Neural correlates of emotional response to taste: an EEG study

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The brain produces a prediction error (PE) in response to a difference between expectation and outcome, an important signal for adaptive learning and optimal decision making. PE signals in EEG are thought to originate in the dopaminergic midbrain and have a source in the anterior cingulate cortex. Previous research utilized monetary reinforcers to compare rewarding and aversive PE, but in such research participants can only gain money – they are never really ‘out-of-pocket’. Here we examined the correlates of personally meaningful aversive PE by using rewarding and aversive tastes. This methodology allowed us to compare positive and negative primary reinforcers from the same modality, something that has not been achieved before. Twenty participants received rewarding (sweet) and aversive (bitter) tastes, indicated by a cue, while EEG was recorded. Expectations for these tastes were controlled by giving participants cues before taste administration, which indicated the type of taste they were about to receive and the likelihood of receiving this taste (25% or 75%). Preliminary analysis shows unexpected delivery of sweet and bitter taste produces a stronger positive event-related potential (ERP) than omission of either bitter or sweet taste. This suggests that this neural response signals delivery and omission of outcome. This challenges the conventional theory of a stronger neural response for rewarding than for aversive outcomes. The FRN has only been shown to signal valence in the context of monetary loss or gain, rather than delivery of either rewarding or aversive outcome. This methodology allows direct analysis of whether the FRN signals the emotional valence of an outcome. Preliminary results suggest an amplitude difference between ERP for delivery and omission of taste. If the forthcoming main results to follow this trend to significance, we will be the first study to show the FRN response to rewarding and aversive taste, using a unimodal stimulus. This is important because using a single primary modality as a stimulus reduces any source of variability between stimuli and between participants, providing the most objective method to assess the function of the FRN. The results challenge the conventional theory that the FRN signals reward and aversion.