Pachur, & Hertwig, 2015; in prep).

In addition to learning from experience, people also exploit properties of their choice environments to help them make their decisions. One of these properties that I am quite interested in is how people use the relationship between risks and rewards to make decisions (Pleskac & Hertwig, 2014). In particular, for many of life's gambles, the big rewards we seek to gain are relatively unlikely to occur. What we have shown is that people exploit this relationship to make decisions when the probabilities of the payoffs are

not given or not known (i.e., decisions under uncertainty). In this case, they use what we call the risk-reward heuristic to infer the probability of a payoff from its magnitude. We have shown that this risk-reward heuristic provides insight into how people solve this problem of uncertainty and can help explain some long-standing puzzles in this area such as why people appear averse to ambiguity.

Exploring the relationship between risk and rewards and how this impacts choice has led to several new questions. One question is how pervasive is this relationship? Does it exist outside man-made economic markets? I have been working with a behavioral ecologist to show indeed that risk-reward relationships are a more general property of our choice environments that arises whenever there is competition over limited resources in the environment (Pleskac, Conradt, & Hertwig, in prep). This idea that risks and rewards are tied also brings a new perspective to the gambles and bets we are offered. Often decision scientists have treated probabilities and payoffs as independent factors that determine choices. We have been working to show that because of the ecological relationship between risks and rewards people do not treat them as independent, that they (incidentally) learn the strength of the relationship in new environments quite easily (almost remarkably so), and that this relationship impacts many aspects of how people make decisions (Leuker, Pleskac, Pachur, & Hertwig, submitted). Finally, this risk-reward relationship also means that gambles or bets are not simply stimuli people respond to. Instead from a risk-reward perspective, the bets we are offered are information that signal people's beliefs in the events. Consequently, people can use the bets they or others are offered to update their own beliefs about the events (Pleskac & Schulze, in prep). This has the promise of showing how people can use their competitors to learn about their environment.

Going forward, knowing how people learn about and use their choice environments generates ideas about how to design these environments to help people make better decisions. For instance, how can we use simulations to help people make better decisions especially about rare events? Or, how can we help people identify when an option is 'too good to be true' or even help them understand when an option is not 'too good to be true'?

TRANSLATIONAL MODELING

My third line of work builds from my more basic research and works to translate these computational models of decision making from the laboratory into tools for identifying and improving problematic decision making.

One way I have done this, building on my dissertation work, is to use computational models to identify decision making deficits among real world risk takers. Of course investigating the precise properties of these cognitive processes in real world situations is very difficult. To get around this difficulty, I work with more complex laboratory-based gambling tasks that require respondents to make repeated risky decisions with real money at stake such as the Balloon Analogue Risk Task (BART; Lejuez et al., 2002), or similar tasks that I have developed (Pleskac, 2008). Importantly, risk taking in the laboratory tasks is associated with risk-taking behavior outside the lab. To get at the cognitive level, my colleagues and I develop cognitive models of how people complete these tasks (Pleskac, 2008; Wallsten, Pleskac, & Lejuez, 2005). These models synthesize in a formal framework how people process rewards, select a response, and learn from experience. We have used these models to identify the cognitive dimension(s) that are

responsible for the clinical diagnosticity of the gambling tasks. Doing this we have identified the differential role reward processing and learning can play in risk taking behaviors like drug use (Pleskac, 2008), how the development of automatic response pathways plays a role in the risks individuals with conduct disorder take (Pleskac & Wershbale, 2014), and how early critical events have long term impacts on the risks people take (Schuermann, Pleskac, & Frey, in prep).

More recently, I have been working with my colleague Joe Cesario to use computational models of decision making to understand a police officer's decision to shoot and the role a suspect's race can play in the decision (Pleskac, Cesario, & Johnson, in press). Previous work on this decision to shoot suggested that the suspect's race biased the criterion used to decide to shoot. We, however, have found that for some participants the race of the suspect is being accumulated as information in deciding to shoot. This means that instead of trying to correct the bias by changing incentives or goals as the earlier research suggests, one may have to change how police officers process the scene in front of them. However, I should emphasize that it is not the case every person uses race as information in deciding to shoot. We know this because our models use advanced techniques in multi-level modeling so we can examine both individual and group differences at the process level. Consequently, we can show that there are some people that accumulate race as information in deciding to shoot, some people for whom race serves as an a priori bias in deciding to shoot, and another subset of people who show no race effect at all. Indeed this ability to characterize the heterogeneity between people maybe the most important result in understanding the role race plays in the decision to shoot.

One important observation that becomes painfully obvious when applying these computational models to decisions like the decision to shoot is that the models are well calibrated for laboratory tasks where information is neatly presented to participants on a computer screen. This, however, does not reflect real decision situations. Thus, we are now working to develop what we call an Attention-integrated Model-based Shooting Simulator (AiMSS), which combines computational models of decision making, visual psychophysics, eye tracking methods, and an immersive decision simulator to map the decision processes a police officer uses to decide to shoot. We aim to use this framework as a complete diagnostic and person-specific training system for law enforcement as a means of reducing errors in decision-making – and in particular errors related to shooting unarmed minorities.

IN SUMMARY

Decisions, almost by definition, link our thoughts to our actions. My research program seeks to characterize this critical link not only to provide a more complete picture of how the mind works but also to understand how and why individuals, groups, and organizations do what they do and how they can do it better.

— Tim Pleskac