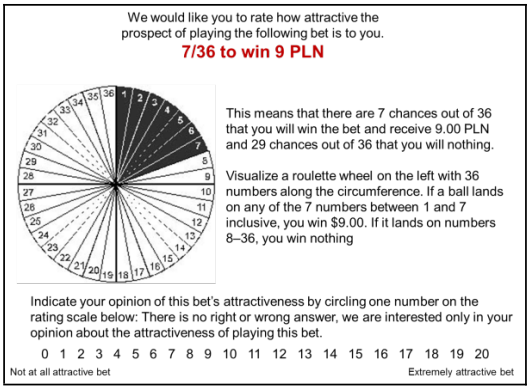
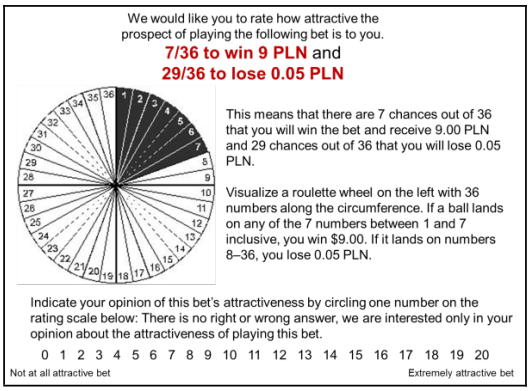
Imagine that you have visited a casino in which you have been asked to rate the attractiveness of the following bet :



Next, you have been offered with a new bet presented below. How attractive is this bet to you?



As you probably noticed, there was only one difference between these two bets. Specifically, the former offered the probability of 29/36 to win nothing (no-loss bet), whereas the latter offered the same chance to lose 0.05 PLN (loss bet). Intuitively, participants presented with these two bets rated the no-loss bet as more attractive than the loss bet. However, results were much more surprising if bets were presented separately to two groups of participants. Specifically, individuals who saw only the no-loss bet rated it on average as less attractive than the loss bet which was rated by the other group of participants. Authors of this study (Bateman, Dent, Peters, Slovic, & Starmer, 2007) concluded that winning 9 PLN alone is difficult to evaluate ('how good is 9 PLN?'). On the other hand, introducing a small loss to which winning of 9 PLN could be compared, made this bet "come alive with the feelings" and exerted an impression of attractiveness.

The same experimental procedure was repeated in different study (Peters et al., 2006) aimed at investigating the role of numeracy. Numeracy can be defined as the cognitive ability to understand and process statistical and probability information, therefore it appears logical that higher numeracy should be related to superior decision making. In particular, high numerate participants should rate the no-loss bet as more attractive. However findings were opposite to this intuitive prediction. That is, high numerate individuals rated objectively worse bet as more attractive. Peters et al. (2006) argued that 'the highly numerate tended to draw different (generally stronger or more precise) affective meaning from numbers and numerical comparisons'. In this sense, more frequent comparisons between numbers (9 PLN vs. 0.05 PLN) led to a more precise affective impression of this bet and suboptimal valuation. Despite this interpretation is very interesting, it has not been tested experimentally yet.

In this project, I put forward a question regarding how do high and low numerate individuals deal with affective influences in risky decision making? Specifically, I am interested whether they acquire and compare more information or rather they are more efficient in processing less information? I intend to tackle this research problem in four research tasks covering areas of: (1) motivation and effort, (2) process tracing, (3) neural mechanisms of numeracy, and (4) information processing in risk communication.

In a series of ten experimental studies, I plan to combine different methods such as functional magnetic resonance imaging (fMRI), eye tracking, behavioral and self-reported measures to provide wide-ranging picture of undertaken research problem. In general, in Task 1, I am going to test the role of motivation (e.g., need for cognition or cognitive effort as measured by pupil diameter) and its relationship to numeracy. In Task 2, I will employ process-tracing methods (e.g., eye tracking, MouseLab, verbal protocols) to study how information about probabilities and payoffs are processed depending on numeracy level, task difficulty and manipulation of affect. Additionally, I will apply here the distinction between decisions from description and decisions from experience to gain deeper understanding of the underpinning processes. Next, functional resonance imaging will be used in Task 3 to test the relative contribution of cognitive (e.g., prefrontal cortex) and affective (e.g., amygdala and insula) components to superior decision making as well as neural efficiency in processing risky decision problems. Last but not the least, I am going to propose and validate a novel, experienced-based method of presenting numerical information, which should improve risk and probability comprehension among less numerate individuals regardless of affective influences (Task 4). Building on evidence from psychophysical, computational and dual-process approach to numeracy, I hypothesize that the high numerates would make

normatively superior decisions (i.e., closer to expected value) because they (1) are more motivated to deliberate on the problem, (2) engage more elaborative cognitive processes as well as acquire more information, and (3) process numerical information more efficiently leading to the reduced impact of affect on decisions.