Asymmetric effects of losses on the brain but no loss-aversion

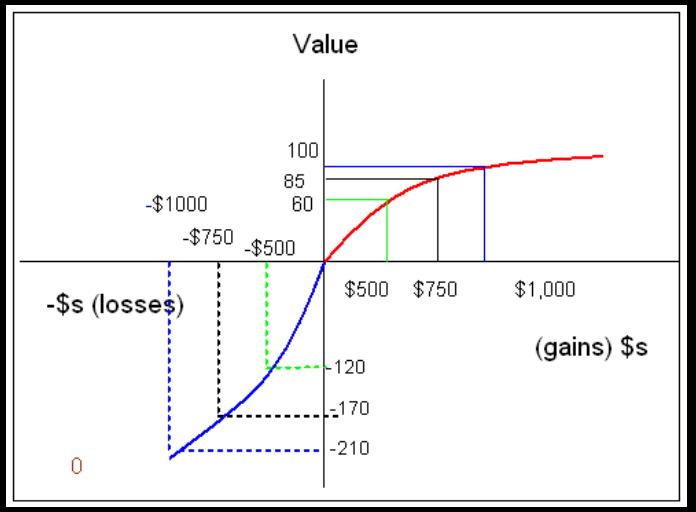
Guy Hochman & Eldad Yechiam

Technion – Israel Institute of Technology

Max Wertheimer Minerva Center for
Cognitive Processes and Human Performance

Loss aversion

- Loss aversion – losses loom larger than gains
  (Kahneman & Tversky, 1979)
  - Anecdotic and indirect (e.g., the status-quo bias, the endowment effect; cf. Rozin & Royzman, 2001)
  - No appropriate control conditions (e.g. no symmetrical gains and loss)
  - Recent description and experience-based decision research fail to support (Ert & Erev, 2008; Erev, Ert, & Yechiam, 2008; Erev et al., 2010; Kermer, Driver-Linn, Wilson, & Gilbert, 2006; Kortizky & Yechiam, 2009; Yechiam & Ert, 2007; 2009)



Aim

- Exploring the role of losses in decision making
  - The loss-aversion controversy
  - Affect-based models for decision making
  - The interplay between physiological and behavioral responses

Hypotheses

- Three competing hypotheses:
  - No special role for losses – no loss sensitivity both behaviorally and physiologically
  - The individual differences hypothesis – high arousal and loss aversion at the individual level
  - The Loss Signal Risk hypothesis – a dissociation between autonomic arousal and behavior (increased arousal with no loss aversion)

Cluster 1

Loss-aversion in the Eye and in the Heart: The Autonomic Nervous System's Responses to Losses

(Hochman & Yechiam, in press, Journal of Behavioral Decision Making)

Study 1

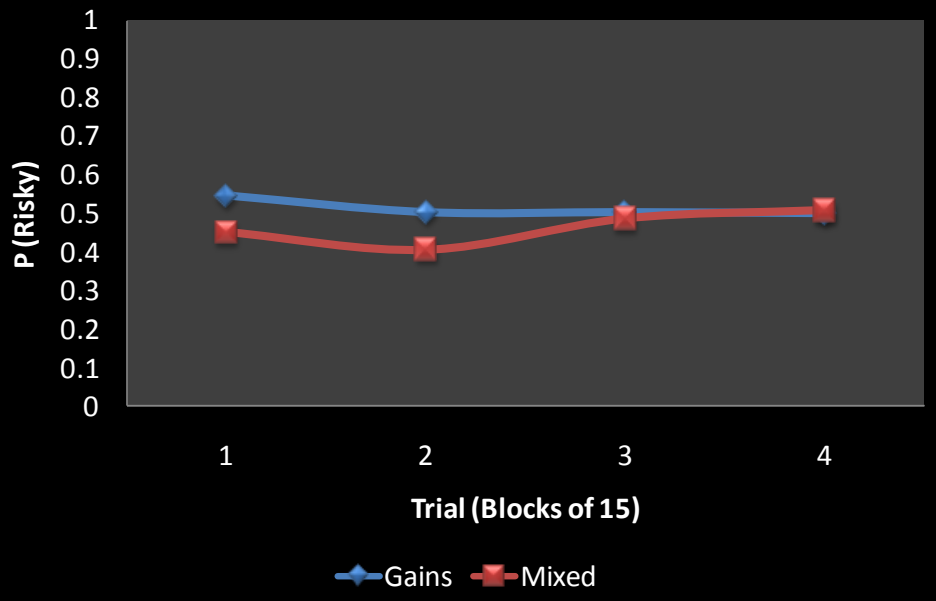
- 25 participants
- 2 conditions in a within subjects design:
  - Condition Mixed

1, 0.5; -1 otherwise	2, 0.5; -2 otherwise

Assuming loss aversion

  - Condition Gains (adding 3 to each payoff)
- Pupil diameter

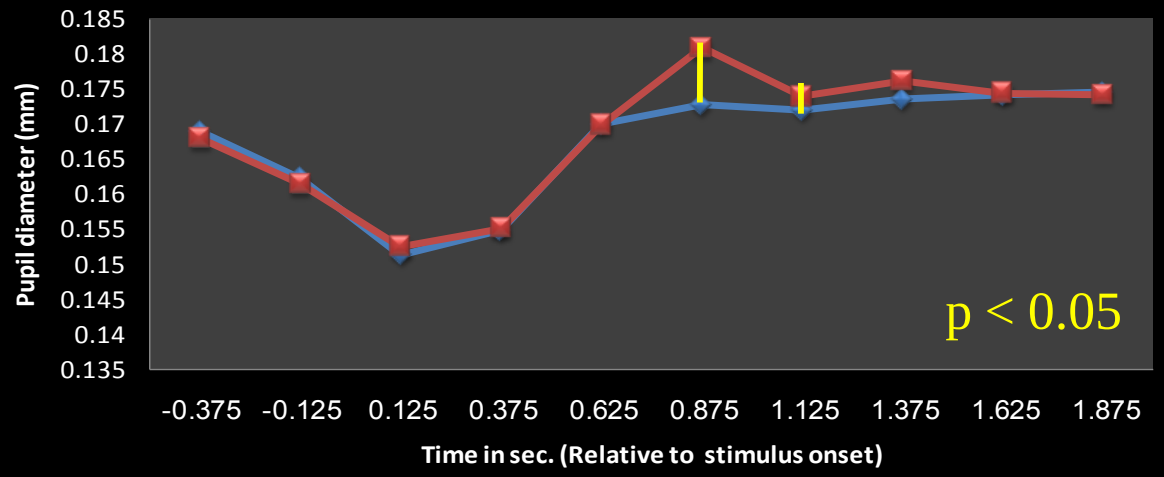
Study 1 - results



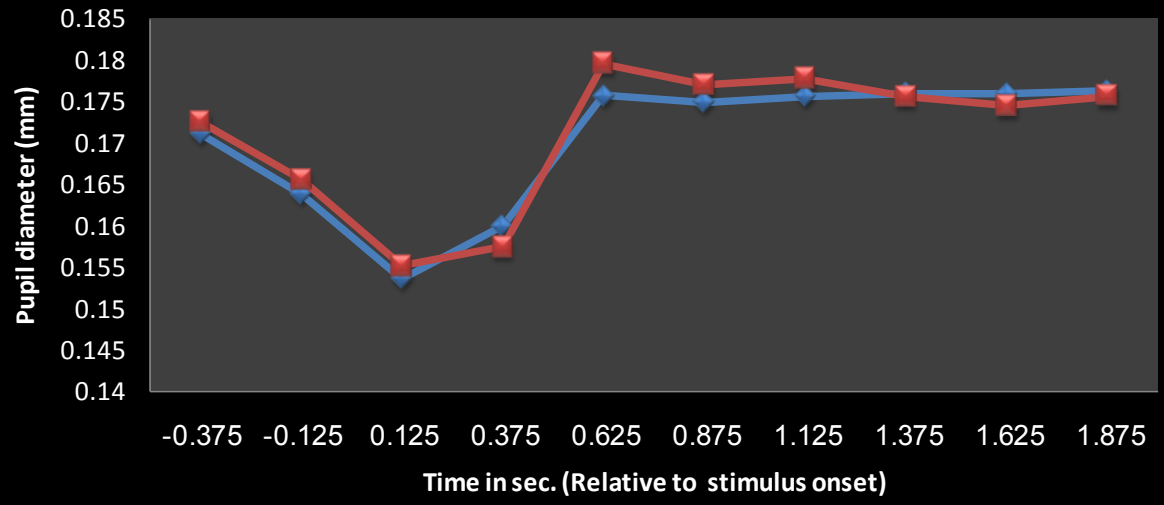
- No behavioral loss aversion:
  - Mixed: P(R) = 0.46; Gains: P(R) = 0.51
  - Both condition *ns* different than 50% chance (t(24) = -1.249, *p = 0.224*; t(24) = 0.255, *p = 0.801*, respectively)

Study 1 - results

Mixed



Gains



Study 1 - results

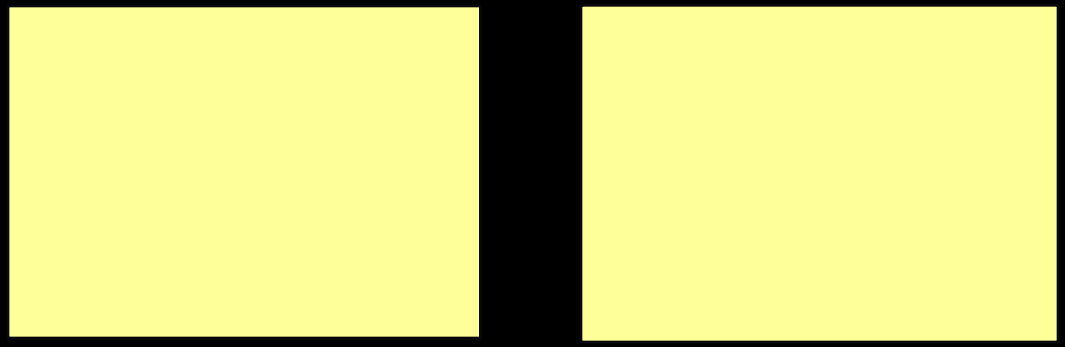
- Individual differences:

1. correlation between P(Risk) and PD(losses) – PD(gains) = -0.06, p = .76
2. correlation between PD(losses) after "risky" and the tendency to switch choices = -0.014, p = 0.76

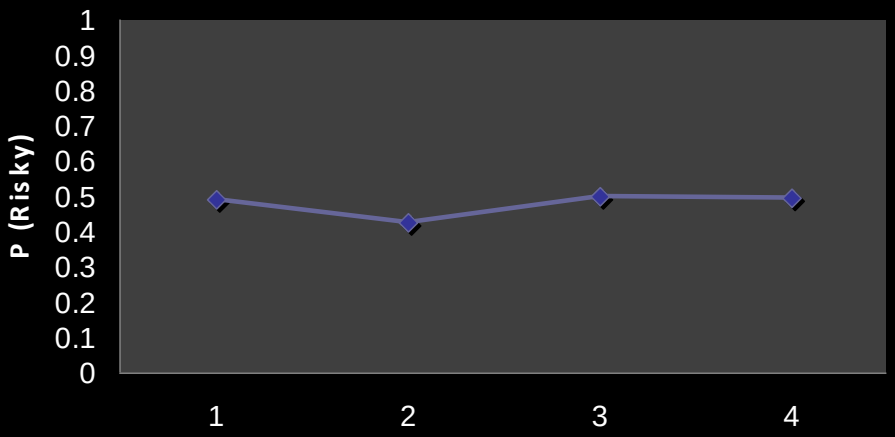
No association between P(Risk) or P(shift-loss) and autonomic arousal

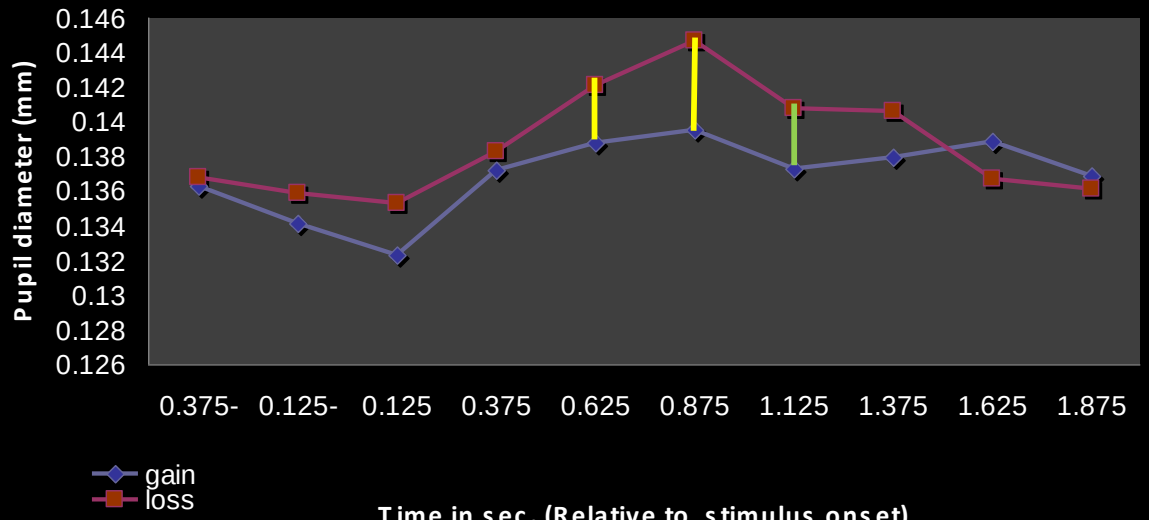
Study 2

- Only Condition mixed
- 19 participants
- Colors instead of +/- signs



Study 2 - results





$p < 0.05$

$p < 0.1$

Study 2 - results

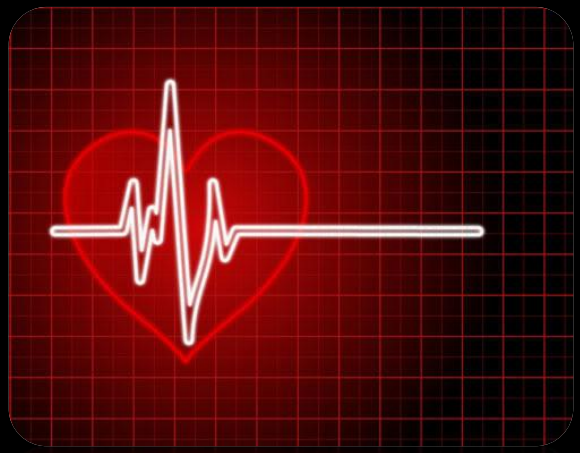
- Individual differences:

1. correlation between P(Risk) and PD(losses) – PD(gains) = -0.31, p = .19
2. correlation between PD(losses) after "risky" and the tendency to switch choices = 0.04, p = 0.425

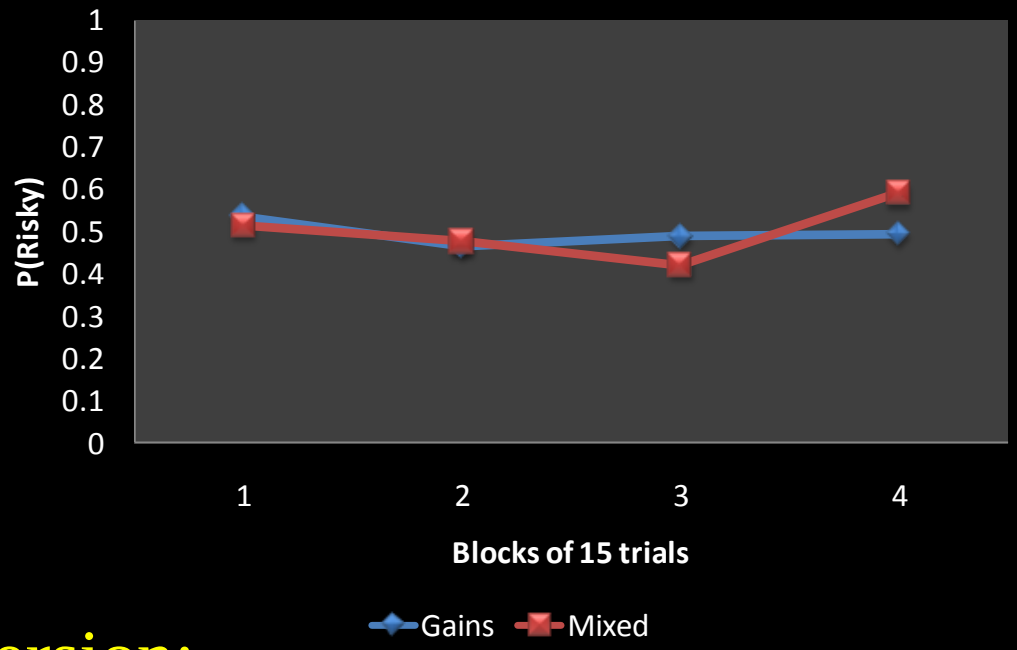
No association between P(Risk) or P(shift-loss) and autonomic arousal

Study 3

- Examining the generalization of the first two studies
- 22 participants
- Heart rate
- Replication of Study 1



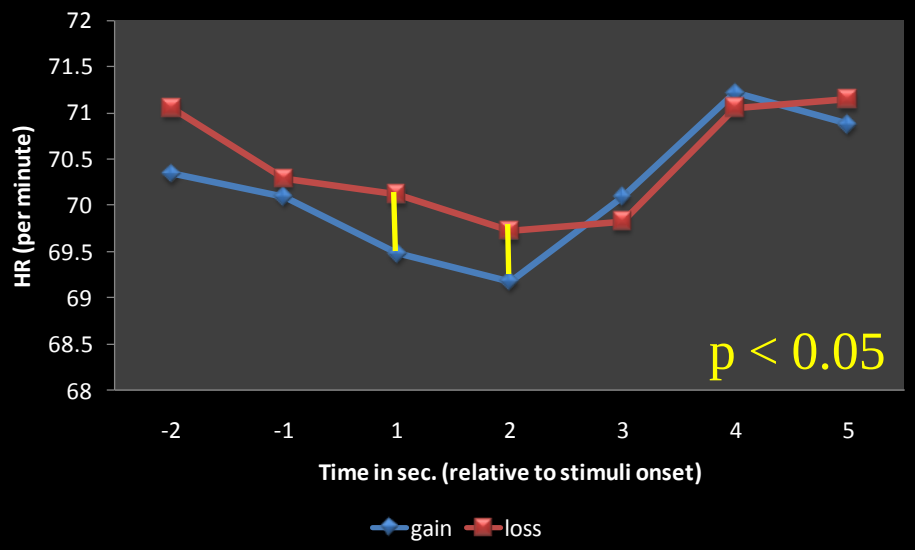
Study 3 - Results



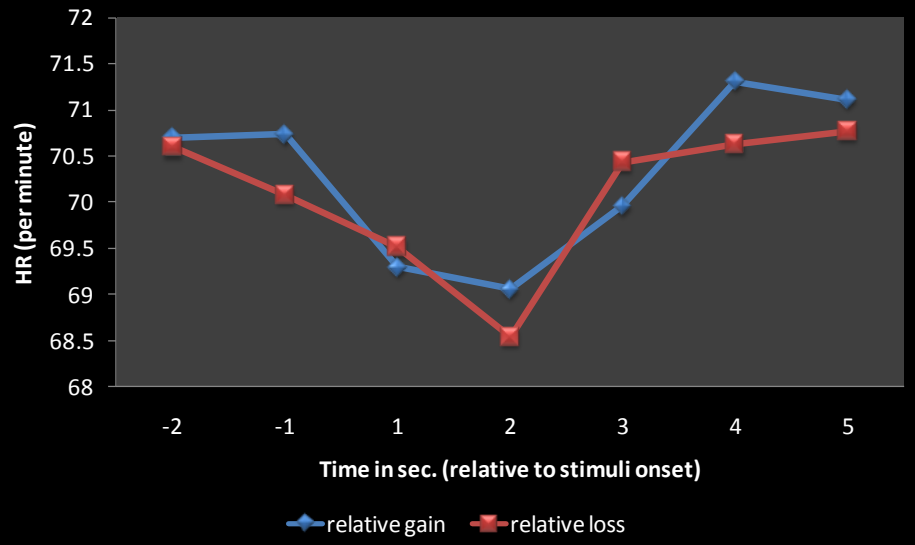
- No behavioral loss aversion:
  - Mixed: P(R) = 0.50; Gains: P(R) = 0.49
  - Both conditions *ns* different than 50% chance (t(21) = 0.034, $p = 0.94$; t(21) = -0.10, $p = 0.92$, respectively)

Study 3 - Results

Mixed



Gains



Study 3 - Results

- Individual differences:

1. correlation between P(Risk) and

   HR(losses) – HR(gains)

   = -0.06, p = .78

2. correlation between PD(losses) after "risky" and the tendency to switch choices

   = 0.02, p = 0.55

No association between P(Risk) or P(shift-loss) and autonomic arousal

Cluster 2

An EEG study

(work in progress)

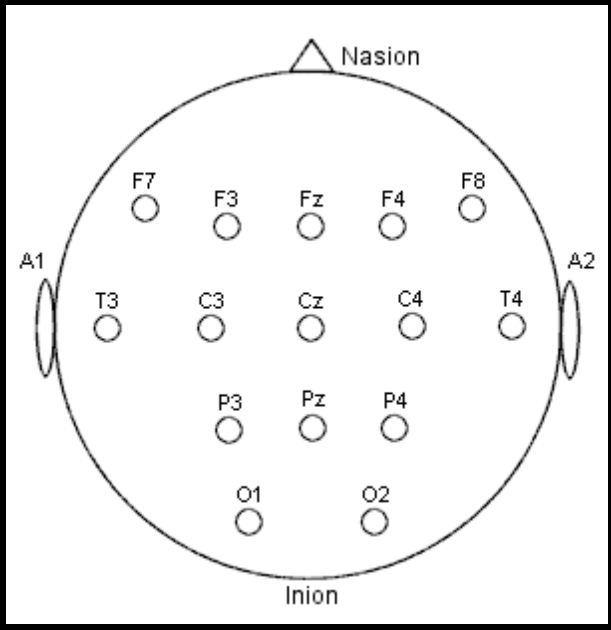
Study 1

- EEG – focusing on N200 (Lim et al., 1999) and P300 (Salisbury et al., 2004; Shimamura, 2000)

  Rate – 256 Hz

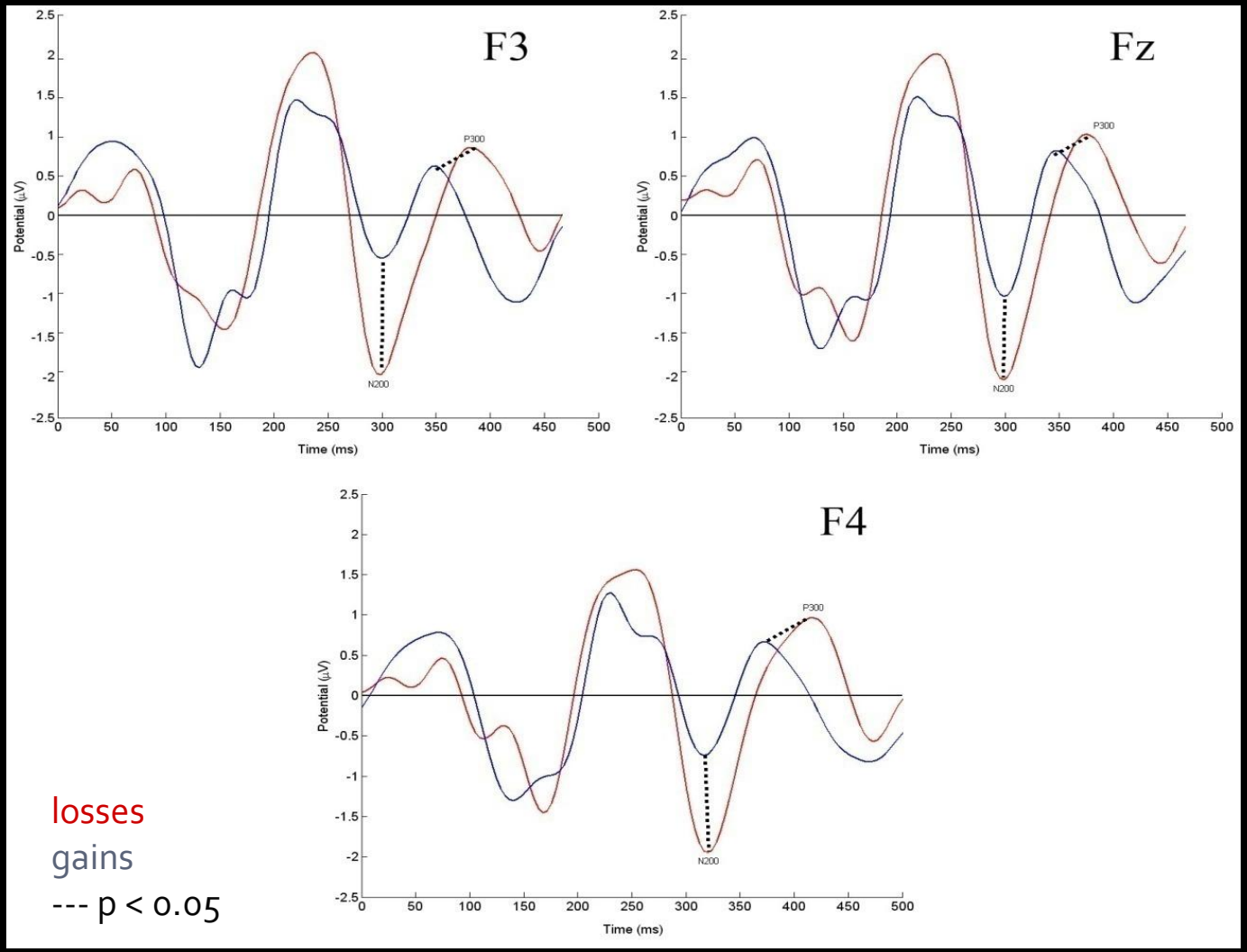
  bandpass – 0.5-100 Hz

- Passive & Active tasks



0	+/-20 +/-40 +/-60 +/-80

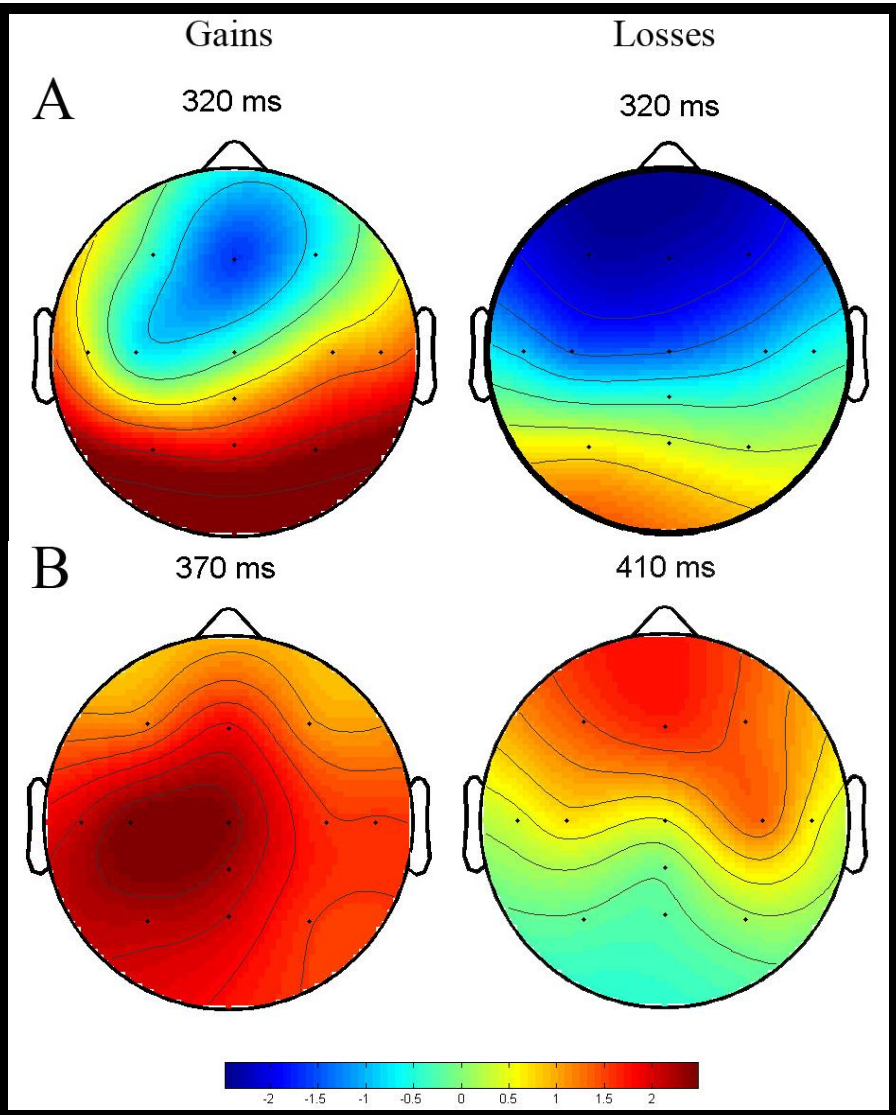
Study 1 - Results



Study 1 - Results

N200

P300



Study 1 - Results

- Individual level analysis:

  correlation between P(Safe) and mean difference in peak amplitudes for losses versus gains at the midfrontal site [N200, P300 (Losses – Gains)]

  N200: r = -0.12, p = .66

  P300: r = 0.56, p < .05

The tendency to select risky decreases as the inhibitory signal increases

General discussion

- Increased Autonomic sensitivity to losses without behavioral loss aversion
- Support for the LSR hypothesis:
  no correlation between autonomic measures (PD, HR, N200 amplitudes) and the loss sensitivity of individual decision makers
- Boundary conditions for affect-based decision models

General discussion

- Losses versus risk
- "cognitive" versus "emotional" considerations
- The ANS as a "general alerter"
- Monetary losses as natural signals