



Still Not Rational, But Different... A Registered Replication Study Of “Why Humans Deviate From Rational Choice”



Introduction:

- Registered replication report of well cited (~200) finding in neuroeconomics concerning the Feedback related negativity (FRN) (see Hewig et al., 2011):
 - FRN to dictator game (DG) and ultimatum game (UG) offers: unfair offers lead to higher FRN response than fair offers: linear relation
 - No difference between the FRN responses in UG and DG
- Extension of this replication concerning analysis methods: Single trial analysis in addition to mean based analysis and extension of sample size
- Extension of this replication concerning EEG signal features: Analysis of midfrontal theta band activation (MFT)

Methods:

- 105 student participants (37 male (36.19%), mean age = 26.0, SD = 8.82, range = 18 – 65)
- Study design:
 - role of the responder 360 offers in 6 blocks:
 - 30 for each of 6 conditions: 6:6, 5:7, 4:8, 3:9, 2:10, 1:11
 - for UG and DG
 - role of proposer: 10 times dictator game offer, 40 times ultimatum game offer
- Statistics:
 - multilevel mixed models (random intercept for participant/paradigm), cluster level 3: participant
 - fixed effect level 1: offer (6:6 / 5:7 / 4:8 / 3:9 / 2:10 / 1:11)
 - fixed effect level 2: paradigm (UG/DG)
 - dependent variables: single trial FRN / single trial MFT

ultimatum / dictator game:

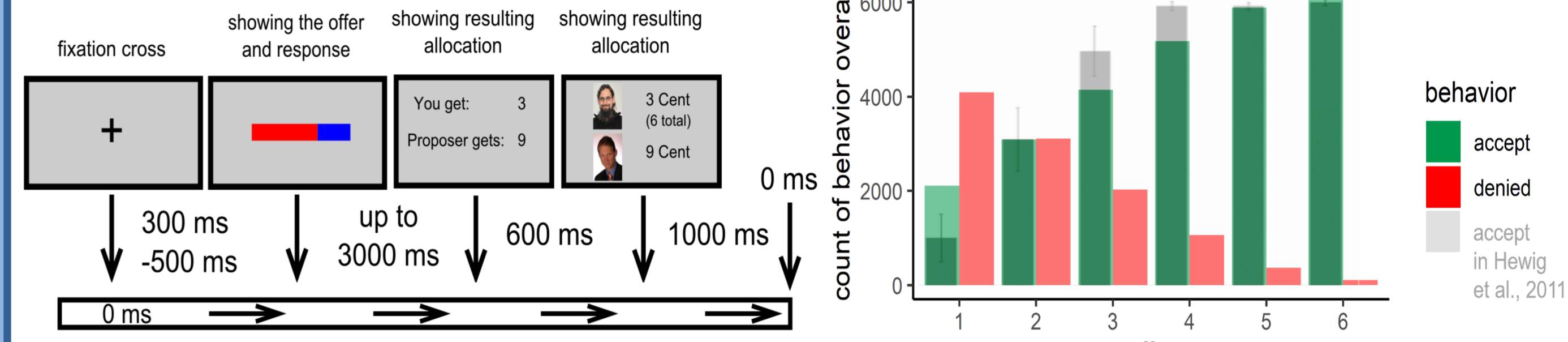


Figure 1: Paradigms used in the present study and behavioral responses to ultimatum game (cf. Hewig et al. 2011).

EEG and EEG-processing:

- 66 electrode cap (Ag/AgCl passive electrodes, amplifier: DC Brainamp MR plus), sampling rate: 500 Hz
- (Pre-)processing: EPOS pipeline (see Rodrigues et al., 2021)
- FRN / MFT quantification windows on FCz: 280 ms – 320 ms (see Hewig et al., 2011)
peak in time window from 250 ms – 250 ms (see Rodrigues et al., 2022)

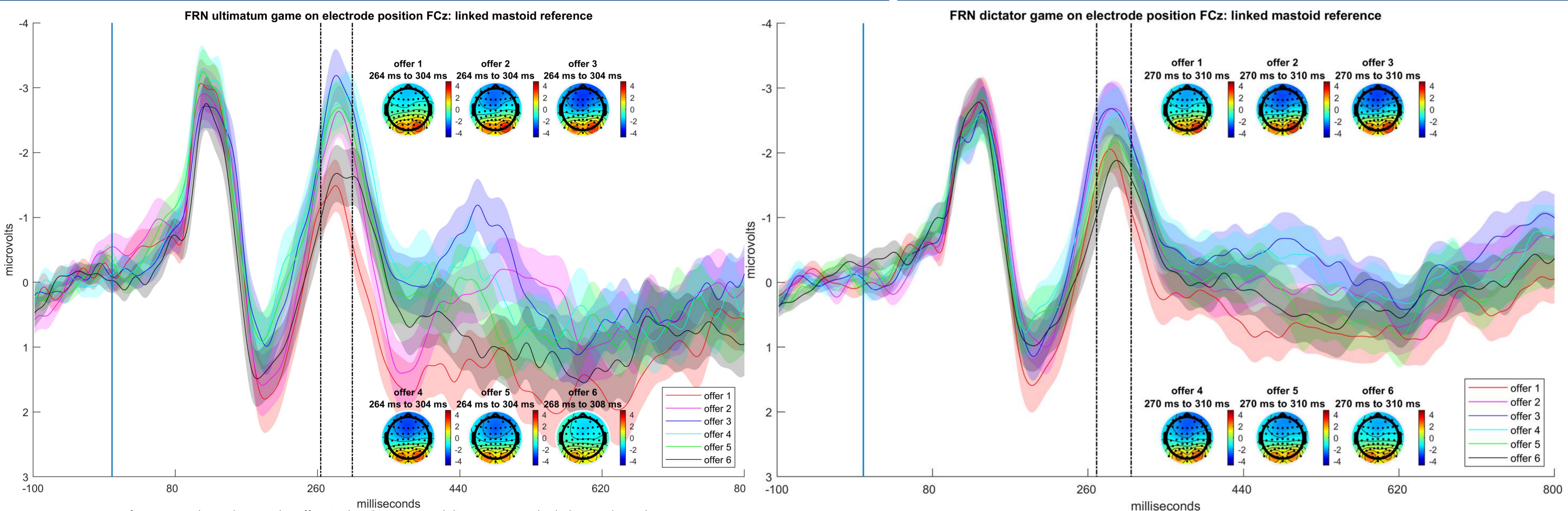


Figure 2: ERPs: FRN of responses dependent on the offers in the ultimatum and dictator game. Shaded areas depict between SE.

Results:

	FRN				MFT			
	β	SE	z-value	p-value	β	SE	z-value	p-value
(Intercept)	-1.508	.349	-4.318	.000	-.730	.118	-6.189	.000
paradigm (baseline UG)	.751	.368	2.042	.041	.456	.078	5.839	.000
quantification	-.232	.261	-.888	.374	-.091	.040	-2.261	.024
offer 2 (baseline 1)	-.904	.261	-3.459	.001	.009	.070	.131	.895
offer 3 (baseline 1)	-.873	.261	-3.344	.001	.114	.070	1.636	.102
offer 4 (baseline 1)	-.816	.261	-3.121	.002	-.088	.069	-1.267	.205
offer 5 (baseline 1)	-.444	.261	-1.701	.089	-.159	.069	-2.290	.022
offer 6 (baseline 1)	-.177	.263	-.675	.499	-.309	.070	-4.444	.000
paradigm x offer 3	-1.166	.372	-3.134	.002	-	-	-	-
paradigm x offer 4	-1.309	.372	-3.524	.000	-	-	-	-
paradigm x offer 5	-.877	.372	-2.362	.018	-	-	-	-

Table 1: Significant fixed effects in single trial multi level models predicting FRN and MFT responses

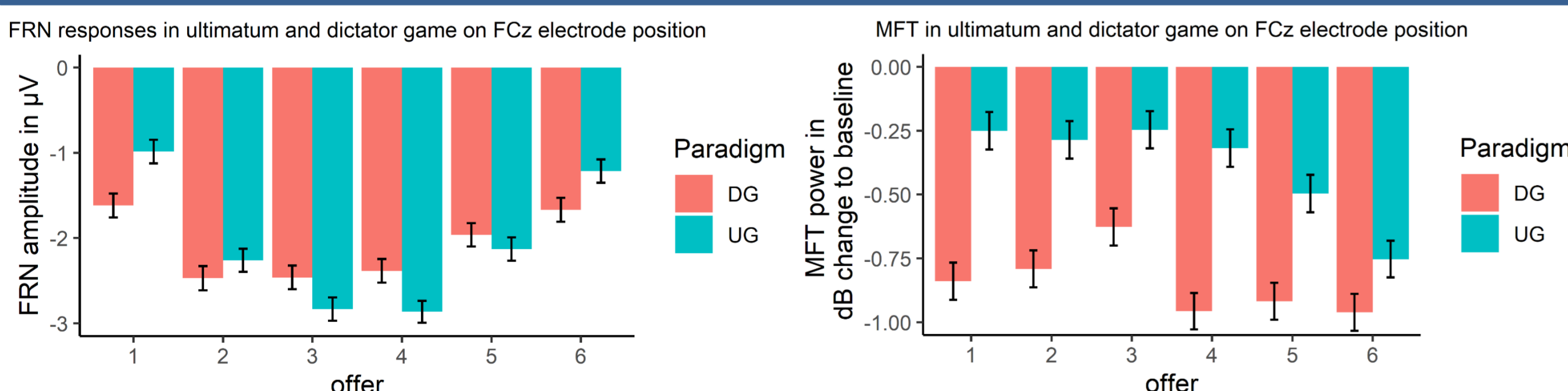


Figure 3: MFT and FRN responses in the ultimatum and dictator game. Error-bars depict mean within SE.

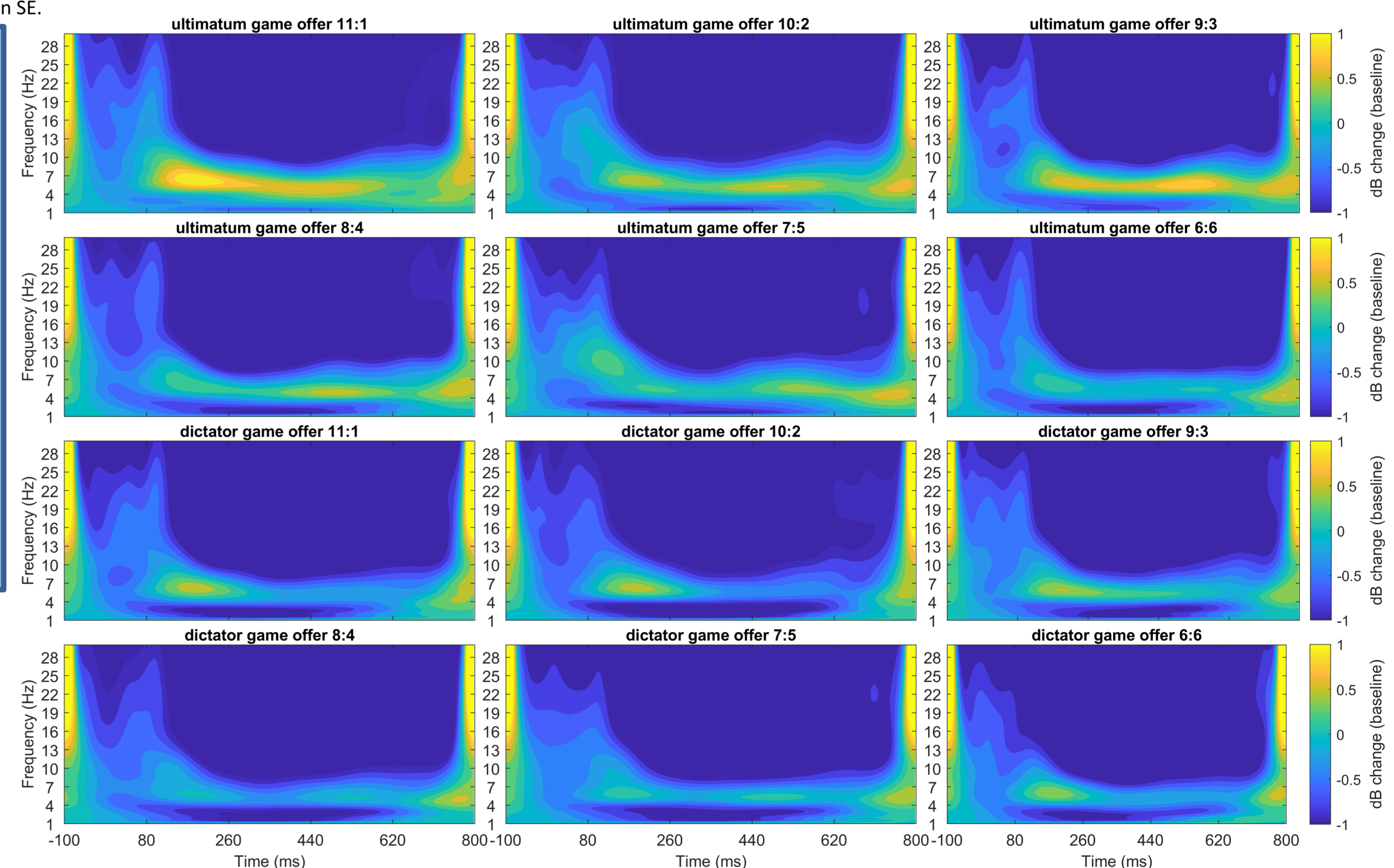


Figure 4: Time frequency analysis of responses dependent on the offers in the ultimatum and dictator game.

Discussion:

- The proposed linear relation the offer and the FRN response was not found:
 - A quadratic relation of the FRN response emerged, questioning the binary positive/negative evaluation proposed in economic games (cf. Hajcak et al., 2006).
 - Strategic decisions change the perception (P2) and evaluation process from offer fairness to anticipatory satisfaction of punishment (cf. Mussel et al., 2022).
- A minor difference in main effect between the UG and DG FRN responses (smaller amplitude for DG) and an interaction with the offers were found:
 - The intensity of the fairness evaluation and the anticipatory satisfaction of punishment declines in DG as punishment is not possible (cf. Mussel et al., 2022).
- Highly significant main effect for MFT vs. “minor” FRN effect: FRN as evaluation of the offers and MFT as cognitive control to overcome behavioral default:
 - The cognitive control needed to overcome the behavioral default to accept the offer in the UG (vs. DG) lead to higher MFT responses (cf. Rodrigues et al., 2022).

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OSF-repository:

<https://osf.io/zq5ej/>
registered replication report:
Psychophysiology:
in principle acceptance



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