

# The Effect of Cognitive Depletion on Decisions in the Iowa Gambling Task

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## COGNITIVE DEPLETION

The question of which important factors enter into everyday human decision-making and what is the mechanism of their influence is still open in many respects. One of the factors significantly impacting our daily decisions is the so-called **cognitive depletion** (ego depletion).

The theory of cognitive depletion postulates the existence of a **limited mental resource** that is necessary for self-regulation. If the resource is diminished by a task involving self-control, achievement in subsequent self-control tasks will be impaired (Unger & Stahlberg, 2011).

## STROOP TEST

The Stroop test (Stroop, 1935; MacLeod, 1991) is used to determine whether and to what extent have the cognitive depletion occurred, but can also serve for inducing the ego depleted state itself (Job et al., 2010; Webb & Sheeran, 2003).

Correct color identification of incongruent stimuli in the Stroop test requires suppressing the primary automatic impulse, i. e. written name of the color. Suppressing primary impulses requires self-control and leads to cognitive depletion.

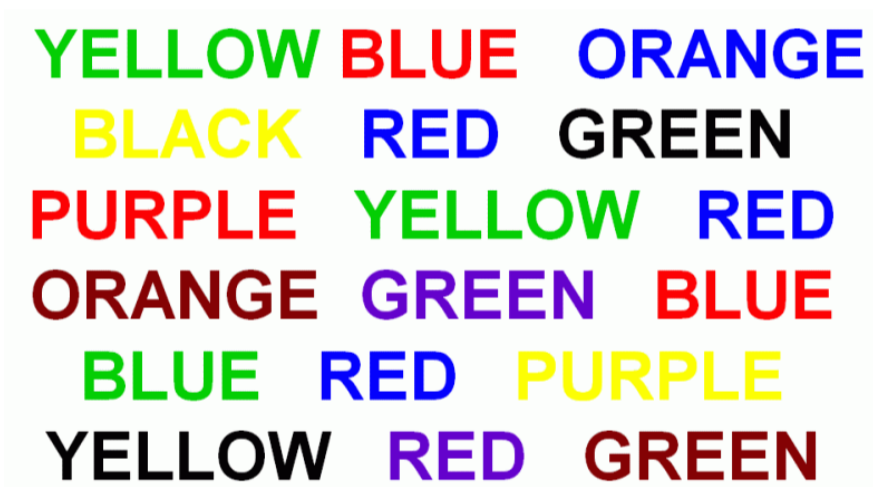


Figure 1: The Stroop Test.

## IOWA GAMBLING TASK

The Iowa Gambling Task (IGT) is designed to measure **real-life decision-making** in the way it factors uncertainty of premises and outcomes, as well as rewards and punishment (Bechara et al., 1994).

The (originally neurological) test is represented by four decks of cards. Each card yields a certain gain and sometimes there is a penalty. Two of the four decks ("good" decks) yield lower immediate gains, but are advantageous in terms they result in overall gain in the long run. The other two decks ("bad" decks), on the contrary, yield higher immediate gains, but are disadvantageous in the long run as the sum of losses (penalties) exceeds the sum of gains. Probabilities and payoffs are initially unknown to the subjects and are learned from repeated choices with payoff feedback.

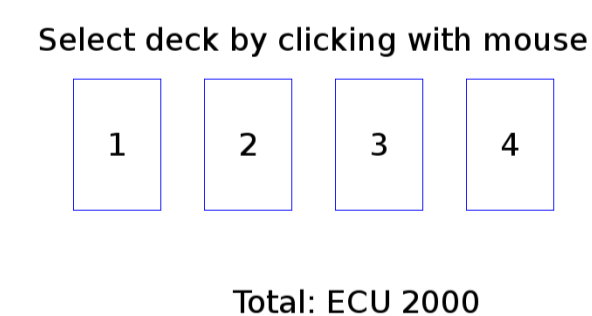


Figure 2: Iowa Gambling Task (PEBL).

## CENTRAL RESEARCH QUESTION

The **dual process theory** (e. g. Kahneman, 2011) postulates two systems involved in information processing and decision-making: **System 1** – automatic, unconscious, emotional – and **System 2** – deliberative, conscious and cognitive. System 2 is slower and is employed only if there is sufficient cognitive capacity for its functioning (Smith & DeCoster, 2000).

It was found that effective learning in the IGT is closely related to emotional reactions to "good" and "bad" decks (Bechara et al., 1997) and that cognitive depletion leads to consequent **greater impact**

of emotional system on decision-making, i. e. to enhancement of System 2 (Pocheptsova et al., 2009; Noguchi & Hillis, 2000).

**It is therefore possible to assume that subjects experiencing cognitive depletion should achieve better results in the IGT (Figure 3).**

However, the outlined mechanism can be **mediated by other factors** (Figure 4). Among the most important factors that could be considerably affected by cognitive depletion and consequently influence decisions in the IGT, are risk preference (Unger & Stahlberg, 2011) and time preference/impulsivity (e. g. Frederick et al., 2002).



Figure 3: Hypothesized impact of cognitive depletion on decisions in the Iowa Gambling Task.

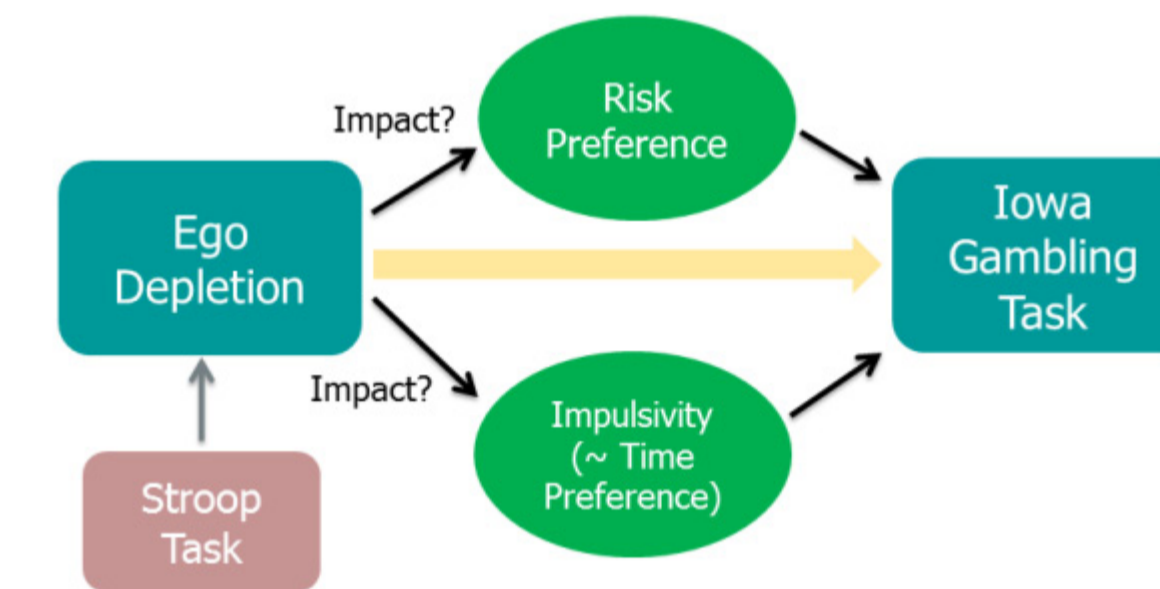


Figure 4: Hypothesized mediating factors caused by cognitive depletion and impacting decisions in the Iowa Gambling Task.

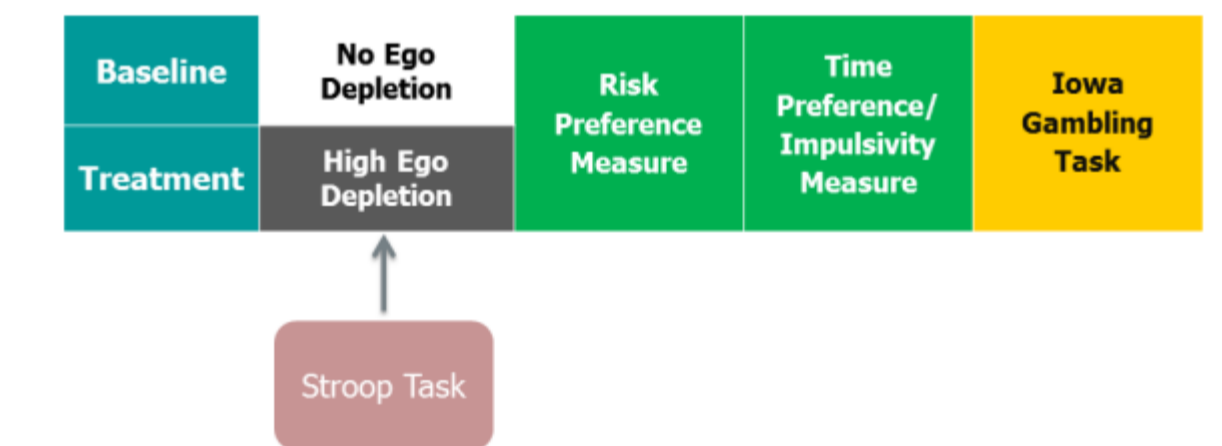


Figure 5: Core experimental design.

## EXPERIMENTAL DESIGN (Figure 5)

- Treatments: high vs. no ego-depletion task (control)
- Between subject design

**1. Induction of cognitive depletion** – a standardized computerized Stroop test (Figure 1) is used:

- Treatment group: mix of congruent (same meaning and color: **red**), incongruent (different meaning and color: **red**) and neutral (e. g. **over**) stimuli,
- Control Group: congruent stimuli only (**red, blue, ...**).

**2. Risk Preference Measure** – choosing one from several lotteries differing in expected value and risk – allows for constructing immediate change in subjects' risk preferences (Garbarino et al., 2011).

**3. Time Preference/Impulsivity Measure** – choosing either lower immediate reward or higher future reward – allows for constructing time preferences of subjects (Andreoni et al., 2013).

**4. Iowa Gambling Task** – a standardized computerized task preserving the originally designed structure is used (Figure 2).

## OTHER INTERESTING FACTORS controlled for:

- Cognitive Reflection (Cognitive Reflection Test; Frederick, 2005) – assesses individuals' ability to suppress an intuitive and spontaneous wrong answer in favor of a reflective and deliberative right answer.
- Barratt Impulsiveness Scale (BIS)
- Domain-Specific Risk-Taking (DOSPERT) Scale
- General Personality Traits (Big Five)
- 2D:4D – correlated with risky decisions, aggression and perceived (male) dominance



Figure 6 and 7. In the laboratory.

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