# Tracing changes in risky decision making processes with real monetary and non-monetary outcomes

Bettina von Helversen
University of Zurich

Benjamin Scheibehenne
University of Geneva

Géraldine Coppin
University of Geneva

## Abstract

Although monetary gambles are widely used to study risky decision making it has been shown that decision process changes when outcomes are non monetary and affect-rich. However, most of this research has used hypothetical outcomes and results from studies with real outcomes are inconsistent. Using unpleasant odors and monetary losses we investigated how risky decision processes change depending on the nature of the outcome in a fully incentivized task with real outcomes. Odor and money decisions were equated so that monetary losses corresponded to the amount of money participants were willing to pay to avoid an odor. Consistent with previous research we find that participants were less sensitive to probabilities when outcomes involved odors compared to monetary outcomes.

## Introduction

- Monetary lotteries are a standard task to investigate risky decision making

- Risky decision making processes change with the nature of the outcome

- Less sensitivity for probabilities with hypothetical affect-rich non-monetary outcomes compared to (hypothetical) monetary outcomes (Rottenstreich & Hsee, 2001; Lejarraga, Pachur & Hertwig, 2015)

- Modeling with prospect theory shows different probability weighting function
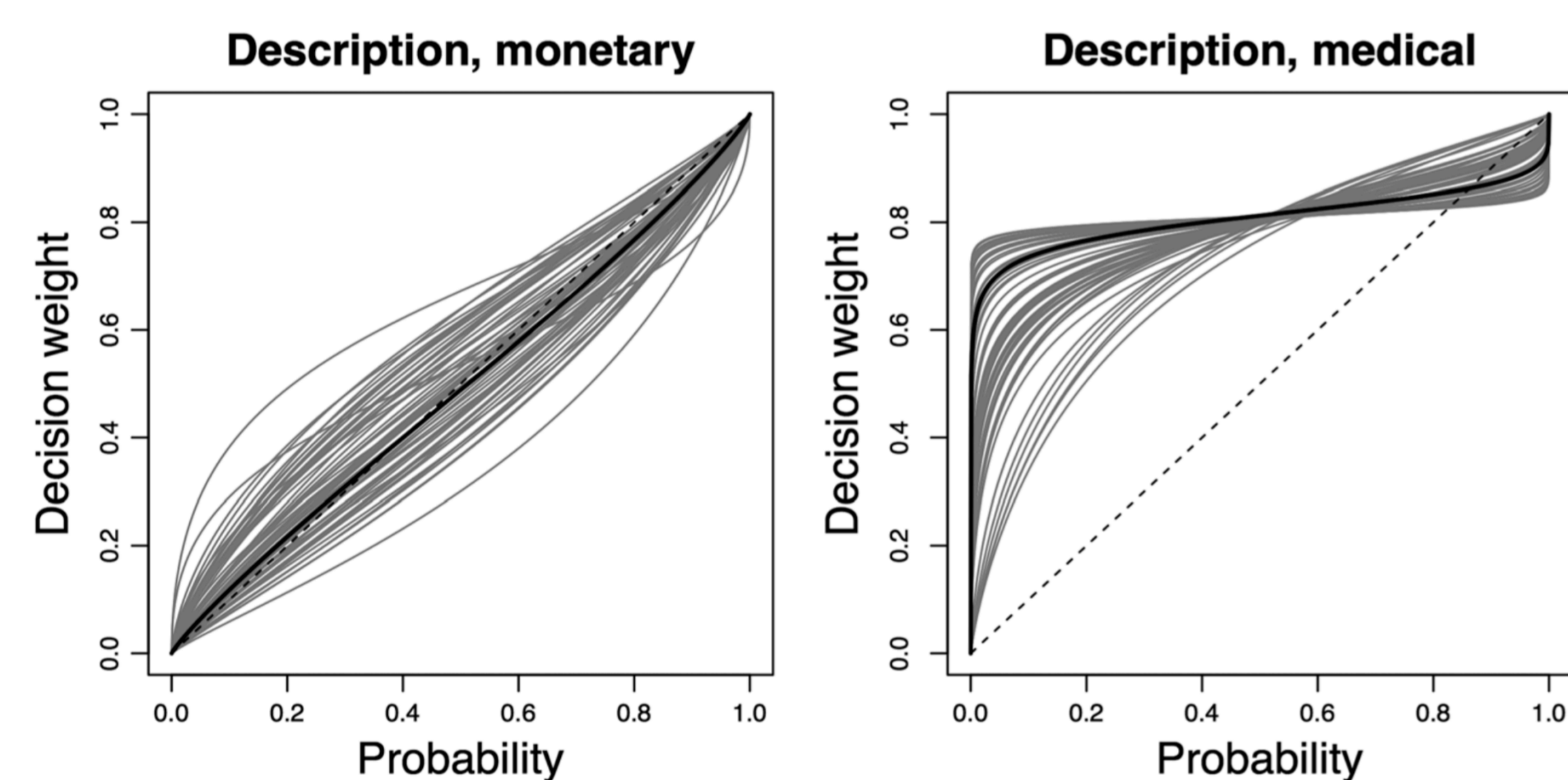


- But: little research with consequential non-monetary outcomes and results are inconsistent

- Hayden & Platt (2009): No difference when gambling for drinks and small monetary amount, Rosati & Hare (2016) find more risk taking with food than money

- People are poor in affective forecasting

## Research Question

Do effects of hypothetical non-monetary outcomes on probability sensitivity and risky choice generalize to consequential non-monetary affect-rich outcomes?

## Method

60 Participants, mostly female students with functioning sense of smell; 12 excluded because willingness to pay to avoid odors was > 0 for less than 3 odors

### Design

- Varied outcome type (monetary vs. odor) within participants

### Procedure

- Willingness to pay (WTPs) to avoid smelling an odor measured for 8 odors with BDM auction
- Decisions in two sets of 42 gambles, one with monetary losses, one with displeasing odors (order randomized)
- Payoff: One gamble randomly selected and played; determined payment

### Materials

- Monetary and odor gambles were equated for each participant by using WTP judgments for the odors as respective monetary losses
- Gambles were created by crossing for each vpn 4 odors/monetary losses selected to maximize loss range (from 0 to 15 CHF) with 7 probability levels
- All gambles required trade-offs: Gambles with worse odor/loss had lower probability that odor/loss occurred
- Odors: 8 odors (Smelly body odor, old socks, feces, civette, cheese, sulfur and onion, sweat, cigarettes) presented in odor pens

## Results



$BF_{10} = 33.7$    $BF_{10} = 4.3$
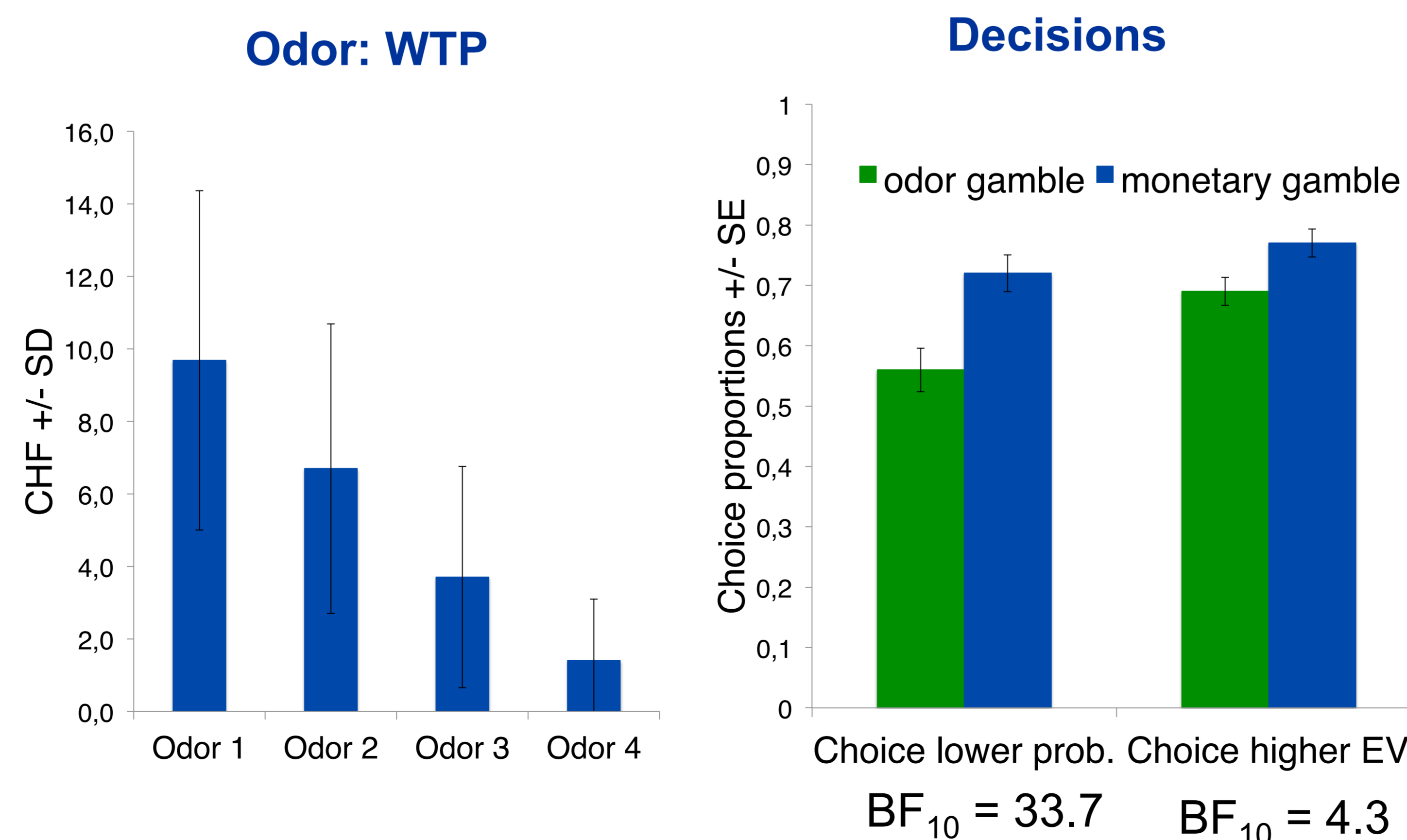
- Correlation choices odor & money, $r(48) = .12$, $BF_{10} = .25$

## Modeling with prospect theory

- Prospect theory with 4 Parameters:
  - Value function: alpha
  - Probability weighting function:
    - delta (elevation) & gamma (curvature)
  - Choice sensitivity: theta

$$V(A) = \sum_{i=1}^{n} v(x_i) w(p_i)$$

$$w(p_i) = \frac{\delta p_i^\gamma}{\delta p_i^\gamma + (1 - p_i)^\gamma}$$

$$p(A,B) = \frac{e^{\varphi * V(A)}}{e^{\varphi * V(A)} + e^{\varphi * V(B)}}$$

- Analysis: Bayesian Hierarchical Modeling

### Posterior distributions of the differences in parameters between odor and monetary decisions
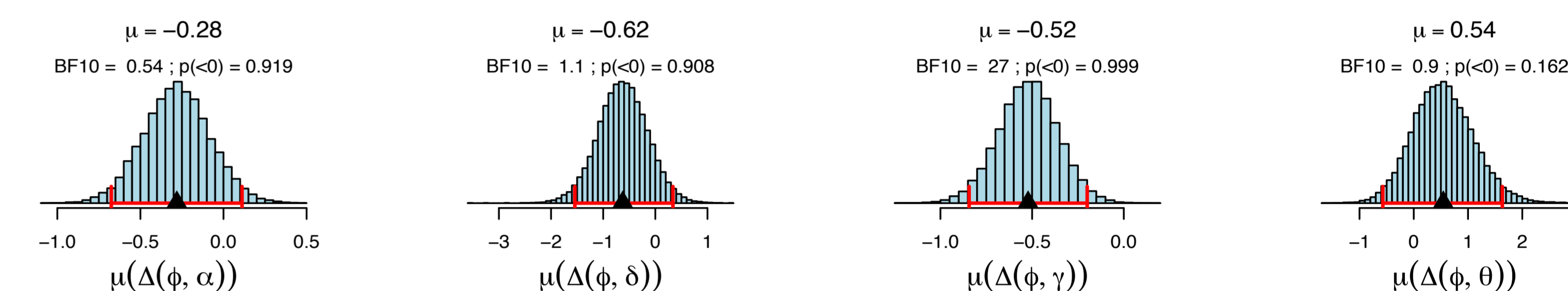


### Probability weighting functions for odor and monetary decisions
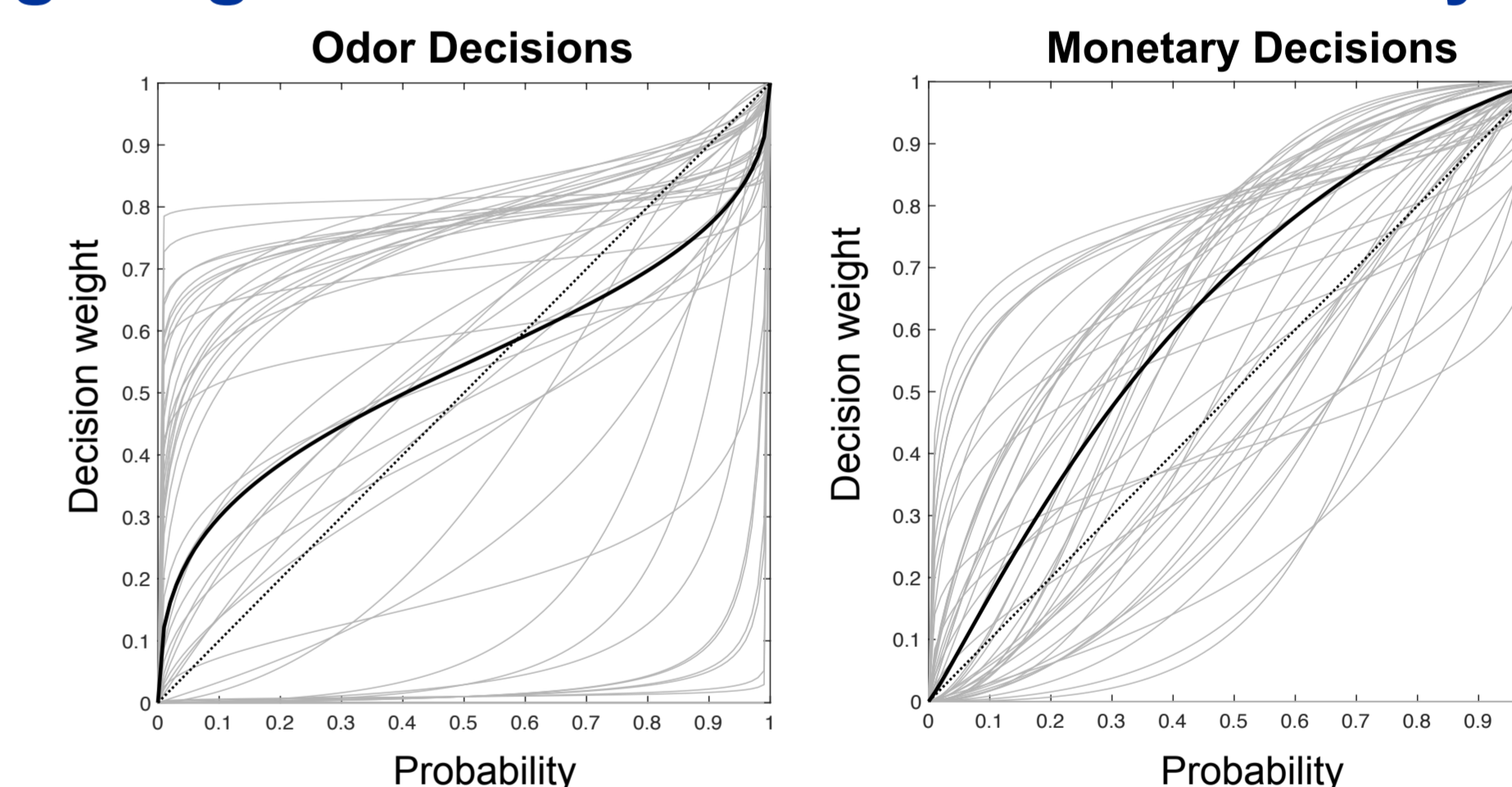


## Discussion

- Less sensitivity for probabilities when gambling with odors than money, in line with research on affect-rich vs. affect poor hypothetical gambles
- Less frequent choice of option with lower probability led to more frequent losing when odor gambles were selected
- No stability in relative risk preference across outcome domains

## References

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**Contact: b.vonhelversen@psychologie.uzh.ch**