The Influence of Patients' Emotions and Mental Health Histories on Emergency Medicine Nurses Clinical Reasoning and Decision-Making

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Summary This experimental study investigates the influence of patient mental illness (MI) and emotional behaviors on clinical reasoning and decision-making among emergency medicine (EM) nurses. Nurses assessed angry (v. calm) patients who presented to an emergency department (ED) with a physical health concern and either with (or without) a comorbid MI.

Keywords · Emotions and Information Processing · Judgement and Decision-Making · Mental Illness · Experimental Research · Emergency Medicine Nurses

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Introduction Individuals with MI experience significant healthcare disparities (Thornicroft, 2020), which are likely due in part to the negative emotions (e.g., anger) that this population evokes. Such emotions may be common in the ED, where this population disproportionately seeks care (Weiss, Barrett, Heslin, & Stocks, 2006). Research suggests negative emotions may adversely impact healthcare providers' clinical reasoning and increase risk to patients (Isbell, Tager, Beals, & Liu, 2020). EM nurses spend considerable time with patients, make important clinical judgements, and actively transmit patient information to other providers. Nurses' judgements and the content of their patient handoffs are susceptible to influence by emotions and biases – both of which can adversely impact patient care and contribute to healthcare disparities.

Aims The current study aims to investigate the effects of patient emotions and mental health history on EM nurses' (1) clinically-relevant judgements (i.e., advocating for specific tests) and (2) transmission of patient information via patient handoffs when assessing patients presenting with a physical health complaint (e.g., headache). We hypothesize that biases will emerge in clinical judgments for patients with a history of MI (relative to those without) and patients who are angry (v. calm). We expect these biases will also be evident in nurses' written patient handoffs with EM nurses writing less comprehensive, more negative, and lower quality handoffs for patients in these conditions.

Methods 128 EM nurses recruited from hospitals in the Northeastern United States assessed four video-recorded patient cases presented online using Qualtrics. Four versions of each of four different patient cases were created and employed in a 2 (angry v. calm patient behavior) x 2 (presence v. absence of MI) within-subjects design. Following each case, nurses reported their impressions of the patient, made clinically-relevant judgements (e.g., diagnostic test recommendations, necessity of visit, pain) and wrote a patient handoff for a hypothetical shift change. After completing all cases, nurses reported their general attitudes toward patients with MI.

Proposed Analysis/Predicted Results Data collection was just completed. Impression and judgement variables will be analyzed as a function of patient emotion (angry v. calm) and MI (present v. absent) using analyses of variance (ANOVA). Written patient handoffs will first be analyzed using the Linguistic Word Inquiry Count (LIWC) Software. LIWC variables obtained (e.g., emotional tone, length of handoff) will then be subjected to ANOVA. We expect the results of these analyses will be consistent with the hypotheses described in the aims section. Individual differences in attitudes towards patients with MI will be included in subsequent exploratory analyses as a potential moderator of the predicted effects.

Conclusions Results from this study will inform our understanding of factors that can compromise decision-making among nurses and place vulnerable patients at increased risk of medical error and healthcare disparities. An understanding of these factors is essential before interventions can be developed and implemented to combat these biases.

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Mind-body dualism in emotion concepts across 2,474 languages

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Summary Using computational linguistics and network statistics, we explored the universality of mind-body dualism and its implications for emotion in a database of concepts across 2,474 spoken languages/20 language families. Although languages broadly distinguished between mind vs. body, there was also significant variability in how languages conceptualized mind-body links, especially with regard to emotions. Assumptions about mind-body dualism and emotions vary across human societies.

Keywords · Language · Mind-body dualism · Emotion concepts · Linguistic analysis · Cross-cultural

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Introduction Western philosophy and folk beliefs often view the mind and body as distinct (e.g., Bloom, 2004), yet it is unclear whether this conceptual distinction is universal. Similarly, some scientific models emphasize the cognitive nature of emotion, whereas others argue that emotions are rooted in internal bodily or interoceptive states (Barrett, 2017). These models may reflect differing lay theories about both mind-body dualism and how cognitive states (e.g., "memories") vs. interoceptive states (e.g., "hungry") relate to emotion (e.g., "anger"), which in turn may manifest as variability in mind-body conceptual links across spoken languages.

Aims Primary aims of this study included: (1) Describing the semantic structures for cognitive, interoceptive, and emotion concepts across the world's language families, (2) Testing the degree of universality vs. variability in mind-body dualism for cognitive, interoceptive, and emotion semantics, and (3) Evaluating semantic overlaps for emotion concepts with cognitive and interoceptive concepts across languages.

Methods To test the universality of mind-body dualism and its implications for emotion concepts, we used a new, extensive database of concept colexifications across 2,474 spoken languages within 20 language families from around the world (Jackson et al., 2019; Rzymski et al., 2020). Colexification occurs when languages express related concepts using the same word, which can in turn be used to infer semantic structure both within and between languages. First, an online American sample (N=109) classified concepts within the database as instances of the superordinate Western concepts of cognitive, interoceptive, and emotional states. We then computed networks of colexification to identify similar and different semantic structures across languages.

Results Cognitive and interoceptive concepts often clustered together, reflecting frequent semantic overlaps between the two categories (all results herein, ps<.01). But European languages in the Uralic and Indo-European families showed greater semantic separation for cognitive and interoceptive concepts than African, South American, or Asian families, suggesting that European cultures may be more dualist. Interestingly, cognitive concepts showed a more universal semantic structure than interoceptive concepts, indicating that the mind may be a more universal semantic category than the body across cultures. Finally, initial network structures show variability across language families in the degree to which different cognitive and interoceptive semantics are colexified with emotion.

Conclusions In sum, although language families broadly distinguish between the mind and body, there also appears to be significant variability in how people across languages conceptualize mind-body links. Importantly, this work sheds light on how people from around the world may connect different emotion categories with cognitive and bodily states in similar and unique ways. As such, these findings bring together computational linguistics, network science, and affective science to help reveal differences and similarities in emotion meaning across the human experience.

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A network-based hierarchical taxonomy of affect from language

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Summary There is no consensus on the nature and number of unique definitions used by people to describe how they feel. An optimal taxonomy should reconcile the large number of affective terms with the different granularity levels of individuals. We propose a hierarchical taxonomy of affect based on natural language, which can be used to partition the semantic space at increasing levels of granularity.

Keywords · Language · Communication · Methods Development · Data-driven · Networks

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Introduction Research on behavioral, physiological and brain correlates of emotion typically focuses on a limited set of affective categories. The choice of terms is guided by either a theory-based or a data-driven approach. Studies relying on the former assume the superiority of the chosen model, disregarding the others *a priori*. While recent data-driven studies overcome such a limitation, they show a substantial dependence of categorization on the employed stimuli and modalities (Cowen and Keltner, 2017; Cowen et al., 2020). A strategy to build a generalizable yet versatile taxonomy would be to start from spoken and written definitions of affective states, as language is crucial in their construction (Jackson et al., 2019).

Aims Our research aims at building a data-driven taxonomy of affect from natural language, which can reveal communities of terms at increasing levels of granularity. In addition, we hypothesize that the semantic structure of affect retrieved from spoken descriptions of naïve individuals would be similar to the one obtained from modern world literature.

Methods Sixty-Four Italian individuals (34F, age: 29±5 yrs, education: 17±1 yrs) provided a 3-minute oral description for 201 affective states (~200h in total), focusing on related bodily sensations, concepts and contextual information (e.g., events, relationships). Two corpora were also built from the Italian and English version of 500 emotionally charged books of modern world literature. A word-embedding approach was used to determine the cosine similarity between pairings of affective states in spoken and written language. To assess the quality of oral descriptions, we tested the correlation between the behavioral dissimilarity matrix and those obtained from corpora. A cross-validation half-split procedure identified reproducible links between affective terms and revealed the semantic structure of affect in spoken language. Lastly, a community-detection algorithm provided partitions of the semantic space at increasing levels of granularity.

Results We show significant correlations between the behavioral- and the corpora-based semantic structure of affect (ITA: r=.41, p<.001; ENG: r=.36, p<.001, ~20k DOF). The standard partitioning retrieved from spoken language comprises 19 communities (Fig.1A). Moreover, the flexibility of the network approach allows the partitioning of the semantic space into optimal units, from 11 to 44 communities or more (Fig.1B).

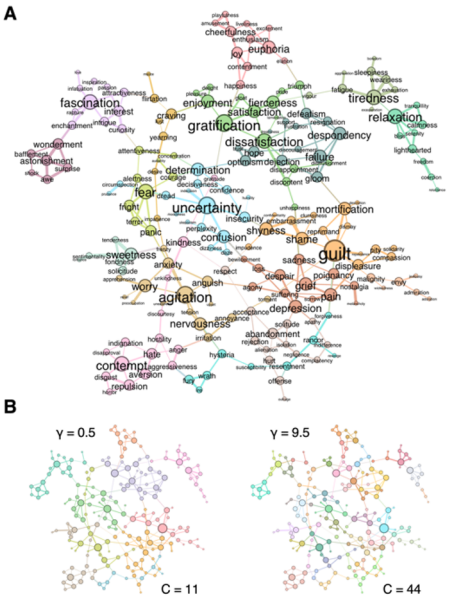

Figure 1: The semantic network of affect

Conclusions Our network-based approach can generate optimal taxonomies of affect from language. Despite chronological and modality differences, our results suggest a significant association between written and spoken affective spaces. The hierarchical partitioning of the affective space could be exploited by future studies requiring different granularity levels.

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Theta and Delta changes in resting-state EEG activity after regulating emotions

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Summary One intriguing but still unexplored question is whether regulating emotions can leave a trace in the brain by affecting its oscillatory activity. To address this issue, electrical brain activity at rest was recorded before and after deploying an emotion regulation strategy, namely *distancing*. A significant increase in theta and delta activity after the regulation session emerged, suggesting that regulating emotions can alter brain activity at rest. This is not only of great interest for affective neuroscience, but may also be helpful for clinical applications.

Keywords · Emotion Regulation · Experience of Emotion · Oscillatory Activity · EEG: Resting-state · Human Behavioral Experiment
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Introduction Emotions are powerful determinants of our everyday life, and the ability to regulate them is essential for our well-being (Gross, 2015). Several studies focused on the neurophysiological mechanisms associated with emotion regulation. One precious source of information about the brain's physiological and cognitive functioning is brain oscillatory activity (Sulpizio et al., 2020; Knyazev, 2007). Changes in theta and delta frequencies have been associated to the deployment of emotion regulation strategies (Sulpizio et al., 2020), and a sense of increased wellness and relaxation (Harmony, 2013).

Aims We aim to outline a comprehensive view of the neurophysiological mechanisms associated with emotion regulation. We expect increased theta frequencies in the post regulation session, as an extension of the Effect of Strategy observed during the task execution (Grecucci et al., 2019; Sulpizio et al., 2020), as if the brain continues to train itself to better face emotional stimuli. Such increased top-down control may also be reflected in increased delta activity, similarly to what emerged during and after meditative states (Harmony, 2013). Demonstrating that the application of regulation strategies can alter brain activity at rest may shed light on how affective processes affect brain functioning. Furthermore, it can represent a first evidence of the effect the psychotherapy can have on the patients' daily life.

Methods Thirty-three adults participated in the experiment. 5 minutes resting-state EEG (RS-EEG) was recorded, to provide a baseline measure of brain activity. After that, participants completed an Emotion Regulation task consisting of two randomized sessions, each one followed by 5 minutes RS-EEG. In one session, participants attended to the stimuli and experience the emotions elicited. In the other one, they regulated the elicited emotions by applying *distancing*, that consists in assuming a detached perspective from an emotional situation. To elicit emotions, 160 picture stimuli (80 neutral, 80 negative) were taken from the International Affective Picture System. Participants rated their emotions on both the valence and arousal dimensions using the Self-Assessment Manikin procedure.

Results A nonparametric cluster-based permutation approach was used. This is a data-driven approach that provides appropriate control for multiple comparisons. The analysis indicated an increased RS-EEG activity after regulating emotions, corresponding to two positive clusters at the level of delta (3.6 to 4 Hz, p = .033) and theta (6 Hz, p = .040) frequencies.

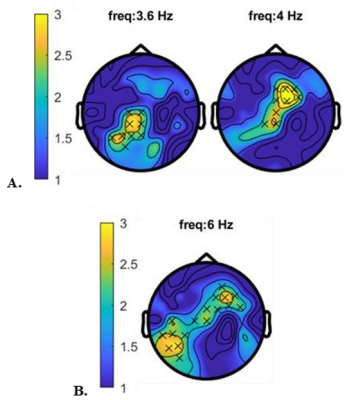

Figure 1: Topographic distributions of cluster-based permutation results, indicating increased **A.** delta and **B.** theta frequencies in the post regulation session compared to the post attended to session.

Conclusions The novel findings we report show that in the post-regulation session - but not in the post "attend to" session - an increase in theta and delta frequencies takes place. After regulating emotions, the brain remains in a state of enhanced preparation for facing future emotional stimuli. This may lead us to hypothesize a relevant role of any post-therapy session.

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Resting parasympathetic and sympathetic activity deficits are associated with left-lateralized insula atrophy in semantic variant primary progressive aphasia

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Summary This study found diminished resting autonomic nervous system activity in semantic variant primary progressive aphasia (svPPA), a neurodegenerative syndrome that impacts language and emotion. Diminished resting parasympathetic and sympathetic activity were both associated with left-lateralized insula atrophy. In svPPA, deficits in basal autonomic outflow may contribute to the alterations in emotion and social behavior that characterize this syndrome.

Keywords · autonomic nervous system · insula · frontotemporal dementia · physiology · neuroimaging

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Introduction Emotions and social behavior are influenced by the autonomic nervous system. Prior research has shown that parasympathetic and sympathetic activity depend on lateralized insular networks (i.e., left and right insula, respectively; Sturm et al., 2018a). In neurodegenerative syndromes that target the insula (e.g., frontotemporal dementia), there are deficits in resting parasympathetic and sympathetic activity (Joshi et al., 2014; Sturm et al., 2018b). Resting autonomic physiology has not yet been directly examined in svPPA, a neurodegenerative syndrome characterized by progressive decline in language and emotion and lateralized anterior temporal lobe and insula atrophy (Gorno-Tempini et al., 2011).

Aims In the present study, we examined whether (1) resting autonomic physiology is diminished in svPPA, and (2) lateralized insular atrophy relates to resting autonomic deficits in svPPA. Based on prior work, we hypothesized that (1) resting parasympathetic and sympathetic activity would be diminished in svPPA, and (2) whereas diminished parasympathetic activity would be associated with left-lateralized insula atrophy, diminished sympathetic activity would be associated with right-lateralized insula atrophy.

Methods We measured resting parasympathetic and sympathetic activity in 33 people with svPPA and 49 healthy older controls. Participants sat for a two-minute resting baseline period during which heart rate, respiration rate, and skin conductance (SCL; a sympathetic measure) were recorded continuously. Respiratory sinus arrhythmia (RSA; a parasympathetic measure) was derived from heart rate and respiration rate using the peak valley method. A subset of the sample had neuroimaging data within three months of the autonomic assessment (23 svPPA). Because neurodegeneration in svPPA is highly lateralized, we computed asymmetry scores for each voxel in the brain MRI, which provide an index of relative atrophy in the left and right hemispheres. We used these scores in the structural imaging analyses, masked to bilateral insula.

Results Compared to healthy controls, people with svPPA had lower mean resting RSA ($p < .01$, ANCOVA accounting for heart rate and respiration rate) and SCL ($p < .01$, t-test). The neuroimaging analyses revealed that in svPPA, lower RSA was associated with greater left-lateralized atrophy in the posterior dorsal insula ($p_{FWE} < .05$, accounting for heart rate, respiration rate, age, and head size), and lower SCL was associated with greater left-lateralized atrophy in the ventral anterior insula ($p_{FWE} < .05$, accounting for age and head size).

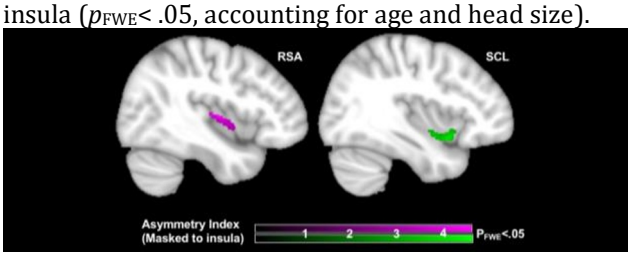

Figure 1: Lower RSA and SCL associated with left-lateralized insula atrophy in svPPA

Conclusions In svPPA, there were deficits in resting parasympathetic and sympathetic activity that were both associated with left-lateralized insula atrophy. These results suggest the integrity of the left insula is critical for supporting resting activity in both branches of the autonomic nervous system. Further research is needed to address how lateralized brain atrophy and autonomic dysfunction relate to altered emotions and social behavior in svPPA.

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On the Automatic Nature of Threat: Physiological and Evaluative Responses to Subliminal Survival-Threats

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Summary The literature on threat sensitivity suffers two problems: distinguishing threat from negative stimuli and differentiating responses sped and strengthened by threat vs. delayed and diminished by conscious processing of nonthreat. Three within-subject studies address both issues by comparing responses to threat, negative, positive, and neutral stimuli, and isolated threat sensitivity from opposing effects of conscious attention via subliminal presentation.

Keywords · Threat · Subliminal Processing · Valence · Startle Eyeblink · Skin Conductance

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Introduction Humans ostensibly inherited a neural architecture that preferentially processes immediate survival threats (i.e., threat superiority; LeDoux, 2012). Threat superiority manifests as earlier detection and faster/stronger responses to threat than nonthreat stimuli (for a review, see March et al., 2018). However, two problems complicate attributing those effects to an acute threat sensitivity. One problem, which was addressed but remains relevant, is that threatening stimuli are also negative. The second, and more challenging problem, is that supraliminal presentations do not distinguish whether faster/stronger responses to threat are due to threat superiority or the opposing effects of conscious processes evoked by nonthreat stimuli.

Aims The current work addresses both problems to test whether the mind is uniquely sensitive to survival threats. Two pilot studies ensured the subliminal nature of the stimuli. Three within-subject studies subliminally presented threat, negative, positive, and neutral stimuli and assessed skin conductance responses (SCR; Study 1), startle-eyeblink (Study 2), and evaluative inference (Study 3). If the mind is uniquely sensitive to threat as a functional adaptation for survival, reflexive responses should be stronger to subliminally presented threats than to non-threatening stimuli and such responses should influence downstream judgment.

Methods In all studies, each trial (1) began with a 2000ms centrally located pre-mask of a colorful mosaic that was (2) replaced by a 21ms image, that was (3) backward masked by a colorful mosaic (rotated 90° clockwise) and, (4) ended with a 4000ms blank screen. In Study 1 (N=111), SCR was recorded during 64 trials (16 each stimulus category). In Study 2 (N=106), fEMG recorded the amplitude of startle-induced eyeblink during 48 critical (of 136 total) trials (12 of each category). In Study 3 (N=83), participants rated the valence ("1 = Very Negative" to "5 = Very Positive") of 136 subliminally presented images (34 from each category).

Results In each study, two a priori orthogonal contrasts were consistent with threat superiority. In Study 1, threat stimuli yielded a stronger SCR than the mean skin-conductance response to negative, positive, and neutral stimuli, $F(1, 110) = 4.63$, $p = .0336$, $d = .21$, and there was no systematic variability among the latter three, $F(2, 109) = 0.03$, $p = .9687$. In Study 2, threat stimuli elicited a larger startle-eyeblink than the mean startle-eyeblink to negative, neutral, and positive stimuli, $F(1, 100) = 5.36$, $p = .0226$, $d = .23$, and there was no systematic variability among the latter three, $F(2, 99) = 0.30$, $p = .7442$. In Study 3, participants rated threat stimuli less positively than the mean valence of the negative , neutral, and positive stimuli, $F(1, 80) = 12.17$, $p = .0008$, $d = 0.39$, and there was no systematic variability among the latter three, $F(2, 79) = 1.88$, $p = .1588$.

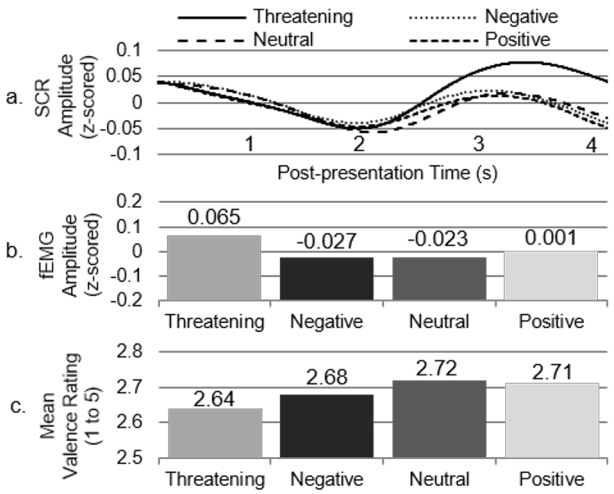

Figure 1: (a) SCR over time from Study 1, (b) mean eyeblink from Study 2, and (c) mean rating from Study 3

Conclusions By comparing responses to threating, negative, positive, and neutral stimuli, and isolating threat sensitivity from the opposing effect of conscious attention via subliminal presentation the current work demonstrates the minds unique sensitivity to survival threats. Preferentially processing and responding to immediate danger is functional for survival.

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Profound experiences of emotion early in life: Investigating children's perceptions of awe

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Summary Awe is a profound emotion that has been hypothesized to have evolutionary roots (Keltner & Haidt, 2003), but we know little about whether awe is present early in life and the development of self-transcendent emotions in general. Across two preregistered studies, we found that children discern key features of both positive and threatening awe experiences from neutral experiences, contributing to a better understanding of early self-transcendent experiences.

Keywords · Experience of Emotion · Perception · Positive Emotions · Human Behavioral Experiment · Questionnaire

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Introduction Awe is a profound emotion that has been closely linked to wonder and the sublime and is thought to be an integral component of many spiritual, religious, and peak experiences (Burke 1757/1990; James, 1902; Maslow, 1964). However, the perception of awe experiences during development remains largely underexplored. A great majority of research on emotion development focuses on primary emotions and self-conscious emotions, but awe by its very nature is a "self-transcendent emotion", which theoretically may involve different underlying cognitive abilities and have different developmental trajectories.

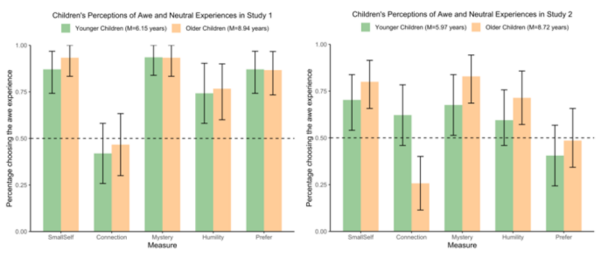

Figure 1: Children's perceptions of awe experiences by measure and median split of age in Study 1 and Study 2.

Aims We know very little about the emergence and development of self-transcendent emotions like awe in childhood. We begin to shed light on this question by asking: How do children perceive awe experiences? We predict that children will be able to delineate awe experiences from other kinds of emotional experiences, and of interest is whether there are developmental changes in their perceptions.

Methods In two preregistered studies, we investigated children's perceptions of and emotional responses to positive (Study 1) and threatening (Study 2) awe experiences. In Study 1, 4-9-year-old children (N=61) watched an awe-inspiring video of the BBC's *Planet Earth* consisting sweeping panoramic footage of natural landscapes (Rivera et al., 2020) and a neutral video of plants in a small garden. In Study 2, 4-9-year-old children (N=72) watched an awe-inspiring video of destructive natural disasters and the same neutral video as in Study 1. Children answered questions about how the videos made them feel in both studies.

Results We found that awe experiences, in comparison to neutral experiences, led children across ages to perceive themselves as small in regard to the rest of the world (M = 0.90, p < 0.001), and overall increased motivation to explore unknown things (M = 0.75, p < 0.001), and led to more perceived mysteries in the world to understand (M = 0.93, p < 0.001), but did not lead children to feel more connected to everything in the world (M = 0.44, p = 0.44), *Figure 1.* Consistent with Study 1, results from Study 2 revealed that negative awe experiences, relative to neutral experiences, led children to perceive a smaller self (M = 0.75, p = 0.001), feel more motivated to explore unknown things in the world (M = 0.65, p = 0.02), and perceive more mysteries in the world (M = 0.75, p < 0.001), but did not lead children to feel more connected to everything in the world (M = 0.44, p = 0.50), *Figure 1.*

Conclusions In conclusion, these findings show novel evidence that children discern awe experiences from neutral experiences. An ongoing study examines how vast nature vs. social scenes (crowds of people) may differentially affect children's emotion, motivation, and sense of self. The results together may contribute to a better understanding of profound, potentially self-transcendent, emotional experiences early in life, inspiring questions about the evolutionary and adaptive functions of awe experiences in development.

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Better when shared:
listening to music with others increases the musical pleasure

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Summary Media reporting people playing and singing from Italian balconies during the COVID-19 lockdown highlighted the importance of sharing music for improving the affective state. By implementing an online behavioural protocol simulating a social shared experience, we show that listening to music with other people can significantly increase the pleasure felt by the participants.

Keywords · Musical Pleasure · Social Sharing · Online Experiment · Emotion

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Introduction Music is one of the most pleasant stimuli for humans. Musical pleasure can be modulated, in the laboratory, through brain stimulation or pharmacological interventions (Ferreri et al., 2019). However, these invasive methods are far from reflecting the every-day, deeply social musical experience. The question raises on how musical pleasure can be modulated, and more specifically increased, in ecological paradigms similar to real-life experience. Motivating insights come from affective science research showing that emotions can be perceived as more intense when experienced with a friend (Liljeström et al., 2013; Wagner et al., 2014). However, no study so far investigated whether sharing a musical experience with strangers can specifically increase musical pleasure.

Aims We aimed to explore to which extent shared musical listening can increase the subjective musical pleasure. Given the current pandemic situation and the associated social distancing, the implementation of an online protocol seemed of particular interest.

Methods In an online behavioural task, participants (N=34; 20 men; age: 33±8.2 years) had the illusion of listening to music under different *social* conditions: sharing the listening experience with nobody (Non Social), with few people (i.e., from 3 to 5; Low Social), with many people (i.e., from 18 to 20, High Social). Participants saw how many people were listening to the song concurrently with them by looking at a map of where each icon represented a virtual listener in their city of residence (Fig. 1A). Each participant listened to 18 songs (9 self-selected, 9 randomly assigned; 1 min duration each). Unbeknownst to the participants, there were no real people "connecting" to each of the trials; we showed them videos mimicking real-time virtual companions. During each song, participants provided real-time the amount pleasure felt using a cursor on the screen. After listening to each excerpt, they provided an overall subjective rating of the pleasure felt while listening to the musical piece, as well as a familiarity control score (among others, not reported here).

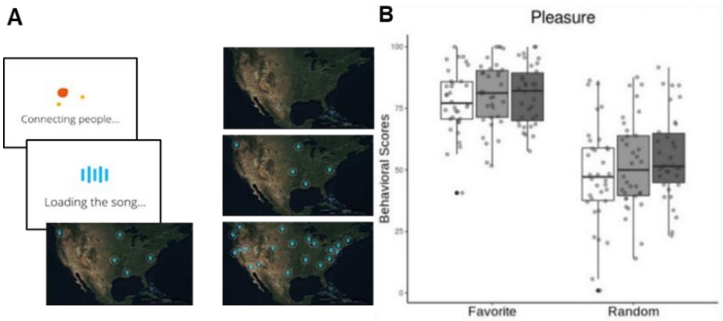

Figure 1: Online experimental paradigm (A) and pleasure ratings results (B).

Results We found a significant main effect of song category for both pleasure ($F(1,33) = 55.762$, $p<0.001$, partial $\eta^2=0.618$) and familiarity ($F(1,33) = 61.280$, $p<0.001$, partial $\eta^2=0.650$; as expected, participants were more familiar and felt more pleasure with their favourite songs) and a main effect of social condition only for the pleasure scores ($F(2,66) = 6.215$, $p<0.003$, partial $\eta^2=0.158$). Post-hoc tests with Bonferroni correction showed that the pleasure during the High Social (Fig.1B, white) condition was higher than during the Non Social one (Fig. 1B., dark grey) ($p<0.003$; marginally effect for Low -Fig.1B, light grey- vs. Non Social, $p=0.062$).

Conclusions In sum, we found that sharing an emotional experience (i.e., music) with other people can significantly increase the pleasure experienced by participants, even when the social sharing is just illusory and online. These encouraging preliminary results open new perspectives for the study of music reward and for the implementation of online social-cognitive paradigms.

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Do opioids induce euphoria and reduce anxiety in healthy humans?

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Summary Opioids are thought to be so addictive because they make people feel great, either by inducing euphoria or by relieving stress and anxiety. The endogenous opioid system is believed to similarly improve mood in the healthy human brain. Our data suggest that positive opioid effects on mood are rare in non-opioid users. Probing subjective report data from 172 healthy non-opioid users from two placebo-controlled experiments with per-oral opioids[1,2] and one open-label study with intravenous opioid effects pre-surgery, we observe variability in the subjective responses and no overall improvement of mood in individuals without a history of opioid misuse.

Keywords · opioid · euphoria · human ·
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Introduction The canonical view that pain protects against the addictive properties of opioids (1) has now been abandoned, and many pain practitioners are reluctant to prescribe opioids for persistent pain (2). Here, we question another canonical view of opioid analgesics, namely their ability to cause euphoria and reduce anxiety. Euphoria is listed as a common side effects of opioid analgesics, and is thought to predict the abuse liability of these medications. Opioid stress relieving and anxiolytic effects are also highlighted as key predictors of opioid misuse.

Aims To assess the subjective effects associated with acute administration of opioid drugs in humans without addiction or problematic opioid use.

Methods We probe subjective effects data from two in-house datasets after placebo-controlled administration of opioid agonists and antagonists in healthy volunteers (morphine 10 mg p.o.; naltrexone 50 mg p.o.; sample sizes 49(3) and 63(4). Moreover, we report subjective effects (drug *liking/disliking and mood*) of pre-anaesthesia remifentanil treatment (effect site concentration 5ng/ml, Minto model) in 160 relatively healthy day surgery patients (96 women, mean age = 46) with no or low ongoing pain. These open-label data were collected using numerical rating scales (NRS) while patients were on the operating table.

Results Morphine did not systematically enhance mood in our two placebo-controlled studies where participants were successfully blinded to drug identity, did not report a drug *high* and where drug *liking* was comparable for morphine and placebo (3.6 and 3.5 on an 11-point scale). Further, 50 mg of naltrexone (n = 49) producing ~95% blockade of mu-opioid receptors, we find no evidence of reduced mood. The open-label data of 160 day-surgery patients mirrors our lab results. Patients were relatively healthy and average ongoing pain before operation was only 1.2 on an 11-point scale. One-two minutes after remifentanil infusion, patients reported a considerable drug *high* (mean ± SD: 6.4 ± 2.7), but nevertheless reported feeling *less good* after remifentanil (pre: 6.9 ± 2.1; post: 6.4 ± 2.3, t (156) = 3.6, $p < 0.001$, $BF_{10} = 40$, Cohen's $d = .3$). Moreover, pre-surgery remifentanil only marginally reduced *anxiety* ratings (pre: 3.4 ± 2.7; post: 3.0 ± 2.8, t (150) = 2.6, $p = 0.01$, $d = .2$) although the evidence was insubstantial according to common Bayesian criteria, $BF_{10} = 2.2$).

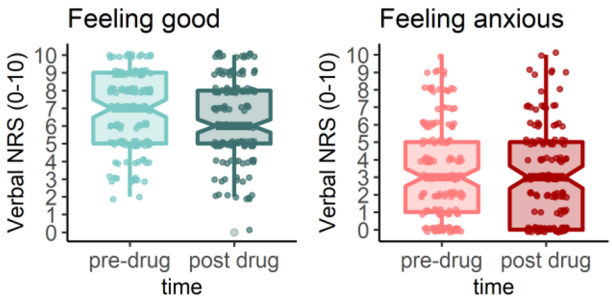

Figure 1: Ratings pre- and post- i.v. remifentanil.

Conclusions As early as in 1955, Henry Beecher and colleagues (5) showed that several doses of morphine and heroin i.m. injections caused dysphoria rather than euphoria in healthy, non-opioid-using young men. Despite those early results, medical textbooks still list euphoria and drug liking as consequences of opioid analgesia treatment. Our data and other published drug studies in non-opioid users suggests that only a subgroup of healthy people experience euphoria from treatment with opioids. Further, we found no anxiolytic effects of opioids. Importantly, intact endogenous opioid signalling is not necessary to maintain good mood, even in studies of pain(6) or stress(7) . In sum, the role of opioid drugs in regulating human mood appears vastly exaggerated.

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Predicting real-time fMRI-based insula regulation from brain structure

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Summary In this study, we employed MVPA to investigate structural brain features predictive of successful real-time fMRI-based anterior insula regulation. Our results indicate the main contribution of FPCN and SN along with cerebellum to learned anterior insula control. Altogether, our findings highlight specific regions involved in real-time fMRI-based emotion regulation and partial overlap with brain networks related to cognitive emotion regulation.

Keywords · emotion regulation · real-time fMRI · anterior insula · MVPA · structural

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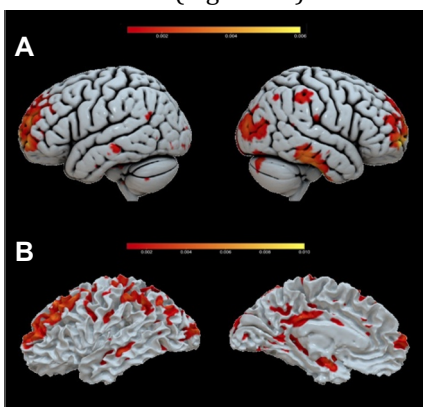
Introduction In the last decade, real-time (rt)fMRI-based techniques proved to be an effective strategy for emotion regulation, complementary to other strategies such as cognitive emotion regulation. Using rtfMRI feedback, healthy individuals and patients can learn to control activity of cortical and subcortical regions related to socioemotional behaviour. Previous studies indicated that several regions included in the salience network (SN) and in the frontoparietal control network (FPCN) might play an important role in rtfMRI-based emotion regulation (Caria, 2020). However, these findings are mainly dependent on the same fMRI data, that are related to several distinct regulatory aspects, and are also inherently limited by BOLD signal characteristics. On the other hand, it has been shown that brain structure measures might actually represent a good predictor of behavioral performance, and in some cases even better than functional measures (Kristanto, Liu, Liu, Sommer, Zhou, 2020). Thus, the exploration of the relationships between structural MR measures and learned emotional brain regulation might possibly corroborate and extend current evidences on the brain networks supporting rtfMRI-mediated emotion regulation.

Aims In this study, we aimed to investigate the predictive value of whole-brain structural MR features in rtfMRI-based emotion regulation performance. Specifically, we assessed GM and WM regions responsible for successful BOLD regulation of the anterior insula (AI) using multivariate pattern analysis (MVPA) applied to structural data. In line with previous functional evidences we expected to observe differential engagement of specific brain regions included in the SN and FPCN during rtfMRI-mediated emotion regulation.

Methods MVPA was applied to anatomical images of 17 healthy participants who underwent AI-mediated emotion regulation (Caria, 2020). MVPA was performed using Kernel Ridge Regression as implemented in PRoNTo toolbox. Linear kernels were built separately for whole brain smoothed GM and WM images. Leave-one-out cross validation was applied to assess to what extent WM and GM regions are predictive of the AI %BOLD signal changes across 4 rtfMRI regulation runs. Accuracy classification was tested using 5000 permutations.

Results A large GM network including frontal, temporal, occipital areas along with portions of the cerebellum were the strongest predictors of AI-mediated emotion regulation (Figure 1A). Coherently, predictive WM features included fibers connecting fronto-temporal-occipital areas, such as the inferior fronto-occipital fasciculus and the uncinate fasciculus, as well as the posterior thalamic radiation (Figure 1B).



Conclusions These results confirm previous functional studies indicating engagement of the FPCN and SN in rtfMRI-based regulation and extend them by showing involvement of the cerebellum, that some other studies suggested relevant for the regulation of emotion and mood. Altogether, our findings highlight specific regions involved in rtfRMI-based regulation and partial overlap with brain networks related to cognitive emotion regulation (Pappaianni, De Pisapia, Siugzdaite, Crescentini, Calcagnì, Job, Grecucci 2019).

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Co-rumination Across In-person and Digital Communication: Associations with Affect and Relationship Closeness in Adolescents

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Summary Although interpersonal emotion regulation in the form of co-rumination and the use of digital technology is prominent during adolescence, no study to date has investigated the effects of co-rumination through multiple modalities of communication (i.e., in-person, text, social media, phone). This study investigated the effects of co-rumination through different modalities of communication on co-rumination use, affect, and relationship closeness. Findings revealed that co-rumination occurs across all communication modalities, though adolescents spend the most time co-ruminating in person. Furthermore, the effect of co-rumination in one modality on the future use of co-rumination within that same modality and across other modalities and the impacts on affect and relationship closeness are uniquely attributed to specific modalities and not others. The results of this study have important implications for the field of interpersonal emotion regulation and for efforts to better support adolescents' emotional development.

Keywords · Emotion regulation · Emotion · Co-rumination · Adolescence · Affect

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Introduction Despite the prominence of interpersonal emotion regulation, particularly during adolescence, it is a relatively understudied area of investigation. One interpersonal emotion regulation strategy frequently used by adolescents is *co-rumination*, which is defined as dwelling on negative feelings and problems in the context of a dyadic interaction (Rose, 2002). Past research has focused on the in-person use of co-rumination, while largely overlooking digital modes of communication. This study was the first to investigate adolescents' co-rumination across in-person and digital modes of communication (i.e., in-person, text, social media, phone) and its downstream effects.

Aims Specifically, we examined: **(Aim 1)** the amount of time spent co-ruminating across modalities, **(Aim 2)** the effect of co-rumination in one modality on the future use of co-rumination within that same modality (inertia) and across other modalities (contagion); and **(Aim 3)** the prospective effects of co-rumination on subsequent negative affect, positive affect, and relationship closeness. We also assessed gender differences, given past research documenting differences in outcomes of co-rumination across girls and boys (Rose, 2002).

Methods Adolescents (n = 71; 33 girls and 38 boys; M_{age} = 12.70 years) recruited from Vancouver, Canada, completed daily diary surveys twice a day at 3pm and bedtime for 14 days during the first two weeks of the transition to high school. Participants reported on time spent co-ruminating across communication modalities, affect (positive and negative), and relationship closeness with their best friend. Analyses were conducted using multilevel modelling (MLM).

Results **(Aim 1)** Participants co-ruminated across all modalities and spent more time co-ruminating in person than in any other modality, $\chi^2(3) = 12.47$, $p = .006$. **(Aim 2)**. In terms of inertia, time spent co-ruminating over the phone was predicted by greater time spent co-ruminating over the phone at the previous prompt, $\beta = -0.15$, $p < .001$. With regards to contagion, time spent co-ruminating in person was predicted by greater time spent co-ruminating over social media at the previous time prompt, $\beta = 0.51$, $p = .013$. **(Aim 3)** We also found that co-rumination had downstream effects on affect and relationship closeness. Whereas time spent co-ruminating via text predicted *increases* in positive affect at the subsequent prompt, $p < .001$, time co-ruminating via social media predicted *decreases* in positive affect at the following prompt, $p = .009$, suggesting a difference in affective consequences across communication modalities. Finally, with regards to relationship consequences, co-ruminating via text, $p < .001$, and via phone, $p = .003$, predicted greater relationship closeness at the following prompt. In terms of gender differences, most effects were stronger for girls than for boys. For example, for girls, co-rumination over social media was a stronger predictor of subsequent in-person co-rumination, relative to boys. However, for boys, co-ruminating over the phone was a predictor of less co-rumination in-person, compared to girls.

Conclusions This study was the first to investigate the temporal dynamics and consequences of co-rumination across different modes of communication. Findings revealed that co-rumination occurs across all communication modalities, though adolescents spend the most time co-ruminating in person. Furthermore, inertia and contagion effects of co-rumination and the impacts on affect and relationship closeness are uniquely attributed to specific modalities and not others. The results of this study have important implications for the field of interpersonal emotion regulation and for efforts to better support adolescents' emotional development.

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Boredom in parenthood: Examining an overlooked but important emotion

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Summary Three preregistered studies were conducted on boredom felt in parenthood — the very first to tackle this ill-understood area not only qualitatively but also quantitatively, providing detailed information on the nature of boredom felt by parents. The inclusion of measures of situational characteristics and personality moreover help to specify these boring instants and the parents who experience it.

Keywords · Boredom · Parenthood · Personality · Thematic Analysis · Correlational Research

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Introduction Although parents' complaints of being bored are widespread online, research on boredom experienced in parenting is scarce. The emotion of boredom has been associated with maladaptive tendencies like anxiety and depression (LePera, 2011) and even parents' sadistic behavior toward their children (Pfattheicher et al., 2020). We theorize that parenting young children is likely to involve high risks of experiencing several of the hallmarks of boredom (Westgate & Wilson, 2018) like constraint, understimulation, and potentially lapses in meaning. Thus, parents may experience boredom often - a state that in turn may be essential to both their own and their children's wellbeing.

Aims We aimed to get a first fundamental look at boredom in this specific context: how do parents describe the experience; which cognitive challenges and emotions arise alongside it; in what type of situation does it occur; and finally, what defines the personality of those parents most vulnerable to boredom?

Methods Three mixed methods online studies were conducted on boredom experienced when parenting. In Study 1 (N = 100) and Study 2 (N = 248), we asked parents to describe a situation of parenting where they felt bored. In Study 2, parents additionally rated the situation for the degree of boredom and several other cognitive and emotional aspects selected based on recent theory development on boredom (Westgate & Wilson, 2018). A measure of general situational characteristics was also included (DIAMONDS S8-I; Rauthmann & Sherman, 2016). In Study 3 (N = 262), we examined individual differences in the boredom of parents and the possibly related experiences. Study 3 also included measures of personality (HEXACO-60; Ashton & Lee, 2009; SD4; Paulhus et al., 2018).

Results Using qualitative thematic analysis, we found that the descriptions of boredom obtained in Study 1 were related to 6 dimensions: issues of stimulation, attention difficulties, frustration, constraint, guilt, and finally, fluctuations in the experience of meaning. The ratings of the described situations for boredom, cognitive and emotional aspects in Study 2 supported these first findings. Further, building on the DIAMONDS-model, the situations of boredom in parenthood were characterized by the situational markers of duty, sociality, and both positivity and negativity. In Study 3, there were significant correlations (all p's < .001) between boredom and multiple of the aspects measured: concentration problems, issues with maintaining focus on the child, understimulation, repetition, situation difficulty, perceiving the child as a source of difficulty, frustration, guilt, and finding the situation less meaningful. Those scoring low on Honesty-Humility, Extraversion, and Conscientiousness, and high on Machiavellianism, Psychopathy, and Sadism were significantly more likely to experience boredom when parenting (all p's < .01).

Conclusions In this unexplored area of affective science, we found that the neglected emotion of boredom is a regular part of parenthood related to challenging negative emotions, cognitive issues, and lapses in the experience of meaning. The novel and thorough approach delivers completely new knowledge on several aspects of this contextually specific boredom thus helping to define boredom itself, the situations it arises in, and those parents who are most vulnerable to it.

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The Effect of Valence and Arousal Levels on Taste Perception

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Summary We investigated the effect of affective valence and arousal on taste perception. Participants were divided into four groups. Each group watched different videos that evoked positive/negative and high arousal/low arousal emotional states. After the affective induction, they were asked to drank the same juice. On one hand, valence levels influenced the perception of sweetness, bitterness and likeability of the juice. On the other hand, there was no evidence of the influence of arousal on taste perception.

Keywords · Arousal · valence · taste perception · self-report · frequentist statistics

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Introduction Previous studies reported that taste perception changes according to the emotional state experienced (Ileri-Gurel, Pehlivanoglu, & Dogan, 2013; Reinoso-Carvalho, Dakduk, Wagemans, & Spence, 2019). However, each study has reported different changes in sweetness perception due to negative emotions. To understand the relationship between emotions and taste, it is necessary to consider more than just whether emotions are positive or negative. Therefore, we focused not only on positive and negative valence, but also on low and high arousal.

Aims This study aims to determine how different valence and arousal states affect taste perception.

Methods 81 volunteers (49 female, aged 18-28, M = 21.26, SD = 2.12) took part in the study. They were assigned to four groups according to the video they watched: Positive - High / Low arousal group or Negative High / Low arousal group. A 200 ml of juice mix was used as the taste stimulus. The juice was designed to be sweet, salty, sour, bitter, and not unpleasant, and was specifically designed to provide an unfamiliar stimulus. Each participant first watched each video they had been assigned to watch. After doing so, participants were asked to evaluate their valence and arousal using a Visuo-Analog Scale (VAS). Valence ranged from unpleasant (0 %) to pleasant (100 %). Arousal ranged from sleepy (0 %) to awake (100 %). After that, they drank the juice and evaluated the intensity of its sweetness, saltiness, sourness, bitterness, umami and likeability, ranging from 0% (very weak) to 100% (very strong).

Results Valence and arousal ratings were compared for each group using a two-way factorial analysis of variance (ANOVA) with valence condition (positive or negative) and arousal condition (high or low). As expected, there was a main effect of valence condition on valence ratings. Also, there was a main effect of arousal condition on arousal ratings. There were no main effect and interaction on these ratings. Taste ratings were also compared for each group using a two-way factorial ANOVA. The results showed that there were main effects of valence condition in the perception of sweetness [$F(3, 77) = 5.35$, $p < .05$, $\eta_p^2 = .06$], bitterness [$F(3, 77) = 11.77$, $p < .001$, $\eta_p^2 = .13$], and the likeability [$F(3, 77) = 8.57$, $p < .01$, $\eta_p^2 = .10$] (Fig. 1). Furthermore, we found significant correlation between valence ratings and sweetness [$r = .32$, $p < .01$], bitterness [$r = -.36$, $p < .001$], and likeability[$r = .40$, $p < .001$]. Finally, there was no main effect of arousal condition and no interaction. However, there was a significant negative correlation between arousal ratings and likeability in negative valence condition[$r = -.32$, $p < .05$].

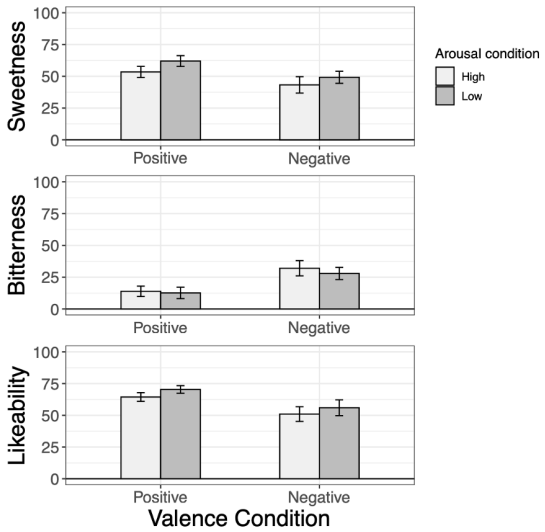

Figure 1: The mean ratings of sweetness, bitterness and likeability for each group.

Conclusions In the present study, we found that the elicited affective valence influenced taste perception. These results are in line with previous research (Reinoso-Carvalho et al., 2019). In addition, we observed that the higher the level of arousal, the lower the likeability, but only when participants were experiencing a negative affective state.

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Emotion increases neural similarity, but not perceived similarity, between pictures of realistic events

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Summary Two events, such as illness and death, are thematically similar because one often follows the other. They are also similar in that both evoke negative feelings. Emotional similarity refers to inter-stimulus similarity on an emotional dimension. Here we show that emotional similarity does not increase subjective judgements of similarity, but emotion nevertheless strengthens the association between subjective and neural similarity.

Keywords · *Experience of emotion* · *perception*· *Semantic cognition* · *Human behavioural experiment* · *fMRI: task* D

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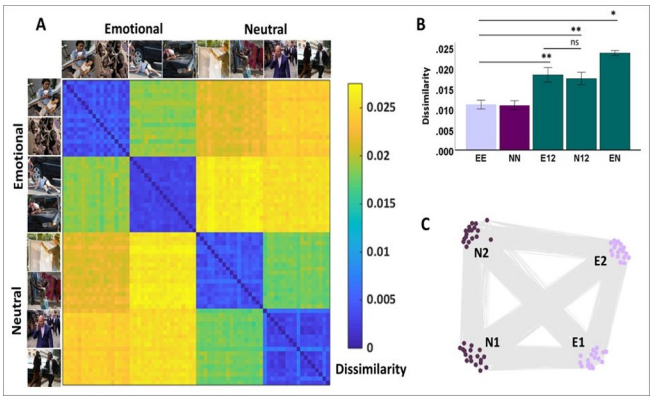
Introduction People use the similarity between their experiences to comprehend the present, reflect on the past, and plan for the future. For example, the contentious similarity between Boris Johnson and Donald Trump has helped people make sense of world events. Yet it is unknown whether the feelings that are associated with mental representations influence the perceived similarity between them, or the similarity between their neural representations. Neither research on semantic cognition, nor research on emotion, has investigated this question.

Our Aim was to test the hypothesis that similarity in the valence of evoked emotions contributes to the extent to which events are perceived to be similar to one another, and the neural similarity between.

Methods We used a novel stimulus set that equated the thematic similarity of realistic pictures of emotional and neutral events, as well as numerous visual and semantic features. 20 healthy adults took part in Experiment 1, where they rated 72 pictures from 4 categories (2 neutral: N1, N2; and 2 negative emotional; E1, E2) by arranging them in a bidimensional space, according to the overall similarity among them (Kriegeskorte & Mur, 2012). 40 additional participants took part in Experiment 2, where they provided pairwise ratings of overall similarity on a 1-7 Likert scale. Finally, 29 additional participants took part in Experiment 3, where they performed a visual complexity rating of the same pictures while scanned with fMRI, and then provided similarity judgements as in Experiment 1. A searchlight Representation Similarity Analyses (RSA) was conducted to constrain the search volume to regions that represented perceived similarity. We then conducted two additional RSAs to compute the correlation between neural pattern activations and perceived similarity between the 2 emotional categories (E12), and separately, between the 2 neutral categories (N12). The brain-behaviour correlations for E12 and N12 in each cluster were contrasted using a t-test, p_{FDR} <0.05.



Behavioural results in Experiment 3. (A) The representational dissimilarity matrix depicts (B) equivalent dissimilarity between emotional and neutral categories, E12 and N12. (C) a multidimensional scaling analysis of the judgment data.

Results The pattern of perceived similarity judgments was replicated in 3 experiments. As predicted, perceived similarity within category (within E1/E2, or within N1/N2) was lower than between categories (E12, N12, EN, p<0.001). In contrast to the hypothesis, the similarity between emotional categories (E12) was not greater than between neutral (N12) categories. The fMRI study showed that N12 judgments were correlated with clusters in the bilateral occipital place area (OPA) and parahippocampal place area (PPA). In addition to OPA and PPA, E12 judgements correlated with clusters in the precuneus, dorsal anterior cingulate cortex and left anterior insula. The correlations between neural pattern activations and participants' similarity space were stronger for E12 than N12.

Conclusions While subjective judgments in healthy participants consistently disregarded the similarity between the emotional valence of events, emotion increased the association between similarity judgments and neural patterns in high-level visual regions, and in areas involved in emotional processing and regulation.

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Self-Compassion in Chinese Young Adults: Its Measurement and Specific Features of the Construct

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Summary We explored the factor structure of the Self-Compassion Scale-Chinese version (SCS-C) and how Chinese young adults understand self-compassion. Our study identified cultural factors in the understanding of self-compassion that may explain psychometric problems with the current SCS-C and provided suggestions for its revision and for how to use the current version of the SCS-C in empirical research.

Keywords · Self-Compassion Scale · Chinese Version · Factor Analysis · Focus Groups · Culture Differences

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Introduction Self-compassion, being kind to oneself in difficult times (Neff, 2003), has been linked to fewer symptoms of psychopathology (e.g., MacBeth & Gumley 2012). The Self-compassion scale (SCS, Neff, 2003) has been widely used and translated into different languages to assess self-compassion. However, inconsistent findings on the psychometric properties of the SCS-C are accumulating (e.g., Neff et al., 2019; Zeng et al., 2016). Additionally, relatively little is known about this multidimensional concept from a cultural perspective. Recent research suggested that Chinese individuals, representing a collectivist culture, may have a different understanding of self-compassion, which could differentially contribute to mental health.

Aims We aimed to get an in-depth insight into Chinese adults' understanding of self-compassion and explore the factor structure of the SCS-C.

Methods Using a mixed methods approach, we conducted two studies. For our quantitative study, we recruited two young adult samples [Sample 1, N = 465, 141 males, Mean age (M_{age}) = 20.26; Standard Deviation of the age (SD_{age}) = 2.18; Sample 2, N = 392, 71 males; 317 females; M_{age} = 18.97; SD_{age} = .98] to explore the factor structure of SCS-C. Confirmatory Factor Analyses (CFA) and Exploratory Structural Equation Modeling (ESEM) were used to examine seven models (correlated and bifactor models) in order to test previously discussed four-factor and six-factor structures of SCS-C. For our qualitative study, four online focus groups comprising a subsample of young adults with different levels of self-compassion and gender were recruited to discuss Neff (2003)'s construct of self-compassion based on self-kindness, self-judgment, common humanity, isolation, mindfulness and over-identification. Thematic analysis was used to analyse the data.

Results Although ESEM supported the six-factor structure when problematic items were omitted, stronger evidence for a novel four-factor structure of the SCS-C was revealed with self-kindness, common humanity, mindfulness and uncompassionate self-response suggesting a different understanding of the negative components of self-compassion from the original definition in Chinese samples. Omega coefficients of the bifactor models suggested that it is not appropriate to use the SCS-C total score in Chinese samples. In the focus group study, the resulting themes helped to reveal that Chinese participants valued what can be described as benign self-criticism and self-reflection when reflecting on their understanding of self-judgement. In this same vein, participants' view of self-compassion dimensions can be described as dialectical in that they reflected both negative and positive perceptions in each factor rather than suggesting purely negative and purely positive dimensions. There was also overlap in the interpretation of the negative dimensions (self-judgment, isolation and overidentification).

Conclusions When using the existing SCS-C in path models, researchers are advised to use a latent variable approach and establish the measurement construct rather than sum scores of the scale or subscales in future empirical studies. Our findings highlight particularities in the understanding of self-compassion in China, a collectivist culture influenced by philosophical traditions promoting dialecticism and the dual focus on the transformation of the self and social participation.

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