

Research Article

Cite this article: Peressotti, F. and Miozzo, M. (2025). Feeling more in the language used among family and friends. *Bilingualism: Language and Cognition* 1–18. <https://doi.org/10.1017/S1366728925000355>

Received: 27 March 2024

Revised: 3 March 2025

Accepted: 14 March 2025

Keywords:



emotional language; bilingualism; regional languages; disgust; humor

Corresponding authors:

Francesca Peressotti and Michele Miozzo;

Emails: francesca.peressotti@unipd.it;

mmiozzo@barnard.edu

  This research article was awarded Open Data and Open Materials badges for transparent practices. See the Data Availability Statement for details.

Abstract

Many bilinguals speak both languages proficiently and habitually; however, the contexts in which the languages are used can vary. The present study examined the effects of context variation on emotions, comparing a national language used everywhere to a regional language spoken only among family and friends. We found a higher sensitivity to disgust (Experiment 1), a greater enjoyment of humor (Experiment 2) and stronger emotions in response to endearments, reprimands and insults (Experiment 3) with the regional language. The regional language induced stronger emotional responses, even though it was used less frequently than the national language. The effects of the regional language varied depending on the frequency of its use. We propose that these effects on emotions reflect the different opportunities to use the language among family and friends, contexts critical for the acquisition and regulation of emotions and in which emotions are expressed quite vividly.

Highlights

- Bilinguals often speak a language they can use only among family and with friends
- The regional language we studied was of this kind
- We compared it to the national language that our bilinguals could use in any other context
- Stronger emotional responses were elicited by the regional than the national language
- This difference was found in a variety of emotions

1. Introduction

Millions of bilinguals around the world speak different languages whether they are in their family or outside their household. This is the typical language experience of immigrants and their children who speak their mother tongue only at home (Montrul, 2016; Polinsky & Kagan, 2007) or in communities where the household language differs from the national language used in public institutions and by the media (Auer, 2005). Such a split in language use has potential implications for language and cognition. Here, we investigate its effects on emotion, asking whether languages spoken in these distinct contexts induce emotions of different intensities. The question is, in part, motivated by studies showing that, compared to native tongues, emotions are weaker with foreign languages learned in school and used sporadically (for a review, see Thoma, 2024). This lack of emotional grounding has been attributed to the limited opportunities to experience foreign languages in emotional contexts (Caldwell-Harris, 2015; Pavlenko, 2017). The two languages we compared in this study are spoken in Italy; both are acquired early in life and are used proficiently, differing crucially in their contexts of use. The *regional language* can only be spoken among family and people in the community who learned it, whereas the *national language* is required in all other circumstances, including in print and digital media as a written language (Tuttle, 1997). We examined whether the regional language, which is rooted in the family and the community, induces stronger emotions. Such a difference in emotional intensity would likely reflect the quality and richness of the emotions experienced among relatives and acquaintances, a difference that the regional language is able to recreate to some extent. A greater emotional intensity with the regional language would contrast with the decreased emotional intensity observed with foreign languages. Accounts explaining the language effects on emotion as depending on the richness of the emotion experienced in the language (Caldwell-Harris, 2015; Pavlenko, 2017) would naturally predict such polar opposite effects of regional and foreign languages. Evidence of especially intense emotions with the regional language would strengthen accounts linking language effects to opportunities of emotional experience.

The emotional imbalance between bilinguals' languages has been shown to affect several aspects of daily life, including language choice in psychotherapy (Dewaele & Costa, 2013), intimacy and romance between partners who do not share a native language (Piller, 2011), food preferences (Geipel et al., 2018) and the effectiveness of advertising (Puntoni et al., 2009).

© The Author(s), 2025. Published by Cambridge University Press. This is an Open Access article, distributed under the terms of the Creative Commons Attribution licence (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted re-use, distribution and reproduction, provided the original article is properly cited.

However, the implications of such an emotional imbalance extend to cognitive theories. Decisions concerning risky prospects, monetary rewards and moral judgments were found to vary depending on whether bilinguals made such choices in their native or foreign language (for reviews, see Circi et al., 2021; Del Maschio et al., 2022; Stankovic et al., 2022). An explanation that has received extensive consideration relates such language effects to the weaker emotionality of foreign languages (Costa et al., 2014; Pavlenko, 2017). The emotions elicited by the regional language would provide a crucial test for explanations linking language effects to emotionality. The effects of the regional language on choices should, in fact, reflect its emotional strength. Therefore, for example, they should differ from the effects of the foreign languages if the regional language induces stronger emotions than the foreign languages.

The regional language is spoken in contexts that provide unique conditions for expressing and feeling emotions. The family is where emotions are first experienced, learned and regulated (Morris et al., 2007); the bonds created with friends allow one to express emotions more freely (Rubin et al., 2008). The contexts in which the national language is used may shape emotions in a different way. There are many opportunities to experience emotions at school and work, but the norms regulating social interactions that are in place here are likely to restrict emotional range and expressivity. Books and movies describe a variety of emotions – often very intense ones – but these emotions, in contrast to those felt in other contexts of everyday life, lack multisensory richness and are portrayed as another person's experiences rather than our own. Our study investigates whether the strength of emotions elicited by regional and national languages reflects the fundamental differences between the environments in which the languages are used. Although our participants knew the regional language quite well, how early they learned it in childhood and how extensively they have used it could vary. This is expected with a language whose acquisition and use depend on specific circumstances. For example, many acquire their regional language among family; if parents do not speak it, the neighborhood could offer an alternative learning environment. Similarly, the possibility of speaking it among friends depends on how many of them have learned it. This variability gives us an opportunity to assess the possible effect of age of acquisition (AoA) and frequency of use on the perceived strength of emotions induced by languages used skillfully and habitually.

Context matters not only for language but also for emotions. The contexts in which emotions are learned, expressed and regulated may vary across emotions. This variation is relevant for testing our hypothesis that the emotions felt in each language reflect the emotional experience afforded in the contexts in which the language is used. The hypothesis does not anticipate generalized differences between the national and the regional language; rather, differences should appear with emotions experienced differently across linguistic contexts. Identifying such emotions is crucial for testing the hypothesis. Two plausible candidates, we reasoned, are disgust and mirth (i.e., the feeling of well-being experienced with humor).

Although newborns show an innate response to bitter and sour tastes and irritants, it is only through prolonged learning, between 2 and 12 years of age, that children become sensitive to the variety of stimuli adults find repugnant (Rottman, 2014; Rozin & Haidt, 2013). Social transmission is the key in this acquisition, and interaction with parents is especially critical in shaping revulsion responses that are mainly associated with food, nauseous body substances and repugnant animals in the first years of life (DeJesus et al., 2021; Stevenson et al., 2010). Evidence suggesting

parental modeling of disgust includes similarities in disgust sensitivity between parents and their offspring (Rozin et al., 1984) and the negative reaction to spiders demonstrated by daughters of arachnophobic mothers (De Jong et al., 1997). When disgust is first experienced and regulated in an environment where the regional language is extensively used, a greater sensitivity to disgust could arise in this language, a possibility we tested in Experiment 1.

We focused on humor, a main source of mirth. Research on humor has emphasized the many social functions served by humor (La Fave et al., 2017; Martin & Ford, 2018). For example, it can provide an effective persuasion device (Beard, 2005), and since it is perceived as a desirable and valued trait, it can boost social recognition (Bressler & Balshine, 2006; Cann & Matson, 2014; Sprecher & Regan, 2002). Its functions extend to in-group settings, as people use humor to enhance cohesion and reinforce a sense of group identity (Kashdan et al., 2014; Kurtz & Algoe, 2015; Martineau, 1972; Meyer, 2000; Romero & Pescosolido, 2008; Treger et al., 2013). Ridicule, the abrasive side of humor, contributes to social control, reinforces hierarchical social structures within the group and is often used to instill prejudice as well as divisions across groups (Ford et al., 2015; Hodson & MacInnis, 2016; Janes & Olson, 2000; Westwood & Johnston, 2013). Of relevance here, irony is rated as more humorous when involving close friends than casual acquaintances (Pexman & Zvaigzne, 2004). It is among family, within the circle of friends and in the hometown – groups where the regional language is spoken – that the multifaceted social functions of humor are at play. Whether these ties between humor and regional language translate into a greater enjoyment of humor in the regional language was investigated in Experiment 2.

In both experiments, the language in which participants were tested was randomly assigned. To preview the results, participants reported feeling disgust more intensely and enjoying humor more strongly in the regional language than in the national language. These results contrasted with the findings of our previous study (Miozzo et al., 2020), in which emotional phrases like endearments (*I missed you!*) and insults (*I'm sick of you!*) elicited emotions of comparable strength in the national and regional language. The lack of stronger emotional responses reported in Miozzo et al. (2020) is puzzling in light of the greater sensitivity to disgust and humor observed in Experiments 1 and 2. Experiment 3 aimed to identify the roots of the discrepancies between the findings in Experiments 1 and 2 and in Miozzo et al. (2020). To this end, in Experiment 3, we re-run the original experiment of Miozzo et al. (2020), improving its design. As explained in detail below (see Experiment 3), we suspected that the comparable strength of the emotional responses observed in Miozzo et al. (2020) was due to the choice of an inadequate baseline. The new baseline introduced in Experiment 3 proved successful in revealing a stronger responsiveness to emotional phrases in the regional language, so that the results of Experiment 3 aligned with those of Experiments 1 and 2, and altogether show more convincingly the greater strength the regional language has to induce certain emotions.

Participants in Experiments 1–3 lived in Veneto, a northeastern region of Italy in which 70% of residents speak Venetian, the local regional language (Demos, 2023). Venetian is one of the several regional languages spoken in Italy (Maiden, 1995). Italian is the national language of Italy, but the use of regional languages remains robust and widespread in the country – as reported in the latest national census, 41.2% of Italians, aged 18–74 years, roughly equivalent to 10.3 million, speak a regional language habitually (ISTAT, 2014). Even though Italian and Venetian are historically derived from Latin, they are mutually unintelligible (Ferguson,

2007), thus differing to a degree comparable to that existing between other Neo-Latin languages, such as Italian and French, or Spanish and Portuguese. While Venetian is only oral, Italian is also written, a feature that, together with its nationwide use, confers it a privileged status.

2. Experiment 1: disgust

Disgust is an emotion with distinct behavioral, cognitive and physiological features that are typically displayed with a characteristic facial expression (Levenson, 2003; Olatunji & Sawchuk, 2005). Autonomic responses induced by disgust include heart rate deceleration, reduced blood pressure and decreased skin conductance (Stark et al., 2005). Ever since Darwin's (1872) seminal study of emotions, disgust has been related to distasting food. However, it has long been recognized that a wide range of aversive stimuli that share potential associations with disease, uncleanness and contamination elicit revulsion responses (Oaten et al., 2009; Olatunji & Sawchuk, 2005). Thus, body waste, gore, dismemberment of the human body and sexual acts could also be repugnant. Disgust has been commonly viewed as a distaste response that protects against pathogen infection (Oaten et al., 2009; Rozin et al., 2016; Schaller & Duncan, 2007). As a defense against contamination and disease, it would provide an evolutionary advantage (Curtis et al., 2004; Rottman, 2014; Tybur et al., 2013). Evidence suggesting its evolutionary fitness includes the cross-cultural similarities of its expression (Mesquita & Frijda, 1992), that disease-predictive cues are among the stimuli universally eliciting it (Curtis et al., 2004; Guernier et al., 2004), and that individuals more exposed to pathogens (e.g., for living nearer the equator) tend to be more sensitive to it (Oaten et al., 2009). Foods and body products represent the main disgust elicitors, being most closely related to disgust's primary function of protecting against pathogens (Oaten et al., 2009; Rozin et al., 2016; Tybur et al., 2013). As a mechanism protecting against contamination, disgust represents the natural precursor of revulsion toward stimuli culturally construed as unclean or impure (Olatunji & Sawchuk, 2005; Rozin et al., 2016; Tybur et al., 2013). The extent of the stimuli eliciting disgust remains a matter of debate, with some researchers proposing that disgust underlies morality or social distancing (Chapman et al., 2009; Faulkner et al., 2004; Fiske et al., 2002; Graham et al., 2013). What causes disgust is also determined by heuristics commonly referred to as laws (Rozin & Nemeroff, 1990). The law of contagion ("once in contact, always in contact") refers to transmissibility by proximity. An example is provided by people's reluctance to drink juice that was previously in contact with a sterile cockroach (Rozin et al., 1986). According to the law of similarity, what looks similar has a similar essence. It is because of this law that, for example, people are hesitant to eat a chocolate fudge shaped like dog feces (Rozin et al., 1986).

The Disgust Scale (DS; Haidt et al., 1994) has been extensively used to measure individual differences in disgust sensitivity. Written sentences are used in the DS to induce reactions typically elicited by visual or olfactory stimuli. It has proven to have predictive utility in psychopathology – for example, with hypochondriasis (Davey & Bond, 2006), spider phobia (Tolin et al., 1997) and blood–injection–injury phobia (Sawchuk et al., 2000) – and to detect experience-based changes in disgust level, such as between medical and psychology students (Pehlivanidis et al., 2020), or during the first trimester of pregnancy (Fessler et al., 2005). We administered the revised version of the DS (DS-R; Olatunji et al., 2007) in which inadequate items were removed. Confirmatory

factor analyses conducted on the DS-R revealed a three-factor solution: core disgust, contamination-based disgust and animal reminder disgust. Example items corresponding to each of these factors are shown in Table 1. Core disgust refers to stimuli that pose a threat of disease, of which rotting food, waste products and small animals are primary elicitors. Contamination-based disgust is related to the risk of contagion and the implicit theories people construe concerning the transmissibility of germs and diseases (Oaten et al., 2009). Animal reminder disgust is a form of disgust stemming from the recognition of our own animality, possibly related to our own mortality (Rozin et al., 2016). Accordingly, dead bodies and dismembered body parts could be considered repugnant because they remind us of the animal origins of humans. Children react negatively to elicitors related to core disgust from an early age, possibly modeling their responses on those of their parents (Rottman, 2014; Rozin et al., 2016). The aspects of disgust related to contamination and animal reminders appear later in development, probably due to the more sophisticated cognitive mechanisms they require (Blacker & LoBue, 2016; Rozin & Haidt, 2013). The three-factor structure of DS-R, originally found with relatively homogeneous samples from the United States, was replicated in several other countries, including Italy, where our experiment was conducted (Olatunji et al., 2009; van Overveld et al., 2011). These findings confirmed the multidimensionality of disgust proposed in several theories of disgust (Marzillier & Davey, 2004; Rozin et al., 2016; Simpson et al., 2006; Stevenson et al., 2019; Tybur et al., 2009). Consistent with the multidimensional nature of disgust revealed by DS-R and proposed in several theories, differences between the national and regional languages were examined not only with the entire scale, but also for each subscale reflecting the three-factor solution found in Oaten et al. (2009).

2.1. Methods

2.1.1. Materials

Regional languages tend to have smaller vocabularies relative to national languages, so the DS-R was first translated from English into Venetian (all items from DS-R are available in the Open Science Framework repository, link: https://osf.io/tzuwp/?view_only=6afecf7a81f942879895cccd53e7a0e). The DS-R was then translated from Venetian into Italian. To ensure between-translations correspondence, the DS-R was back-translated into Venetian. Participants rated either their agreement (first 13 items) or their disgust (last 12 items). Following the recommendations of

Table 1. Examples of items from the Disgust Scale (Revised)

| | |
|----|--|
| a. | I might be willing to try eating monkey meat, under some circumstances. |
| b. | If I see someone vomit, it makes me sick to my stomach. |
| c. | It bothers me to hear someone clear a throat full of mucus. |
| d. | It would bother me to see a rat run across my path in a park. |
| e. | It would bother me tremendously to touch a dead body. |
| f. | I would go out of my way to avoid walking through a graveyard. |
| g. | I probably would not go to my favorite restaurant if I found out that the cook had a cold. |
| h. | I never let any part of my body touch the toilet seat in a public washroom. |

Note: Core Disgust subscale: items a, b, c, and d; Animal Reminder Disgust subscale: items e and f; Contamination-Based Disgust subscale: items g and h.

Olatunji et al. (2007), a 7-point scale was used for both ratings (1 = little agreement/disgust; 7 = complete agreement/disgust). Two symbols (thumbs up and thumbs down) displayed at scale ends indicated maximum agreement and disagreement, respectively. Two emojis, one showing a neutral face and the other showing a face expressing disgust, appeared together with the DS. The use of symbols and emojis allowed us to present the same scale in both languages. Item presentation was randomized for each participant. As in previous studies (Miozzo et al., 2020; Peressotti, Lorenzoni, & Miozzo, 2024; Peressotti, Pianezzola, et al., 2024), different speakers recorded the material in Italian and Venetian because Italian–Venetian bilinguals speak Italian with a regional accent. To minimize any idiosyncrasies related to individual speakers, two speakers (a male and a female) recorded the DS-R in Italian and two other speakers (a male and a female) provided the recording in Venetian. The recordings made in both languages for Experiments 1–3 are available in the Open Science Foundation (OSF) repository (link: https://osf.io/tzuwp/?view_only=6afecf7a81f942879895cccd5f53e7a0e).

2.1.2. Procedure

Experiment 1 was conducted online using the Qualtrics platform. Participants were instructed to find a quiet place or wear headphones. Experiment 1 required the completion of several tasks, starting with the DS-R. To listen to the items of the DS-R, participants clicked on the play button icon that appeared on the screen. Participants could listen to any sentences again. The language (Italian or Venetian) in which the DS-R was administered was randomly assigned to each participant. The next task was a forced-choice grammaticality test assessing Venetian proficiency (from Miozzo et al., 2020). This test examined grammatical features that differed between Venetian and Italian. To make the test especially challenging for speakers with little experience with Venetian, who probably relied for their responses on their knowledge of Italian, foils represented the correct choice in Italian. The final task (Language Use Questionnaire; Scaltritti et al., 2017) was administered in Italian and assessed participants’ acquisition and use of Venetian. Specifically, participants reported whether Venetian was learned before 5 years of age, and the percentage of time in which they spoke Venetian among family, with friends, at work and when interacting with people in their hometown.

2.1.3. Participants

In Experiments 1–3, participants were recruited through social media using a ‘snowball’ procedure. We excluded the responses of 12 participants in Experiment 1 whose accuracy in the forced-choice Venetian grammaticality test was equal to or lower than the chance level (4/8). The remaining participants ($n = 111$) reported speaking Venetian 48.3% of the time (averaged across family, friends, work and hometown); 72% of them indicated that they learned Venetian before 5 years of age. The participants tested in Italian ($n = 50$) and Venetian ($n = 61$) did not differ for gender ($\chi^2 = 0.06$) and age (mean years [standard error]: 47.0 [1.5] vs. 49.5 [1.7]); $t = 1.09$). Demographics and details of the language use of participants tested in each language are reported in Table 2.

2.2. Data analysis

We used cumulative regression mixed models to analyze the responses in each experiment of the present study. The assumption underlying the analyses was that the observed ordinal variable originated from the categorization of a latent continuous variable (e.g., disgust intensity in Experiment 1). All analyses were performed using R (R version 4.3.3, R Core Team, 2024); datasets and analysis scripts from each experiment can be found in the OSF repository (https://osf.io/tzuwp/?view_only=6afecf7a81f942879895cccd5f53e7a0e). To model ordinal responses, we used the brms package (Bürkner, 2017, 2018), which allows estimating ordinal models in combination with multilevel structures (Bürkner & Vuorre, 2019). Models were fitted using the Bayesian Markov Chain Monte Carlo (MCMC) estimation method implemented in the probabilistic programming language STAN through the R package brms (Stan Development Team, 2019). Model estimates were based on four MCMC simulations, each comprising 5,000 replications (2,500 warm-up iterations discarded). To limit the estimate of the regression coefficients, we used Student’s t distribution prior with $df = 3$, mean = 0 and standard deviation = 1. A model comparison approach was used to identify the best model, starting with the null model that only included participants and items as random intercepts to account for individual-specific variability and item idiosyncrasies, respectively. Predictors and interactions were included subsequently. Categorical predictors were coded using Helmert coding. If adding a predictor did not improve

Table 2. Participants’ demographics and language experience

| | N | Females | Mean age | Venetian acquisition ^a | Grammaticality test ^b | Use of Venetian (% time)/context | | | | |
|--------------|-----|---------|----------|-----------------------------------|----------------------------------|----------------------------------|---------|------|------|-------|
| | | | | | | Family | Friends | Work | Town | Mean |
| Experiment 1 | | | | | | | | | | |
| Italian | 50 | 54% | 49.5 | 76% | 6.24 | 61% | 53% | 36% | 44% | 48.4% |
| Venetian | 61 | 62% | 47.0 | 69% | 6.38 | 58% | 54% | 34% | 47% | 48.3% |
| Experiment 2 | | | | | | | | | | |
| Italian | 46 | 74% | 36.9 | 69% | 7.02 | 36% | 20% | 16% | 20% | 24.0% |
| Venetian | 38 | 61% | 30.8 | 68% | 7.34 | 35% | 30% | 26% | 19% | 19.6% |
| Experiment 3 | | | | | | | | | | |
| Italian | 158 | 60% | 33.0 | 71% | 7.06 | 45% | 35% | 21% | 30% | 32.7% |
| Venetian | 182 | 63% | 31.6 | 70% | 6.98 | 45% | 42% | 29% | 33% | 37.2% |

^aPercentage of participants who reported that they learned Venetian before 5 years of age.
^bMean number of correct responses to the eight force-choice questions of the Venetian grammaticality test.

the model's fit, in the next models, the predictor was no longer included. Convergence was assessed (a) by visual inspection of traces of the posterior predictive check and (b) by examining the R -hat values, adopting a maximum accepted value for satisfactory convergence of 1.05 as suggested by Vehtari et al. (2021). We employed the leave-one-out cross-validation (LOOCV; Vehtari et al., 2017) to evaluate model performance and compute model weights (Yao et al., 2018). LOOCV provides a score (leave-one-out information criterion, LOOIC), that can be interpreted similarly to more widely used information criteria for model performance, such as Akaike Information Criterion (Akaike, 1998). Lower LOOIC values and higher weights (w) indicate a more plausible model. The full output of all models is available in the OSF repository. The tables included in the article provide a summary of the models tested in each experiment and of the best-fitting model.

In Experiment 1, in addition to language (Italian vs. Venetian) and subscale (core disgust, contamination-based disgust and animal reminder disgust) – the two variables on which the experiment focused – we also included gender (female vs. male) to control for any gender differences reported in prior studies (higher levels of disgust endorsed by women than men; e.g., see Olatunji et al., 2007). The parameters were introduced into the models in the following sequence: language (Model 1), gender (Model 2), subscale (Model 3) and the random slope for the effect of subscale (Model 4). For exploratory purposes, we also run Model 5, including the language \times subscale interaction. As gender was consistently balanced between the participants tested in the two languages, in none of the experiments was the interaction between gender and language included as a predictor, a choice that allowed us to simplify the model structure. Responses from 12 participants who preferred not to specify a gender were excluded from the analysis. To allow model comparison, they were also excluded from successive analyses. (Note: similar results were obtained in the final model when we included the responses of these 12 participants.)

2.3. Results

Cronbach's α estimates for the whole scale was an acceptable .85. Of the three subscales, only core disgust demonstrated acceptable

internal consistency estimates ($\alpha = .73$; contamination-based disgust, $\alpha = .61$; animal reminder disgust, $\alpha = .57$). The results of the regression model comparison are shown in Table 4A. The model that best fitted the data was Model 5, which included the fixed effects of language and subscale and the language \times subscale interaction. A summary of the output of Model 5 is reported in Table 4B. Parameter posterior means and standard deviations are shown in Table 4B within the "Estimate" and "Est. Error" columns, respectively. The "l-95% CI" and the "u-95% CI" columns provide the lower and the upper bounds of the credible intervals (CrIs), corresponding to the 2.5th and the 97.5th percentiles of the posterior distribution. When this interval does not include 0, one can conclude with at least 95% probability that the participants' response was modulated by that parameter. The results of Model 5, shown in Table 4B, indicate that language affected participants' responses, inducing higher disgust ratings in Venetian than Italian. As illustrated in Figure 1, which shows the estimated frequencies of each score of the 7-point scale, higher scores were more frequent in Venetian and lower scores in Italian. The lack of statistical evidence of a language \times subscale interaction revealed by the CrIs corresponding to the interaction (see Table 4B) suggests a rather uniform language effect across subscales, and it further shows the pervasiveness of the stronger disgust responses elicited by the regional language.

3. Experiment 2: humor

Humor evokes a pleasant emotional response and makes us laugh. Various terms have been used to describe the feeling of well-being experienced with humor, including amusement, hilarity, cheerfulness, exhilaration and merriment (Martin & Ford, 2018). Following Martin (2019), we refer to it as mirth, a term that captures the close relation of this emotion with humor and laughter. Mirth induces a range of physiological changes (Ito & Cacioppo, 2012), many of which are associated with a temporary increase in the activity of the sympathetic nervous system (Behnke et al., 2022; Foster et al., 2002). Laughter is the most immediately recognizable neurophysiological response of mirth. Of the many facial displays associated with laughter and smiles (Frank et al., 1993), the so-called

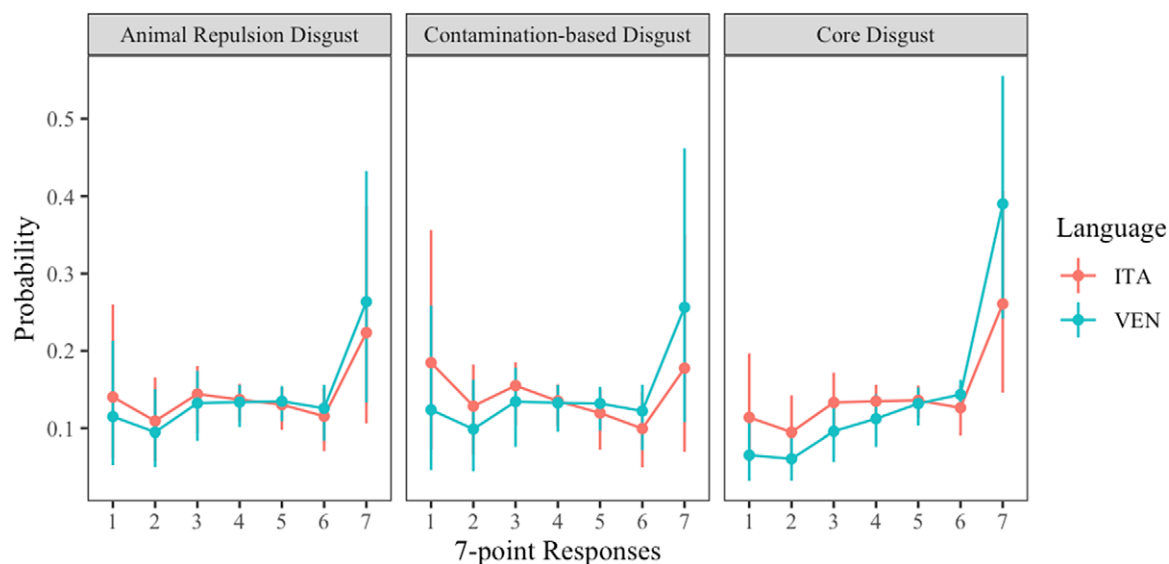


Figure 1. Frequency (estimated probability) of each score in the 7-point scale of the DS-R for each language and subscale. Bars correspond to the interval between the 2.5th and 97th percentile.

Duchenne smile (Ekman et al., 1990) is reliably observed when genuine enjoyment and amusement are experienced (Keltner & Bonanno, 1997). In the Duchenne smile, both the cheeks and the corners of the mouth raise, due to contraction of the muscle orbicularis oculi and the zygomatic major, respectively; only the zygomatic major contracts in a regular smile. We turned to humor to find additional evidence that, compared to national languages, regional languages induced stronger emotional responses. As customary in humor research (Martin & Ford, 2018), we experimentally induced mirth by showing cartoons describing hilarious events or situations. We asked Italian–Venetian bilinguals to rate how much the cartoons made them laugh. To the extent that laughter is inherently related to mirth, assessing laughter provided a measure, although indirect, of the emotional response. Crucially, self-reported measures of amusement of the kind we collected were found to correlate with physiological changes induced by humor, including zygomatic major activity (Ekman et al., 1990), skin conductance responses and heart rate (Fiacconi & Owen, 2015; Kreibig et al., 2013; Ruiz-Padial et al., 2023; Vieillard & Pinabiaux, 2019).

Much research on humor has been devoted to determining why a joke is funny. Current proposals view incongruity as an essential aspect of a joke's humor (Attardo, 1993; Morreall, 1983; Nerhardt, 1976; Shultz, 1972; Warren et al., 2021). Jokes are funny not only when they portray odd or unexpected situations, but also if they provide a framework to interpret the situation in an out-of-the-ordinary, playful way. A cartoon our participants found amusing showed a psychoanalyst telling his client, "For what it's worth, I didn't like your mother either." It is unexpected that a psychoanalyst reveals any feelings, but that becomes understandable (and hilarious) if we think of all the negative things the client must have told, in previous sessions, about the mother. Enjoying the joke requires cognitive processes that output an interpretation consistent with the playful framework of the joke. These processes are cognitively demanding (Giora et al., 2015; Katz et al., 2004; Spotorno & Noveck, 2014). Moreover, jokes often rely on nuanced linguistic knowledge and familiarity with a specific culture (Aarons, 2012; Goatly, 2012; Ritchie, 2004). Increased cognitive demands and cultural specificity, in part, explain why jokes are less funny when told in a foreign language (Ayçiçeği-Dinn et al., 2018; Ezrina & Valian, 2023). We expect our proficient bilinguals to be perfectly capable of understanding humor in both languages. Any language difference is not likely to reflect humor appreciation, but rather the emotional response to it.

3.1. Methods

3.1.1. Materials

To find cartoons appropriate for our multigenerational group of participants, we searched through *La settimana enigmistica*, a weekly Italian magazine specialized in crossword puzzles and word games, with an estimated weekly sale of 600–800,000 copies and a wide readership (Il Post, 2016). We selected 23 cartoons. Each cartoon showed a black-and-white drawing with a caption, written in Italian, which transcribed something said by a character shown in the cartoon. A description of the material is provided in the OSF repository. Written captions were removed. Captions were translated into Venetian and then translated back into Italian. A male or a female bilingual speaker recorded the caption, depending on the gender of the character who said the caption in the cartoon in both Italian and Venetian. Both were nonprofessional actors who had been trained to speak Italian without a regional accent. Lower pitch, higher amplitude or slow speech are prosodic cues speakers may use to express irony and sarcasm (Anolli et al., 2002; Bryant, 2010;

Cheang & Pell, 2008; Rockwell, 2000) or that listeners may use to recognize satire or mockery (Bryant & Tree, 2002; Mauchand et al., 2020; Woodland & Voyer, 2011). We took several measures to minimize the prosodic differences between the Italian and Venetian recordings. First, each speaker (a male and a female) recorded the captions in Italian and Venetian. Second, the speakers were instructed to speak with neutral intonation and at a regular rate. Third, we controlled the length, pitch and amplitude of Italian and Venetian captions. Length was comparable between Italian and Venetian captions (mean (range): 3.00 (1.12–4.34) versus 3.30 (1.46–4.47) sec.; $t(44) = .22$, $p = .22$). The pitch (F0) and intensity were measured for each sentence using Praat (Boersma & Weenink, 2023). Male and female voices were analyzed separately because of the sex differences that exist in pitch and intensity. As shown in the data summary of Table 3, the pitch varied similarly between languages. All measures of amplitude matched with the female voice; maximal amplitude, however, was higher for Italian sentences with the male voice. Higher amplitude could make cartoons more ironic in Italian. Mirth, however, was felt more strongly in Venetian (see results below), a finding that cannot be explained by the higher amplitude of Italian captions.

3.1.2 Procedure

Each cartoon appeared in the center of the screen along with a play button icon that participants clicked to listen to the caption. If they wanted, participants could listen to the caption again. Participants rated how much each cartoon made them laugh, using a 7-point scale (1 = not at all; 7 = a lot). Two emoticons were displayed at the end of the rating scale, one showing a neutral face and a laughing face, respectively. The same rating scale was presented in both languages. In all other respects, the procedure was the same as in Experiment 1. The order of cartoon presentation was randomized for each participant.

3.1.3 Participants

A total of 87 participants completed all the tasks in Experiment 2 (cartoon ratings, Venetian grammaticality test and the Language Use Questionnaire). We excluded from analyses the responses of three participants whose accuracy was equal to or lower than 4/8 responses of the Venetian grammaticality test. The remaining participants ($n = 84$) estimated using Venetian, on average, 25.4% of the time, while among the family, with friends, at work and in their hometown; 58/84 (59%) participants reported an early acquisition of Venetian (before 5 years of age). Participants tested in Italian ($n = 46$) and Venetian ($n = 38$) did not differ for gender ($\chi^2 = 1.71$) and age ($t = 1.68$). A summary of demographic and language use for participants tested in each language is presented in Table 2.

3.2. Data analyses

Two cartoons (4 and 7) were excluded from analyses because the humorous word play worked in Italian, but not in the Venetian translation.¹ Data were analyzed using the cumulative regression mixed models described in Experiment 1. In light of results showing gender differences in contexts eliciting laughter and humor style (Crawford, 2003; Martin & Kuiper, 1999), gender was included as a predictor. Language (Italian versus Venetian) was included in Model 1 and gender (Female versus Male) was added in Model 2.

¹The joke of Cartoon 4, for example, worked in Italian because the word *documenti* (documents) started with the letter *d*. The joke could not work with the Venetian translation *carte*.

Table 3. Pitch (F0) and amplitude of Italian and Venetian sentences recorded by a female ($n = 26$) and a male bilingual ($n = 37$) and presented in Experiment 3; standard deviation in brackets

| | Female voice | | | Male voice | | |
|----------------|--------------|--------------|---------|--------------|--------------|----------------------|
| | Italian | Venetian | | Italian | Venetian | |
| F0 (Hz) | | | | | | |
| Mean | 203.0 (19.2) | 205.0 (18.9) | $t < 1$ | 150.3 (30.0) | 152.1 (29.1) | $t < 1$ |
| Maximum | 282.2 (47.9) | 280.1 (49.0) | $t < 1$ | 215.0 (91.8) | 197.6 (58.4) | $t < 1$ |
| Minimum | 155.5 (30.0) | 151.5 (28.3) | $t < 1$ | 113.2 (15.1) | 114.4 (23.3) | $t < 1$ |
| Range | 126.6 (58.4) | 128.6 (56.4) | $t < 1$ | 101.9 (90.6) | 83.2 (56.8) | $t = 1.07, p = 2.88$ |
| Amplitude (dB) | | | | | | |
| Mean | 68.5 (2.1) | 68.0 (1.8) | $t < 1$ | 73.2 (3.0) | 75.6 (3.5) | $t = 3.11, p < 0.01$ |
| Maximum | 75.4 (2.7) | 75.1 (2.9) | $t < 1$ | 73.6 (3.1) | 81.7 (3.4) | $t < 1$ |
| Minimum | 43.6 (10.0) | 44.1 (7.8) | $t < 1$ | 50.7 (8.9) | 48.8 (9.0) | $t = 2.74, p < 0.01$ |
| Range | 31.8 (10.7) | 31.0 (8.7) | $t < 1$ | 28.9 (8.7) | 31.9 (7.9) | $t = 1.07, p = 2.88$ |

Table 4. (A) Cumulative regression models carried out in Experiment 1. For each model, we report its formula, the LOOIC value, the standard error (SE) of the LOOIC and the model's weight. The best-fitting model (Model 5) is shown in bold and summarized in (B). Language is the only predictor modulating participants' ratings and it is marked in bold. Language 1 contrasts Italian (−1) vs. Venetian (1); subscale 1 contrasts Animal Reminder Disgust subscale vs. the mean of the other two subscales for; subscale 2 contrasts Contamination-based Disgust vs. Core Disgust subscales

| (A) MODEL COMPARISON | | | | |
|--|---------------|-------------|--------------|-------|
| Models | LOOIC value | SE | LOOIC weight | |
| Model 0. Score ~ 1 + (1 Part) + (1 Item) | 8231.8 | 79.3 | 0.071 | |
| Model 1. Score ~ Language + (1 Part) + (1 Item) | 8231.4 | 79.4 | 0.085 | |
| Model 2. Score ~ Language + Gender + (1 Part) + (1 Item) | 8231.5 | 79.5 | 0.082 | |
| Model 3. Score ~ Language + Subscale (1 Part) + (1 Item) | 8231.2 | 79.5 | 0.093 | |
| Model 4. Score ~ Language + Subscale (1 + Subscale Part) + (1 Item) | 8229.3 | 79.8 | 0.239 | |
| Model 5. Score ~ Language *Subscale (1 + Subscale Part) + (1 Item)) | 8228.2 | 80.0 | 0.431 | |
| (B) SUMMARY OF MODEL 5 | | | | |
| Family: cumulative Links: mu = logit; disc = identity | | | | |
| Formula: Score ~ Language * Scale + (1 + Scale Part) + (1 Item) | | | | |
| Estimate | Est. Error | l–95% CI | u–95% CI | |
| Multilevel hyperparameters (random effects) | | | | |
| ~Item (number of levels: 25) | 1.05 | 0.18 | 0.76 | 1.44 |
| ~Part (number of levels: 99) | | | | |
| sd(intercept) | 0.90 | 0.08 | 0.75 | 1.07 |
| szd(subscale 1) | 0.27 | 0.11 | 0.03 | 0.47 |
| sd(sub-scale 2) | 0.06 | 0.04 | 0.00 | 0.15 |
| cor(intercept, subscale 1) | −0.22 | 0.28 | −0.77 | 0.35 |
| cor(intercept, subscale 2) | −0.16 | 0.40 | −0.84 | 0.72 |
| cor(subscale 1, subscale 2) | 0.21 | 0.46 | −0.76 | 0.92 |
| Regression coefficients (fixed effects) | | | | |
| Intercept[1] | −2.07 | 0.25 | −2.55 | −1.59 |
| Intercept[2] | −1.33 | 0.24 | −1.81 | −0.87 |
| Intercept[3] | −0.64 | 0.24 | −1.12 | −0.17 |
| Intercept[4] | −0.06 | 0.24 | −0.54 | 0.41 |
| Intercept[5] | 0.51 | 0.24 | 0.03 | 0.98 |

(Continued)

Table 4. (Continued)

| (B) SUMMARY OF MODEL 5 Family: cumulative Links: $\mu = \text{logit}$; $\text{disc} = \text{identity}$ Formula: $\text{Score} \sim \text{Language} * \text{Scale} + (1 + \text{Scale} \text{Part}) + (1 \text{Item})$ | | | | |
|--|-------------|-------------|-------------|-------------|
| | Estimate | Est. Error | l-95% CI | u-95% CI |
| Intercept[6] | 1.10 | 0.24 | 0.63 | 1.58 |
| Language 1 | 0.22 | 0.10 | 0.02 | 0.42 |
| Sub-scale 1 | -0.09 | 0.30 | -0.70 | 0.50 |
| Sub-scale 2 | 0.17 | 0.15 | -0.13 | 0.47 |
| Language 1: Subscale 1 | 0.06 | 0.06 | -0.06 | 0.19 |
| Language 1: Subscale 2 | 0.04 | 0.03 | -0.01 | 0.09 |

Note: 1 | Part and 1 | Item represent the random intercepts for participants and items, respectively. Subscale | part represents the participants' random slope for the effect of subscale.

Table 5. (A) Cumulative regression models carried out in Experiment 2. For each model, we report its formula, the LOOIC value, the standard error (SE) of the LOOIC and the model's weight. The best-fitting model (Model 1) is shown in bold and summarized in (B). Language affects participants responses, and it is marked in bold. Italian (-1) and Venetian (1) are contrasted

| (A) MODEL COMPARISON | | | |
|--|---------------|-------------|--------------------|
| Models | LOOIC value | SE | LOOIC weight |
| Model 0. $\text{Score} \sim 1 + (1 \text{Part}) + (1 \text{Item})$ | 5588.7 | 62.3 | 0.337 |
| Model 1. $\text{Score} \sim \text{Language} + (1 \text{Part}) + (1 \text{Item})$ | 5588.5 | 62.5 | 0.362 |
| Model 2. $\text{Score} \sim \text{Language} + \text{Gender} + (1 \text{Part}) + (1 \text{Item})$ | 5588.9 | 62.6 | 0.301 |
| (B) SUMMARY OF MODEL 2 Family: cumulative Links: $\mu = \text{logit}$; $\text{disc} = \text{identity}$ Formula: $\text{Score} \sim \text{Language} + (1 \text{Part}) + (1 \text{Item})$ | | | |
| | Estimate | Est. Error | l-95% CI u-95% C |
| Multilevel hyperparameters (random effects) | | | |
| ~Item (number of levels: 21) | 0.67 | 0.12 | 0.47 0.95 |
| ~Part (number of levels: 84) | 1.31 | 0.13 | 1.09 1.58 |
| Regression coefficients (fixed effects) | | | |
| Intercept[1] | -1.35 | 0.22 | -1.79 -0.93 |
| Intercept[2] | -0.08 | 0.22 | -0.51 0.34 |
| Intercept[3] | 0.81 | 0.22 | 0.38 1.23 |
| Intercept[4] | 1.65 | 0.22 | 1.22 2.08 |
| Intercept[5] | 2.69 | 0.23 | 2.25 3.14 |
| Intercept[6] | 3.85 | 0.24 | 3.37 4.35 |
| Language 1 | 0.54 | 0.15 | 0.24 0.84 |

Note: 1 | Part and 1 | Item represent the random intercepts for participants and items, respectively.

3.3. Results

We report the results of the model comparisons of Experiment 2 in Table 5A. The best-fitting model was Model 1, which only included the fixed effect of language, a finding revealing that language modulated laughter ratings. Results of Model 1 are reported in Table 5B. As shown in Figure 2, higher ratings indicating greater laughter occurred more in Venetian; conversely, lower ratings associated with less laughter were more common in Italian. In conclusion, the results of Experiment 2 showed that mirth was experienced with humor more strongly in the regional language.

4. Experiment 3: emotional phrases

To express their emotions, speakers can rely on a swift and effective linguistic device: the many phrases existing in their language to express specific emotions – from happiness (*I'm cloud nine!*) to anger (*That's enough!*) to surprise (*Unbelievable!*). Emotional phrases are part of a language's lexicon and a speaker's vocabulary, and their widespread use is probably explained by the immediacy and efficacy with which a wide range of emotions can be expressed. In light of the results of Experiments 1 and 2, it is surprising that Miozzo et al. (2020) did not find a heightened emotion

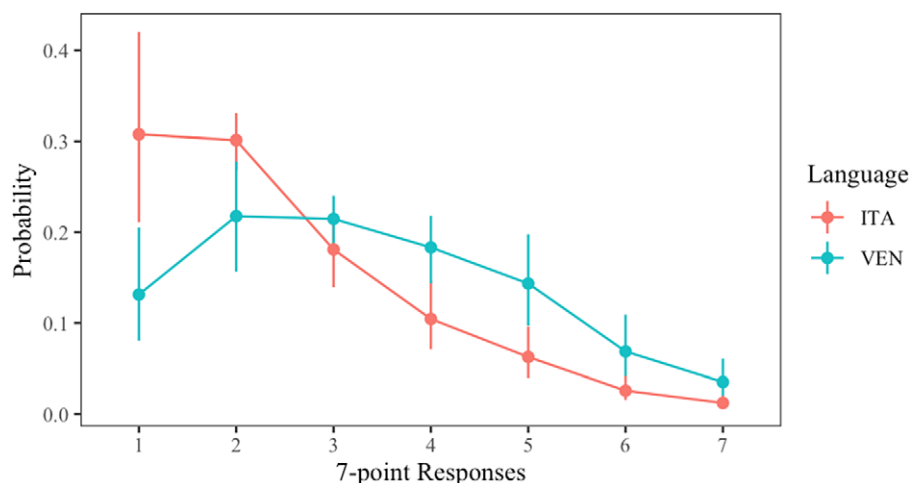


Figure 2. Frequency (estimated probability) of each score of the 7-point scale used in Experiment 2 to evaluate the emotional response to cartoons. Bars represent the interval between the 2.5th and 97th percentile.

responsiveness for emotional phrases in Venetian. Miozzo et al. (2020) translated the emotional phrases used in prior studies (Caldwell-Harris et al., 2011; Caldwell-Harris & Ayçiçeği-Dinn, 2009; Harris, 2004) to assess the intensity of emotions in native and foreign languages: endearments (*I missed you!*), insults (*I'm sick of you!*) and reprimands of the kind parents use to admonish children (*Be good!*). The rather low and uniform emotion ratings found in Miozzo et al. (2020) were a cause of concern, as such a flattening could have resulted from an underappreciation of the emotional content of the phrases. The lack of 'neutral' sentences with low emotional content possibly contributed to this flattening. By providing a baseline, these sentences would have helped the raters appreciate the emotional content of the emotional phrases, which in turn would increase the scores of these sentences. This hypothesis has indeed been confirmed in a pilot experiment conducted exclusively in Italian, in which emotional phrases were presented together with more neutral sentences (details of this pilot experiment are presented in the Methods below). Emotional phrases induced stronger emotions than in Miozzo et al. (2020) (mean ratings: 4.55 vs. 3.90). The present experiment has a twofold aim. First, we would like to verify whether presenting emotional phrases together with neutral sentences would reveal a language effect, with heightened emotion responsiveness in Venetian than in Italian; second, we explored if the strength of the experienced emotions varied as a function of whether the regional language was acquired early in childhood and used often. To the extent that AoA and frequency are variables affecting the processing of lexical forms (Baayen, 2001), we examined the possibility that emotions of stronger intensities appeared only when the regional language is learned early and used extensively. To adequately assess the effect of both variables, we tested a large group of Italian–Venetian bilinguals ($n = 358$). Proficient Venetian speakers like those who participated in our experiment typically acquired Venetian in infancy (Miozzo et al., 2020; Peressotti, Lorenzoni, & Miozzo, 2024; Peressotti, Pianezzola, et al., 2024; Scaltritti et al., 2017), a uniformity making our group of participants far from ideal for assessing whether language effects varied depending on when Venetian was learned. AoA (before/after the age of 5 years) was examined for the sake of completeness.

4.1. Methods

4.1.1. Materials and procedure

The Italian and Venetian emotional phrases (five endearments, five insults and five reprimands) were from Miozzo et al. (2020). Except for two endearments, they were translations of English emotional phrases tested in Harris (2004), Caldwell-Harris and Ayçiçeği-Dinn (2009) or Caldwell-Harris et al. (2011). To control that the emotional phrases existed in Italian as lexicalized forms, we searched whether their translations were cited in Italian–English online dictionaries and on sites devoted to the learning of Italian as a second language (a detailed description of the procedure is presented in the OSF repository). Citations were found for all phrases. One of the authors (FP) created 40 Italian sentences to be used as low-emotion-intensity sentences. These sentences described everyday situations and were comparable in length (word number) to the emotional phrases. In the pilot experiment conducted in Italian, a group of 34 Italian speakers, none of whom participated in Experiment 3, rated these sentences and the Italian emotional phrases for emotional strength, using a 7-point scale (1 = low emotional arousal; 7 = very strong emotional arousal). We selected 11 sentences with ratings ranging between 1.47 and 1.87 (mean = 1.67), which were consistently lower than the average ratings obtained for endearments (5.06), insults (4.79) and reprimands (3.79). A web search conducted for the low-emotion-intensity sentences did not result in any English translations, a finding contrasting with the citations consistently obtained for the emotional phrases and confirming that the low-emotion-intensity sentences did not correspond to lexicalized forms. For Experiment 3, the low-emotion-intensity sentences were first translated into Venetian and then back-translated into Italian to control for translation equivalence. The Italian sentences tested in Experiment 3 were those obtained from back-translation. Two Italian–Venetian bilinguals (one male and one female) audio-recorded the emotional phrases and the low-emotion-intensity sentences in Italian and Venetian. Both were nonprofessional actors who had been trained to speak Italian without a regional accent. All materials are available in the OSF repository. Participants of Experiment 3 rated the emotional strength of the sentences presented either in Italian or Venetian

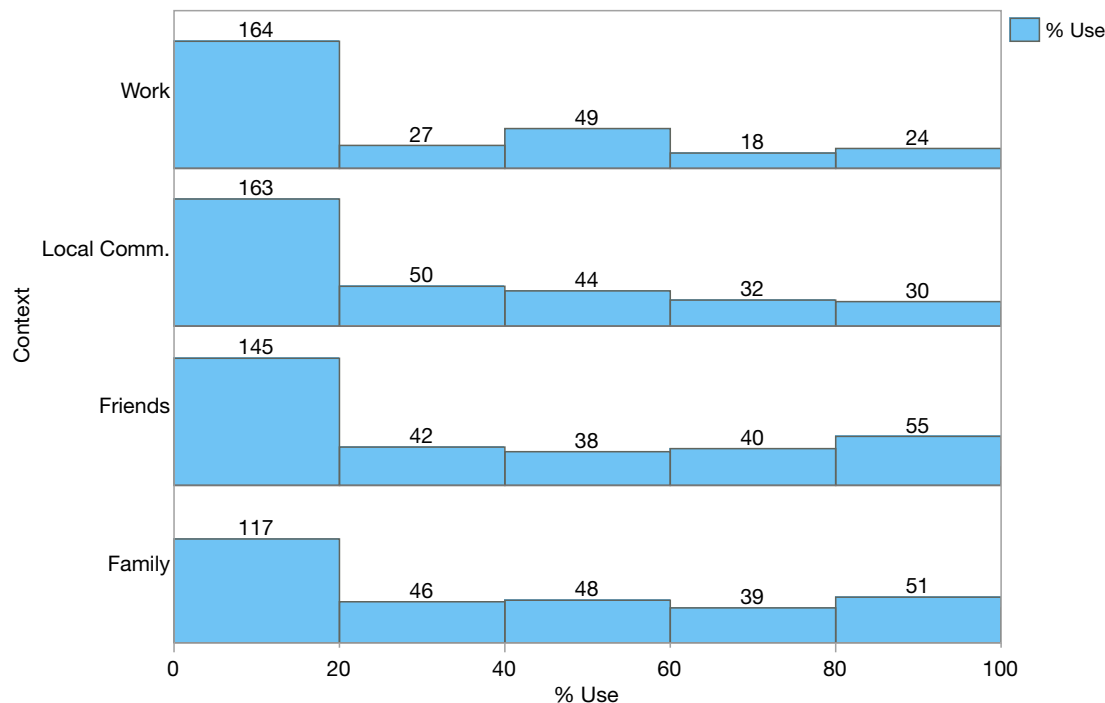


Figure 3. Percentage of time in which Venetian is used in different contexts. Numbers refer to the number of participants within an interval.

using a 7-point scale with arrows pointing down or up at each extreme (1 = low emotional arousal; 7 = very strong emotional arousal). The arrows were introduced to present the same scale in both languages. The scale appeared on the screen together with the play button. In all other respects, the procedure was the same as described in Experiments 1 and 2.

4.1.2. Participants

A total of 358 respondents completed all tasks of Experiment 3. We excluded the responses of 18 participants, whose accuracy in the forced-choice Venetian grammaticality test was $\leq 4/8$ and only analyzed the responses of the remaining participants ($n = 340$). Most of these participants (237; 70.3%) indicated that they learned Venetian before 5 years of age. In line with prior studies (Miozzo et al., 2020; Peressotti, Lorenzoni, & Miozzo, 2024; Peressotti, Pianezzola, et al., 2024; Scaltritti et al., 2017) and census data (ISTAT, 2014), they reported speaking Venetian especially among family and friends – on average, 44.8% and 39.0% of the time, respectively – compared to when in their hometown (32%) or at work (25%). As shown in Figure 3, the time spent speaking Venetian varied widely in each of these contexts, with some participants reporting that they did not have opportunities to speak Venetian in some contexts, while others indicated that they used it rather extensively. However, the percentages of use were strongly correlated across contexts – with correlation coefficients ranging between 0.65 and 0.81 – suggesting that the participants had rather homogeneous opportunities to speak Venetian in these contexts. The correlations between the percentage of use and the age of the participants that we found for all contexts ($r_s = .31-.41$, $p_s < .001$) replicated the census data that showed a stronger Venetian grounding among older generations (ISTAT, 2014).

Demographic and sociolinguistic information regarding the participants tested in Italian ($n = 158$) and Venetian ($n = 182$) is reported in Table 2. The two groups did not differ for gender (females: 60% vs. 63%; $\chi^2 = 0.33$) or age (mean years [sd]: 33.1

[14.4] vs. 31.6 [13.1]; $t = 0.96$). Their experience with Venetian was also comparable in terms of acquisition (participants who learned Venetian before 5 years of age: 71% vs. 70%; $\chi^2 = 0.05$), time spent using Venetian (mean [sd]: 33% [27.8] vs. 37% [31.9]; $t = 1.23$, $p = .22$) and scores in the Venetian grammaticality test (mean [sd]: 6.81 [1.03] vs. 6.98 [0.99]; $t = 1.51$, $p = .13$).

4.2. Data analyses

To test the effect of language, ratings collected in Experiment 3 were analyzed as in Experiments 1 and 2. Following prior studies of emotional sentences that examined gender differences (Caldwell-Harris & Ayçiçeği-Dinn, 2009; Harris et al., 2003), we included gender as a predictor. The predictors were introduced into the models in the following sequence: language (Italian vs. Venetian), gender (female vs. male), sentence (endearments, insults, reprimands and low-emotion-intensity sentences), random slope for sentence and the interaction between language and sentence. To examine the effects of the age at which Venetian was learned and the percentage of time spent using this language, we analyzed only the responses of participants tested in Venetian. We considered whether participants acquired Venetian before or after 5 years of age (AoA). To obtain an overall index of Venetian use (% Venetian Use), we averaged the percentage of Venetian use across the different contexts (work, local community, friends and family). In the null model, we included (a) the random intercepts and (b) the random slope to account for participants' and items' specificity and the fixed effects of gender and sentence. We then compared the null model with Model 1 including AoA (before/after 5 years of age) and with Model 2 including % Venetian Use.

4.3. Results

The outcomes of model comparison for models testing the language effect are reported in Table 6A. The model that best fitted the data

Table 6. (A) Cumulative regression models carried out in Experiment 3. For each model, we report its formula, the LOOIC value, the standard error (SE) of the LOOIC, and the model's weight. The best-fitting model (Model 5) is shown in bold and summarized in (B). Predictors modulating participants' responses are marked in bold. Language 1 contrasts Italian (−1) vs. Venetian (1); Gender 1 contrasts Female (−1) and Male (1); Sentence_Type1 contrasts endearments and the average of the other three sentence types; Sentence_Type2 contrasts insults and the average of reprimands and low emotional sentences; Sentence_Type3 contrasts reprimands and low emotional sentences.

| (A) MODEL COMPARISON | | | | |
|---|--------------|----------------|--------------|--------------|
| Models | | LOOIC value | SE | LOOIC weight |
| Model 0. Score ~ 1 + (1 Part) + (1 Item) | | 27358.0 | 146.5 | 0.000 |
| Model 1. Score ~ Language + (1 Part) + (1 Item) | | 27357.5 | 146.5 | 0.000 |
| Model 2. Score ~ Language + Gender + (1 Part) + (1 Item) | | 27355.6 | 146.5 | 0.000 |
| Model 3. Score ~ Language + Gender + Sentence_Type (1 Part) + (1 Item) | | 27355.1 | 146.6 | 0.000 |
| Model 4. Score ~ Language + Gender + Sentence_Type (1+ Sentence_Type Part) + (1 Item) | | 24307.4 | 173.7 | 0.135 |
| Model 5. Score ~ Language * Sentence_Type + Gender (1 + Sentence_Type Part) + (1 Item) | | 24307.7 | 173.8 | 0.865 |
| (B) SUMMARY OF MODEL 5 | | | | |
| Family: cumulative Links: mu = logit; disc = identity | | | | |
| Formula: Score ~ Language * Sentence_Type + Gender + (1 + Sentence_Type Part) + (1 Item) | | | | |
| | Estimate | Est. Error | l-95% CI | u-95% CI |
| Multilevel hyperparameters (random effects) | | | | |
| ~Item (number of levels: 26) | 0.47 | 0.08 | 0.34 | 0.66 |
| ~Part (number of levels: 340) | | | | |
| sd(Intercept) | 1.93 | 0.08 | 1.78 | 2.11 |
| sd(Sentence_Type2) | 0.43 | 0.03 | 0.37 | 0.49 |
| sd(Sentence_Type3) | 0.56 | 0.03 | 0.51 | 0.61 |
| cor(Intercept,Sentence_Type1) | 0.09 | 0.07 | −0.04 | 0.22 |
| cor(Intercept,Sentence_Type2) | −0.03 | 0.08 | −0.18 | 0.12 |
| cor(Sentence_Type1,Sentence_Type2) | 0.79 | 0.05 | 0.68 | 0.89 |
| cor(Intercept,Sentence_Type3) | −0.26 | 0.06 | −0.38 | −0.14 |
| cor(Sentence_Type1,Sentence_Type3) | 0.00 | 0.07 | −0.13 | 0.14 |
| cor(Sentence_Type2,Sentence_Type3) | 0.37 | 0.07 | 0.22 | 0.51 |
| Regression coefficients (fixed effects) | | | | |
| Intercept[1] | −3.08 | 0.15 | −3.39 | −2.78 |
| Intercept[2] | −1.52 | 0.15 | −1.82 | −1.23 |
| Intercept[4] | 1.04 | 0.15 | 0.74 | 1.33 |
| Intercept[5] | 2.46 | 0.15 | 2.16 | 2.76 |
| Intercept[6] | 3.88 | 0.16 | 3.57 | 4.18 |
| Language1 | 0.32 | 0.11 | 0.11 | 0.53 |
| Sentence_Type1 | −0.45 | 0.17 | −0.78 | −0.12 |
| Sentence_Type2 | −0.40 | 0.09 | −0.59 | −0.22 |
| Sentence_Type3 | −0.87 | 0.06 | −0.99 | −0.76 |
| Gender1 | −0.25 | 0.11 | −0.47 | −0.03 |
| Language1: Sentence_Type1 | 0.10 | 0.07 | −0.04 | 0.25 |
| Language1: Sentence_Type2 | 0.11 | 0.03 | 0.05 | 0.17 |
| Language1: Sentence_Type3 | 0.17 | 0.03 | 0.10 | 0.23 |

Note: 1 | Part and 1 | Item represent the random intercepts for participants and items, respectively. Sentence_Type | Part represents the participants' random slope for the effect of Sentence Type.

was Model 5, which included the fixed effects of gender, language, sentence and the language × sentence interaction (a summary of the model is presented in Table 6B). As revealed by Model 5, language,

type of sentence and gender modulated participants' emotional responses. Figure 4, which shows the estimated probabilities for each score of the 7-point scale across conditions, illustrates the

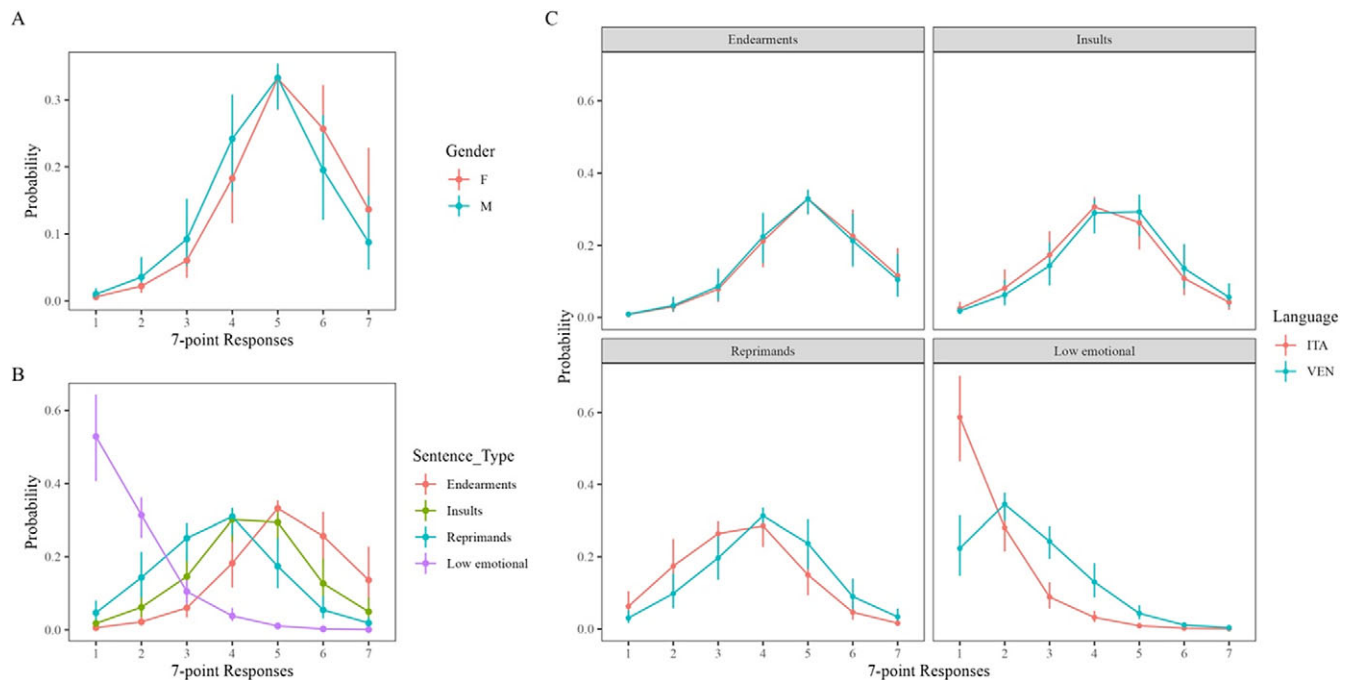


Figure 4. Frequency (estimated probability) of each score in the 7-point scale used in Experiment 3. Bars represent the interval between the 2.5th and 97th percentile. Ratings are shown as varying for participant gender (Panel A), type of sentences (Panel B) and language (Panel C).

effect of the parameters included in Model 5 on individual scores. Ratings were higher in Venetian than Italian, and for female than male participants. Endearments were considered more emotional than insults, and insults more emotional than reprimands. Low-emotion-intensity sentences received the lowest scores. The interaction between language and sentence revealed language effects varying with the type of sentence. As it is shown in the right panel of Figure 4, the language effect was more marked for reprimands and low-emotion-intensity sentences.

The results of the analyses aimed at investigating the effects of AoA and % Venetian Use are reported in Table 7. Only Model 2, which included % Venetian Use, increased the null model's fit (a summary of this model is presented in Table 7B). As shown in Figure 5, the incidence of higher scores corresponding to stronger emotional responses increased with greater Venetian use. Model 1's fit, which included the Venetian AoA, did not differ from the null model's fit. While this pattern suggests that emotional responses were unlikely to vary depending on the age at which Venetian was learned, the over-representation in our sample of speakers who learned Venetian at an early age (70.3%) makes our sample far from ideal to test AoA, demanding instead we interpret the outcome of Model 1 cautiously.

The inclusion of low-emotion-intensity sentences proved successful in revealing emotional phrases eliciting stronger emotions in Venetian than Italian. The results of Experiment 3 further qualify the conditions in which stronger emotions arise in the regional language. First, the language effect varied with Venetian use, increasing as Venetian was used more extensively. Second, the language effect was larger for reprimands and low-emotion-intensity sentences. Our results confirmed the exceptionality of reprimands that, in studies with foreign languages, differed from other emotional phrases for eliciting the strongest language effect (Caldwell-Harris & Ayçiçeği-Dinn, 2009; Harris, 2004; Harris et al., 2003). We typically receive reprimands as children (and possibly utter them as parents). It is, perhaps, not a coincidence that our

participants, most of whom learned Venetian at an early age, felt reprimands especially intensely in the language in which they probably encountered reprimands more often. Low-emotion-intensity sentences elicited relatively weak emotions, as shown by the comparatively low ratings they received (Figure 4). These low ratings did not prevent a significant language effect from appearing with low-emotion-intensity sentences. Such a finding likely reflected the nature of the low-emotion-intensity sentences selected for Experiment 3. Although the situations described in these sentences are weakly associated with emotions, they refer to everyday events, some of which were probably experienced in the household. These are events that our participants probably talked about more in Venetian, or that they associated with circumstances experienced in Venetian. It was on the basis of this language preference that a language effect could arise even with low-emotion-intensity sentences.

5. General discussion

In three experiments, we found that the regional language induced stronger emotions relative to the national language. Two additional findings strengthen the robustness of this language difference. First, it appeared with multiple emotions: disgust, mirth and various positive and negative emotions evoked by emotional phrases. Second, it was observed even with sentences that induced relatively weak emotions. While prior studies have shown differences in emotional strength between native and foreign languages (e.g., Caldwell-Harris & Ayçiçeği-Dinn, 2009; Harris et al., 2003), our results demonstrate similar differences between languages that are acquired early, and used proficiently and routinely.

The regional language was not the language that our participants spoke more frequently. They used it around half of the time among family and with friends and acquaintances, the contexts where it is permissible. The stronger emotions observed in our experiments

Table 7. (A) Cumulative regression models carried out in Experiment 3 to examine the effects of age of acquisition (AoA) and % use of Venetian on the ratings of participants tested in Venetian. For each model, we report its formula, the LOOIC value, the standard error (SE) of the LOOIC and the model's weight. Model 2, with % use included, is marked in bold since it performed better than the null model. Model's 2 results are summarized in (B). The predictors modulating participants' ratings are marked in bold. Gender1 contrasts Female (−1) and Male (1); Sentence_Type1 contrasts Endearments and the average of the other three sentence types; Sentence_Type2 contrasts Insults and the average of Reprimands and Low Emotional sentences; Sentence_Type3 contrasts Reprimands and Low Emotional sentences.

| (A) MODEL COMPARISON | | | | |
|--|----------|-------------|----------|--------------|
| Models | | LOOIC value | SE | LOOIC weight |
| Model 0. Score ~ Gender + Sentence_Type + (1 + Sentence_Type Part) + (1 Item) | | 13504.3 | 125.3 | 0.222 |
| Model 1. Score ~ Gender + Sentence_Type + AoA + (1 + Sentence_Type Part) + (1 Item) | | 13504.4 | 125.4 | 0.207 |
| Model 2. Score ~ Gender + Sentence_Type + %Use + (1 + Sentence_Type Part) + (1 Item) | | 13502.2 | 125.3 | 0.571 |
| (B) SUMMARY OF MODEL 2 | | | | |
| | Estimate | Est. Error | l-95% CI | u-95% CI |
| Multilevel hyperparameters (random effects) | | | | |
| ~Item (number of levels: 26) | 0.57 | 0.10 | 0.41 | 0.79 |
| ~Part (number of levels: 182) | | | | |
| sd(Intercept) | 1.97 | 0.12 | 1.76 | 2.22 |
| sd(Sentence_Type1) | 1.34 | 0.09 | 1.16 | 1.54 |
| sd(Sentence_Type2) | 0.46 | 0.04 | 0.38 | 0.55 |
| sd(Sentence_Type3) | 0.55 | 0.04 | 0.49 | 0.63 |
| cor(Intercept,Sentence_Type1) | 0.17 | 0.09 | −0.02 | 0.34 |
| cor(Intercept,Sentence_Type2) | 0.12 | 0.11 | −0.09 | 0.33 |
| cor(Sentence_Type1,Sentence_Type2) | 0.76 | 0.07 | 0.62 | 0.88 |
| cor(Intercept,Sentence_Type3) | −0.23 | 0.09 | −0.39 | −0.05 |
| cor(Sentence_Type1,Sentence_Type3) | 0.06 | 0.09 | −0.12 | 0.24 |
| cor(Sentence_Type2,Sentence_Type3) | 0.17 | 0.10 | −0.03 | 0.36 |
| Regression coefficients (fixed effects) | | | | |
| Intercept[1] | −2.36 | 0.27 | −2.90 | −1.84 |
| Intercept[2] | −0.87 | 0.27 | −1.41 | −0.36 |
| Intercept[3] | 0.27 | 0.27 | −0.26 | 0.77 |
| Intercept[4] | 1.60 | 0.27 | 1.07 | 2.11 |
| Intercept[5] | 3.02 | 0.27 | 2.48 | 3.54 |
| Intercept[6] | 4.34 | 0.27 | 3.80 | 4.87 |
| Gender1 | −0.41 | 0.16 | −0.73 | −0.09 |
| Sentence_Type1 | −0.36 | 0.21 | −0.78 | 0.07 |
| Sentence_Type2 | −0.29 | 0.11 | −0.52 | −0.07 |
| Sentence_Type3 | −0.70 | 0.07 | −0.84 | −0.55 |
| Use | 0.02 | 0.00 | 0.01 | 0.03 |

Note: 1 | Item represents the random intercepts for Items and Sentence_Type | Part represents the participants' random slope for the effect of Sentence Type.

for the regional language would not result from its dominance, if by dominant language we refer to the language used more frequently. While our results showed that dominance is not a necessary condition for observing stronger emotions, they nevertheless revealed that time spent using the language is critical. The gain of the regional language, in fact, disappeared when the regional language was not spoken frequently enough; when this occurred, the national language induced emotions of comparable, if not greater, intensity than the regional language. In short, whatever makes the regional language able to induce stronger emotions requires a minimal level of language use.

We anticipated emotions of stronger intensity for the regional language because, as the language is shared with family, friends and acquaintances, it is experienced in contexts critical for the acquisition and regulation of emotions and where emotions can be perceived and expressed more spontaneously and with fewer restrictions. The same expectation holds for heritage languages (Polinsky & Kagan, 2007) that children of immigrants learned among family and can only speak at home since these languages are not shared outside the household. Results confirming this prediction are found in the study conducted by Thoma (2024) with German residents who acquired German early in childhood, along

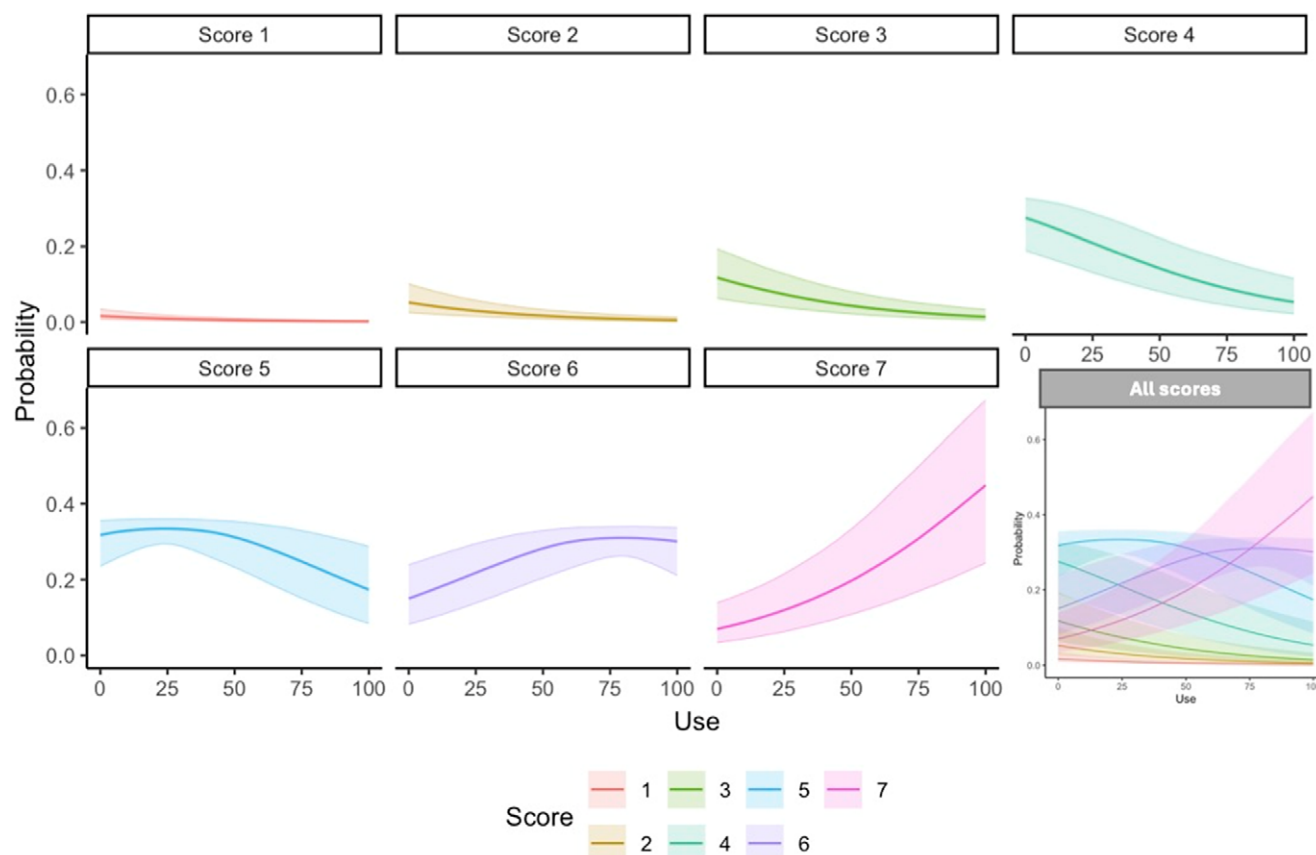


Figure 5. Effect of the percentage of time spent speaking Venetian on the emotion ratings of participants tested in Experiment 3 in Venetian. Estimated probability of each score of the 7-point scale (Y-axis) and the percentage of Venetian use (averaged over contexts; X-axis). Each colored line corresponds to a distinct score.

with a language (Turkish or Russian) they experienced exclusively at home or with friends. When asked to score the intensity of emotions evoked by watching a high-arousal video, these proficient bilinguals reported stronger emotions for the heritage language (Turkish or Russian). They estimated using the heritage language about 50% of the time while among family and with friends, a proportion very similar to that our bilinguals reported for the regional language.

The reduced intensity of emotions found with foreign languages has also been attributed to the context in which these languages are typically acquired and used (Caldwell-Harris, 2015; Pavlenko, 2017). As formal settings such as school or work do not provide especially rich and intense emotional contexts, foreign languages would not induce particularly strong emotions. Findings with regional and heritage languages nicely complement the results with foreign languages, thus confirming predictions derived from the hypothesis that regional and heritage languages, which are spoken in contexts in which emotions are expressed more spontaneously, would evoke relatively strong emotions. In this respect, it is noteworthy that this hypothesis does not anticipate that foreign languages would only elicit weaker emotions. As foreign languages are increasingly used in emotionally rich contexts, it is likely that they induce emotions of comparable, if not greater strength, than those elicited by native languages, as indeed reported by Harris et al. (2003). Similarly, emotions should not always be stronger with the regional language. There could, in fact, be instances in which the national language is experienced in emotionally rich contexts and could therefore induce relatively

strong emotions. This was probably the case with the emotional phrases that, in Experiment 3, elicited stronger emotions in the national language among the participants who used the regional language less often.

Even though emotions reflect variation in the context of use with regional, heritage and foreign languages, it does not imply that these languages would affect emotions in similar ways. Considering how greatly regional and heritage languages differ from foreign languages in terms of AoA, proficiency and frequency of use, it is very possible that other mechanisms, in addition to context, could shape the specific emotion experienced with each of these languages. Researchers, for example, have drawn attention to the effects that a higher cognitive load and less efficient processing of foreign languages could have on emotional appraisal (Thoma & Baum, 2019). Differences in the methods employed to assess emotions are another plausible source of variation we should consider. Measures of physiological correlates of emotions, such as skin conductance or pupillometry, would not only provide a more comprehensive picture of the effects of language on emotions but could also reveal differences across methodologies, possibly linked to distinct processes of emotion arousal and appraisal. An illustrative example in this respect is provided by Thoma (2024), who compared emotional responses in heritage and foreign languages and found different effects in both types of languages when measuring pupil diameter and emotion ratings. Our findings are limited to self-reported emotion ratings. Extending the investigation of regional languages beyond emotion ratings would likely enrich our picture of the effects of such languages on emotions.

An explanation as to why ratings of emotion strength vary across languages requires a detailed description of how ratings are formed. Determining the degree of disgust or pleasure experienced in certain situations could be based on the episodic memories that these situations activate (Förster & Liberman, 2007). However, to some, this situation could also engender a mental image (Zaleskiewicz et al., 2023), whose content, vividness and detailedness could influence the ratings. The language in which the situation is presented would likely evoke episodic memories or generate mental images related to the settings in which the language has been experienced (Caldwell-Harris, 2015; Pavlenko, 2017). If bilinguals speak their languages in settings where emotions are expressed and felt differently, each language will likely evoke episodic memories and mental images that vary in emotional content. Under this explanation, language functions as a cue that triggers certain information. Whether bilinguals' languages trigger different information would, in part, depend on how tightly compartmentalized their use is. How strongly the information is associated with a language is another variable that likely determines whether a language effect appears. Presently, we cannot estimate the likelihood that languages trigger different information. Judging by the pervasiveness of the language effects, however, it appears to be a rather common event. What we can anticipate is that language effects would correlate with language use; therefore, effects should increase in magnitude as use grows. Such a correlation was indeed found in Experiment 3.

Differences between native and foreign languages have been reported with decisions concerning risky prospects, monetary rewards and moral judgments, as reviewed by Circi et al. (2021), Del Maschio et al. (2022) and Stankovic et al. (2022). These effects have been explained by the weaker emotionality of foreign languages (Costa et al., 2014; Pavlenko, 2017). Given that regional and foreign languages induce emotions of different intensities, emotion-based explanations naturally predict that these languages would affect decisions differently. Contrary to this prediction, both languages affected various types of decisions in very similar ways (Miozzo et al., 2020; Peressotti, Lorenzoni, & Miozzo, 2024; Peressotti, Pianezzola, et al., 2024). These findings challenge an emotion-based explanation, suggesting instead that common mechanisms underlie the effects of both languages. Miozzo et al. (2020), and Peressotti, Lorenzoni, and Miozzo (2024), and Peressotti, Pianezzola, et al. (2024) proposed this kind of explanation to account for the similarities found with moral decisions. Foreign and regional languages favored decisions diverging from those endorsed by common morality. Schools, public institutions, churches and media represent primary sources of learning about common morality; it is unlikely that exposure to common morality occurs here in the regional or foreign languages. As their use limits experiencing common morality, foreign and regional languages would be weakly associated with common morality, which in turn reduces the probability that decisions taken in these languages align with common morality. This is a context-based explanation – the moral decisions taken in foreign and regional languages reflect the contexts in which these languages are used – and much like the explanation we propose for the language effects on emotions.

Among the universal features of human natural language, we should include the capacity that it confers to communicate and regulate emotions. Language has become inherently related to emotions, thanks to a whole gamut of mechanisms making it possible for any speaker to express ideas in ways that are as precise as they are effective. Understanding the language–emotion interplay requires us to define what universal features of language

enable such an exquisitely refined communication capacity. Findings with regional and heritage languages, however, appear to reveal that it is not enough to unveil such universal features. The contexts in which languages are spoken also seem to be critical. Confining languages within family, friends and acquaintances results in stronger emotions. An appreciation of what is universal and contextual in language would enhance our understanding of emotions.

Data availability statement. Data supporting the findings of this study are openly available in https://osf.io/tzuwp/?view_only=6afecf7a81f942879895cccd53e7a0e.

Acknowledgements. The authors would like to express their gratitude to Matilde Massara, Jasmine Farah and Tommaso Fassina for their assistance with data collection. The authors would like to extend their special thanks to Massimiliano Pastore for his essential contributions in recommending the statistical approach and providing invaluable support with the R package and script.

Competing interests. The authors declare none.

References

- Aarons, D. (2012). *Jokes and the linguistic mind*. Routledge. <https://doi.org/10.4324/9780203814741>
- Akaike, H. (1998). Information theory and an extension of the maximum likelihood principle. In Parzen, E., Tanabe, K., & Kitagawa, G. (Eds.), *Selected papers of Hirotugu Akaike*. Springer Series in Statistics. Springer. https://doi.org/10.1007/978-1-4612-1694-0_15.
- Anolli, L., Ciceri, R., & Infantino, M. G. (2002). From “blame by praise” to “praise by blame”: Analysis of vocal patterns in ironic communication. *International Journal of Psychology*, 37(5), 266–276. <https://doi.org/10.1080/00207590244000106>
- Attardo, S. (1993). Violation of conversational maxims and cooperation: The case of jokes. *Journal of Pragmatics*, 19(6), 537–558. [https://doi.org/10.1016/0378-2166\(93\)90111-2](https://doi.org/10.1016/0378-2166(93)90111-2)
- Auer, P. (2005). Europe's sociolinguistic unity, or: A typology of European dialect/standard constellations. *Perspectives on Variation: Sociolinguistic, Historical, Comparative*, 7, 7–42. <https://doi.org/10.1515/9783110909579.7>
- Ayçiçeği-Dinn, A., Şişman-Bal, S., & Caldwell-Harris, C. L. (2018). Are jokes funnier in one's native language?. *Humor*, 31(1), 5–37. <https://doi.org/10.1515/humor-2017-0112>
- Baayen, R. H. (2001). *Word frequency distributions* (Vol. 18). Springer Science & Business Media. <https://doi.org/10.1007/978-94-010-0844-0>
- Beard, F. K. (2005). One hundred years of humor in American advertising. *Journal of Macromarketing*, 25(1), 54–65. <https://doi.org/10.1177/0276146705274965>
- Behnke, M., Kreibitz, S. D., Kaczmarek, L. D., Assink, M., & Gross, J. J. (2022). Autonomic nervous system activity during positive emotions: A meta-analytic review. *Emotion Review*, 14(2), 132–160. <https://doi.org/10.1177/17540739211073084>
- Blackler, K. A., & LoBue, V. (2016). Behavioral avoidance of contagion in childhood. *Journal of Experimental Child Psychology*, 143, 162–170. <https://doi.org/10.1016/j.jecp.2015.09.033>
- Boersma, P. & Weenink, D. (2023). Praat: doing phonetics by computer. Version 6.3.20. <http://www.praat.org/>.
- Bressler, E. R., & Balshine, S. (2006). The influence of humor on desirability. *Evolution and Human Behavior*, 27(1), 29–39. <https://doi.org/10.1016/j.evolhumbehav.2005.06.002>
- Bryant, G. A. (2010). Prosodic contrasts in ironic speech. *Discourse Processes*, 47(7), 545–566. <https://doi.org/10.1080/01638530903531972>
- Bryant, G. A., & Tree, J. E. F. (2002). Recognizing verbal irony in spontaneous speech. *Metaphor and Symbol*, 17(2), 99–119. https://doi.org/10.1207/s15327868ms1702_2
- Bürkner, P. C. (2017). brms: An R package for Bayesian multilevel models using Stan. *Journal of statistical software*, 80, 1–28. <https://doi.org/10.18637/jss.v080.i01>

- Bürkner, P.C. (2018). Advanced Bayesian multilevel modeling with the R package BRMS. *The R Journal*, 10(1), 395–411. <https://doi.org/10.32614/RJ-2018-017>
- Bürkner, P. C., & Vuorre, M. (2019). Ordinal regression models in psychology: A tutorial. *Advances in Methods and Practices in Psychological Science*, 2(1), 77–101. <https://doi.org/10.1177/2515245918823199>
- Caldwell-Harris, C. L. (2015). Emotionality differences between a native and foreign language: Implications for everyday life. *Current Directions in Psychological Science*, 24, 214–219. <https://doi.org/10.1177/0963721414566268>
- Caldwell-Harris, C. L., & Ayçiçeği-Dinn, A. (2009). Emotion and lying in a non-native language. *International Journal of Psychophysiology*, 71(3), 193–204. <https://doi.org/10.1016/j.jpsycho.2008.09.006>
- Caldwell-Harris, C. L., Tong, J., Lung, W., & Poo, S. (2011). Physiological reactivity to emotional phrases in Mandarin—English bilinguals. *International Journal of Bilingualism*, 15(3), 329–352. <https://doi.org/10.1177/1367006910379262>
- Cann, A., & Matson, C. (2014). Sense of humor and social desirability: Understanding how humor styles are perceived. *Personality and Individual Differences*, 66, 176–180. <https://doi.org/10.1016/j.paid.2014.03.029>
- Chapman, H. A., Kim, D. A., Susskind, J. M., & Anderson, A. K. (2009). In bad taste: Evidence for the oral origins of moral disgust. *Science*, 323(5918), 1222–1226. <https://doi.org/10.1126/science.1165565>
- Cheang, H. S., & Pell, M. D. (2008). The sound of sarcasm. *Speech Communication*, 50(5), 366–381. <https://doi.org/10.1016/j.specom.2007.11.003>
- Circi, R., Gatti, D., Russo, V., & Vecchi, T. (2021). The foreign language effect on decision-making: A meta-analysis. *Psychonomic Bulletin & Review*, 28(4), 1131–1141. <https://doi.org/10.3758/s13423-020-01871-z>
- Costa, A., Foucart, A., Hayakawa, S., Aparici, M., Apesteguia, J., Heafner, J., & Keysar, B. (2014). Your morals depend on language. *PLoS One*, 9, e94842. <https://doi.org/10.1371/journal.pone.0094842>
- Crawford, M. (2003). Gender and humor in social context. *Journal of Pragmatics*, 35(9), 1413–1430.
- Curtis, V., Aunger, R., & Rabie, T. (2004). Evidence that disgust evolved to protect from risk of disease. *Proceedings of the Royal Society of London. Series B: Biological Sciences*, 271(suppl_4), S131–S133. <https://doi.org/10.1098/rsbl.2003.0144>
- Darwin, C. (1872). *The expression of the emotions in man and animals*. University of Chicago Press. <https://doi.org/10.1037/10001-000>
- Davey, G. C., & Bond, N. (2006). Using controlled comparisons in disgust psychopathology research: The case of disgust, hypochondriasis and health anxiety. *Journal of Behavior Therapy and Experimental Psychiatry*, 37(1), 4–15. <https://doi.org/10.1016/j.jbtep.2005.09.001>
- De Jong, P. J., Andrea, H., & Muris, P. (1997). Spider phobia in children: Disgust and fear before and after treatment. *Behaviour Research and Therapy*, 35(6), 559–562. [https://doi.org/10.1016/s0005-7967\(97\)00002-8](https://doi.org/10.1016/s0005-7967(97)00002-8)
- DeJesus, J. M., Gerdin, E., Venkatesh, S., & Rottman, J. (2021). Considering uncontaminated food as an early-emerging and previously ignored disgust elicitor. *Emotion*, 21(7), 1522–1526. <https://doi.org/10.1037/emo0001042>
- Del Maschio, N., Crespi, F., Peressotti, F., Abutaleb, J., Sulpizio, S. (2022). Decision-making depends on language: A meta-analysis of the Foreign Language Effect. *Bilingualism: Language and Cognition*, 25(4), 617–630. <https://doi.org/10.1017/S1366728921001012>
- Demos (2023). <http://www.demos.it/a02098.php>.
- Dewaele, J. M., & Costa, B. (2013). Multilingual clients' experience of psychotherapy. *Language and Psychoanalysis*, 2(2), 31–50. <https://doi.org/10.7565/landp.2013.005>
- Ekman, P., Davidson, R. J., & Friesen, W. V. (1990). The Duchenne smile: Emotional expression and brain physiology: II. *Journal of Personality and Social Psychology*, 58(2), 342–630. <https://doi.org/10.1037/0022-3514.58.2.342>
- Ezrina, E. V., & Valian, V. (2023). Do bilinguals get the joke? Humor comprehension in mono- and bilinguals. *Bilingualism: Language and Cognition*, 26(1), 95–111. <https://doi.org/10.1017/s1366728922000347>
- Faulkner, J., Schaller, M., Park, J. H., & Duncan, L. A. (2004). Evolved disease-avoidance mechanisms and contemporary xenophobic attitudes. *Group Processes & Intergroup Relations*, 7(4), 333–353. <https://doi.org/10.1177/1368430204046142>
- Ferguson, R. (2007). *A linguistic history of Venice*. Leo S. Olshki Editore.
- Fessler, D. M., Eng, S. J., & Navarrete, C. D. (2005). Elevated disgust sensitivity in the first trimester of pregnancy: Evidence supporting the compensatory prophylaxis hypothesis. *Evolution and Human Behavior*, 26(4), 344–351. <https://doi.org/10.1016/j.evolhumbehav.2004.12.001>
- Fiacconi, C. M., & Owen, A. M. (2015). Using psychophysiological measures to examine the temporal profile of verbal humor elicitation. *PLoS one*, 10(9), e0135902. <https://doi.org/10.1371/journal.pone.0135902>
- Fiske, S. T., Cuddy, A. J. C., Glick, P., & Xu, J. (2002). A model of (often mixed) stereotype content: Competence and warmth respectively follow from perceived status and competition. *Journal of Personality and Social Psychology*, 82(6), 878–902. <https://doi.org/10.1037/0022-3514.82.6.878>
- Ford, T. E., Richardson, K., & Petit, W. E. (2015). Disparagement humor and prejudice: Contemporary theory and research. *Humor*, 28(2), 171–186. <https://doi.org/10.1515/humor-2015-0017>
- Förster, J., & Liberman, N. (2007). Knowledge activation. *Social psychology: Handbook of Basic Principles*, 2, 201–231.
- Foster, P. S., Webster, D. G., & Williamson, J. (2002). The psychophysiological differentiation of actual, imagined, and recollected mirth. *Imagination, Cognition and Personality*, 22(2), 163–180. <https://doi.org/10.2190/kl08-1p9c-k9be-k8va>
- Frank, M. G., Ekman, P., & Friesen, W. V. (1993). Behavioral markers and recognizability of the smile of enjoyment. *Journal of Personality and Social Psychology*, 64(1), 83. <https://doi.org/10.1037/0022-3514.64.1.83>
- Geipel, J., Hadjichristidis, C., & Klesse, A. K. (2018). Barriers to sustainable consumption attenuated by foreign language use. *Nature Sustainability*, 1(1), 31–33. <https://doi.org/10.1038/s41893-017-0005-9>
- Giora, R., Drucker, A., Fein, O., & Mendelson, I. (2015). Default sarcastic interpretations: On the priority of nonsalient interpretations. *Discourse Processes*, 52(3), 173–200. <https://doi.org/10.1080/0163853x.2014.954951>
- Goatly, A. (2012). *Meaning and humour*. Cambridge University Press. <https://doi.org/10.1017/cbo9780511791536>
- Graham, J., Haidt, J., Koleva, S., Motyl, M., Iyer, R., Wojcik, S. P., & Ditto, P. H. (2013). Moral foundations theory: The pragmatic validity of moral pluralism. In *Advances in Experimental Social Psychology* (Vol. 47, pp. 55–130). Academic Press. <https://doi.org/10.1016/B978-0-12-407236-7.00002-4>
- Guernier, V., Hochberg, M. E., & Guegan, J.-F. (2004). Ecology drives the worldwide distribution of human diseases. *PLoS Biology*, 2, 740–746. <https://doi.org/10.1371/journal.pbio.0020141>
- Haidt, J., McCauley, C., & Rozin, P. (1994). Individual differences in sensitivity to disgust: A scale sampling seven domains of disgust elicitors. *Personality and Individual Differences*, 16(5), 701–713. [https://doi.org/10.1016/0191-8869\(94\)90212-7](https://doi.org/10.1016/0191-8869(94)90212-7)
- Harris, C. L. (2004). Bilingual speakers in the lab: Psychophysiological measures of emotional reactivity. *Journal of Multilingual and Multicultural Development*, 25(2–3), 223–247. <https://doi.org/10.1080/01434630408666530>
- Harris, C. L., Ayçiçeği, A., & Gleason, J. B. (2003). Taboo words and reprimands elicit greater autonomic reactivity in a first language than in a second language. *Applied Psycholinguistics*, 24(4), 561–579. <https://doi.org/10.1017/s0142176403000286>
- Hodson, G., & MacInnis, C. C. (2016). Derogating humor as a delegitimization strategy in intergroup contexts. *Translational Issues in Psychological Science*, 2(1), 63–74. <https://doi.org/10.1037/tps0000052>
- Il Post (March 13, 2016). <https://www.ilpost.it/2016/03/13/storia-settimana-enigmistica/>.
- ISTAT, National Institute for Statistics – Italy (2014). L'uso della lingua Italiana, dei dialetti e di altre lingue in Italia. <http://www.istat.it>.
- Ito, T. A., & Cacioppo, J. T. (2012). Affect and attitudes: A social neuroscience approach. In *Handbook of affect and social cognition* (pp. 50–75). Psychology Press. <https://doi.org/10.4324/9781410606181-8>
- Janes, L. M., & Olson, J. M. (2000). Jeer pressure: The behavioral effects of observing ridicule of others. *Personality and Social Psychology Bulletin*, 26(4), 474–485. <https://doi.org/10.1177/0146167200266006>
- Kashdan, T. B., Yarbro, J., McKnight, P. E., & Nezlek, J. B. (2014). Laughter with someone else leads to future social rewards: Temporal change using experience sampling methodology. *Personality and Individual Differences*, 58, 15–19. <https://doi.org/10.1016/j.paid.2013.09.025>
- Katz, A. N., Blasko, D. G., & Kazmerski, V. A. (2004). Saying what you don't mean: Social influences on sarcastic language processing. *Current Directions in Psychological Science*, 13(5), 186–189. <https://doi.org/10.1111/j.0963-7214.2004.00304.x>

- Keltner, D., & Bonanno, G. A. (1997). A study of laughter and dissociation: distinct correlates of laughter and smiling during bereavement. *Journal of Personality and Social Psychology*, 73(4), 687–702. <https://doi.org/10.1037/0022-3514.73.4.687>
- Kreibig, S. D., Samson, A. C., & Gross, J. J. (2013). The psychophysiology of mixed emotional states. *Psychophysiology*, 50(8), 799–811. <https://doi.org/10.1111/psyp.12064>
- Kurtz, L. E., & Algoe, S. B. (2015). Putting laughter in context: Shared laughter as behavioral indicator of relationship well-being. *Personal Relationships*, 22(4), 573–590. <https://doi.org/10.1111/pere.12095>
- La Fave, L., Haddad, J., & Maesen, W. A. (2017). Superiority, enhanced self-esteem, and perceived incongruity humour theory. In *Humor and laughter* (pp. 63–91). Transaction Publishers. <https://doi.org/10.4324/9780203789469-5>
- Levenson, R. W. (2003). Autonomic specificity and emotion. *Handbook of Affective Sciences*, 2, 212–224. <https://doi.org/10.1093/oso/9780195126013.003.0011>
- Maiden, M. (1995). *A linguistic history of Italian*. Longman Group Limited. <https://doi.org/10.4324/9781315845906>
- Martin, R. A. (2019). *Humor*. American Psychological Association. <https://doi.org/10.1037/0000138-019>
- Martin, R. A., & Ford, T. (2018). *The psychology of humor: An integrative approach*. Academic Press. <https://doi.org/10.1016/B978-0-12-372564-6>
- Martin, R. A., & Kuiper, N. A. (1999). Daily occurrence of laughter: Relationships with age, gender, and Type A personality. *Humor: International Journal of Humor Research*, 12, 355–384.
- Martineau, W. H. (1972). A model of the social functions of humor. In J. H. Goldstein, & P. E. McGhee (Eds.), *The psychology of humor* (pp. 101–125). Academic Press. <https://doi.org/10.1016/b978-0-12-288950-9.50011-0>
- Marzillier, S., & Davey, G. (2004). The emotional profiling of disgust eliciting stimuli: Evidence for primary and complex disgusts. *Cognition and Emotion*, 18, 313–336. <https://doi.org/10.1080/02699930341000130>
- Mauchand, M., Vergis, N., & Pell, M. D. (2020). Irony, prosody, and social impressions of affective stance. *Discourse Processes*, 57(2), 141–157. <https://doi.org/10.1080/0163853x.2019.1581588>
- Mesquita, B., & Frijda, N. H. (1992). Cultural variations in emotions: a review. *Psychological Bulletin*, 112(2), 179–204. <https://doi.org/10.1037/0033-2909.112.2.179>
- Meyer, J. C. (2000). Humor as a double-edged sword: Four functions of humor in communication. *Communication Theory*, 10(3), 310–331. <https://doi.org/10.1111/j.1468-2885.2000.tb00194.x>
- Miozzo, M., Navarrete, E., Ongis, M., Mello, E., Giroto, V., & Peressotti, F. (2020). Foreign language effect in decision-making: How foreign is it?. *Cognition*, 199, 104245. <https://doi.org/10.1016/j.cognition.2020.104245>
- Montrul, S. (2016). *The acquisition of heritage languages*. Cambridge University Press. <https://doi.org/10.1017/s0022226717000093>
- Morreall, J. (1983). *Taking laughter seriously*. SUNY Press.
- Morris, A. S., Silk, J. S., Steinberg, L., Myers, S. S., & Robinson, L. R. (2007). The role of the family context in the development of emotion regulation. *Social Development*, 16(2), 361–388. <https://doi.org/10.1111/j.1467-9507.2007.00389.x>
- Nerhardt, G. (1976). Incongruity and funniness: Toward a new descriptive model. In A. J. Chapman & H. C. Foot (Eds.), *Humor and laughter: Theory, research, and applications* (pp. 63–92). Wiley.
- Oaten, M., Stevenson, R. J., & Case, T. I. (2009). Disgust as a disease-avoidance mechanism. *Psychological Bulletin*, 135, 303–321. <https://doi.org/10.1037/a0014823>
- Olatunji, B. O., Moretz, M. W., McKay, D., Bjorklund, F., de Jong, P. J., Haidt, J., ... & Schienle, A. (2009). Confirming the three-factor structure of the Disgust Scale—Revised in eight countries. *Journal of Cross-cultural Psychology*, 40(2), 234–255. <https://doi.org/10.1177/0022022108328918>
- Olatunji, B. O., & Sawchuk, C. N. (2005). Disgust: Characteristic features, social manifestations, and clinical implications. *Journal of Social and Clinical Psychology*, 24(7), 932–962. <https://doi.org/10.1521/jscp.2005.24.7.932>
- Olatunji, B. O., Williams, N. L., Tolin, D. F., Abramowitz, J. S., Sawchuk, C. N., Lohr, J. M., & Elwood, L. S. (2007). The Disgust Scale: item analysis, factor structure, and suggestions for refinement. *Psychological Assessment*, 19(3), 281–297. <https://doi.org/10.1037/1040-3590.19.3.281>
- Pavlenko, A. (2017). Do you wish to waive your rights? Affect and decision-making in multilingual speakers. *Current Opinion in Psychology*, 17, 74–78. <https://doi.org/10.1016/j.copsyc.2017.06.005>
- Pehlivanidis, A., Pehlivanidi, N., Papanikolaou, K., Mantas, V., Bertou, E., Chalimourdas, T., ... & Papageorgiou, C. (2020). The Emotion of Disgust among Medical and Psychology Students. *Diseases*, 8(4), 43. <https://doi.org/10.3390/diseases8040043>
- Peressotti, F., Lorenzoni, A., & Miozzo, M. (2024). Moral judgments in native, regional, and foreign languages. *Bilingualism: Language and Cognition*, 27(1), 154–163. <https://doi.org/10.1017/s1366728923000342>
- Peressotti, F., Pianezzola, G., Battistutta, M., & Miozzo, M. (2024). Foreign and regional languages make you less deontological. *Journal of Cognition*, 7(1), 18. <https://doi.org/10.5334/joc.346>
- Pexman, P. M., & Zvaigzne, M. T. (2004). Does irony go better with friends?. *Metaphor and Symbol*, 19(2), 143–163. https://doi.org/10.1207/s15327868ms1902_3
- Piller, I. (2011). “I Always Wanted to Marry a Cowboy”: Bilingual couples, language, and desire. In *Intercultural Couples* (pp. 53–70). Routledge.
- Polinsky, M., & Kagan, O. (2007). Heritage languages: In the ‘wild’ and in the classroom. *Language and Linguistics Compass*, 1(5), 368–395. <https://doi.org/10.1111/j.1749-818x.2007.00022.x>
- Puntoni, S., De Langhe, B., & Van Osselaer, S. M. (2009). Bilingualism and the emotional intensity of advertising language. *Journal of Consumer Research*, 35(6), 1012–1025. <https://doi.org/10.1086/595022>
- R Core Team (2024). R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria. <https://www.R-project.org/>
- Ritchie, G. (2004). *The linguistic analysis of jokes* (Vol. 2). Routledge. <https://doi.org/10.4324/9780203406953>
- Rockwell, P. (2000). Lower, slower, louder: Vocal cues of sarcasm. *Journal of Psycholinguistic Research*, 29, 483–495. <https://doi.org/10.1023/a:1005120109296>
- Romero, E., & Pescosolido, A. (2008). Humor and group effectiveness. *Human Relations*, 61(3), 395–418. <https://doi.org/10.1177/0018726708088999>
- Rottman, J. (2014). Evolution, development, and the emergence of disgust. *Evolutionary Psychology*, 12(2), 147470491401200209. <https://doi.org/10.1177/147470491401200209>
- Rozin, P., Fallon, A., & Mandell, R. (1984). Family resemblance in attitudes to foods. *Developmental Psychology*, 20(2), 309–314. <https://doi.org/10.1037/0012-1649.20.2.309>
- Rozin, P., & Haidt, J. (2013). The domains of disgust and their origins: Contrasting biological and cultural evolutionary accounts. *Trends in Cognitive Sciences*, 17(8), 367–368. <https://doi.org/10.1016/j.tics.2013.06.001>
- Rozin, P., Haidt, J., & McCauley, R. C. (2016). Disgust. In L. F. Barrett, M. Lewis, & J. M. Haviland-Jones (Eds.), *Handbook of emotions* (pp. 815–834). Guilford Press.
- Rozin, P., Millman, L., & Nemeroff, C. (1986). Operation of the laws of sympathetic magic in disgust and other domains. *Journal of Personality and Social Psychology*, 50(4), 703–712. <https://doi.org/10.1037/0022-3514.50.4.703>
- Rozin, P., & Nemeroff, C. (1990). The laws of sympathetic magic. In *Cultural psychology* (pp. 205–232). Cambridge University Press. <https://doi.org/10.1017/cbo9781139173728.006>
- Rubin, K. H., Bukowski, W. M., Parker, J. G., & Bowker, J. C. (2008). Peer interactions, relationships, and groups. In *Child and adolescent development: An advanced course* (pp. 141–180). Wiley. <https://doi.org/10.1002/9780470147658.chpsy0310>
- Ruiz-Padial, E., Moreno-Padilla, M., & del Paso, G. A. R. (2023). Did you get the joke? Physiological, subjective and behavioral responses to mirth. *Psychophysiology*, 60(6), e14292. <https://doi.org/10.1111/psyp.14292>
- Sawchuk, C. N., Lohr, J. M., Tolin, D. F., Lee, T. C., & Kleinknecht, R. A. (2000). Disgust sensitivity and contamination fears in spider and blood-injection-injury phobias. *Behaviour Research and Therapy*, 38(8), 753–762. [https://doi.org/10.1016/s0005-7967\(99\)00093-5](https://doi.org/10.1016/s0005-7967(99)00093-5)
- Scaltritti, M., Peressotti, F., & Miozzo, M. (2017). Bilingual advantage and language switch: What’s the linkage? *Bilingualism: Language and Cognition*, 20(1), 80–97. <https://doi.org/10.1017/s1366728915000565>

- Schaller, M., & Duncan, L. A. (2007). The behavioural immune system: Its evolution and social psychological implications. In J. P. Forgas, M. G. Haselton, & W. von Hippel (Eds.), *Evolution and the social mind: Evolutionary psychology and social cognition* (pp. 293–307). Psychology Press. <https://doi.org/10.4324/9780203837788>
- Shultz, T. R. (1972). The role of incongruity and resolution in children's appreciation of cartoon humor. *Journal of Experimental Child Psychology*, 13(3), 456–477. [https://doi.org/10.1016/0022-0965\(72\)90074-4](https://doi.org/10.1016/0022-0965(72)90074-4)
- Simpson, J., Carter, S., Anthony, S. H., & Overton, P. G. (2006). Is disgust a homogeneous emotion? *Motivation and Emotion*, 30, 31–41. <https://doi.org/10.1007/s11031-006-9005-1>
- Spotorno, N., & Noveck, I. A. (2014). When is irony effortful? *Journal of Experimental Psychology: General*, 143(4), 1649–1665. <https://doi.org/10.1037/a0036630>
- Sprecher, S., & Regan, P. C. (2002). Liking some things (in some people) more than others: Partner preferences in romantic relationships and friendships. *Journal of Social and Personal Relationships*, 19(4), 463–481. <https://doi.org/10.1177/0265407502019004048>
- Stan Development Team. (2019). Stan language reference manual [Computer software manual]. (Version 2.22). Available online at: <http://mc-stan.org/>
- Stankovic, M., Biedermann, B., & Hamamura, T. (2022). Not all bilinguals are the same: A meta-analysis of the moral foreign language effect. *Brain and Language*, 227, 105082. <https://doi.org/10.1016/j.bandl.2022.105082>
- Stark, R., Walter, B., Schienle, A., & Vaitl, D. (2005). Psychophysiological correlates of disgust and disgust sensitivity. *Journal of Psychophysiology*, 19, 50–60. <https://doi.org/10.1027/0269-8803.19.1.50>
- Stevenson, R. J., Case, T. I., Oaten, M. J., Stafford, L., & Saluja, S. (2019). A proximal perspective on disgust. *Emotion Review*, 11(3), 209–225. <https://doi.org/10.1177/1754073919853355>
- Stevenson, R. J., Oaten, M. J., Case, T. I., Repacholi, B. M., & Wagland, P. (2010). Children's response to adult disgust elicitors: Development and acquisition. *Developmental Psychology*, 46(1), 165–177. <https://doi.org/10.1037/a0016692>
- Thoma, D. (2024). Language-dependent emotions in heritage and second language bilinguals: When physiological reactions deviate from feelings. *International Journal of Bilingualism*, 28(3), 279–315. <https://doi.org/10.1177/13670069231159840>
- Thoma, D., & Baum, A. (2019). Reduced language processing automaticity induces weaker emotions in bilinguals regardless of learning context. *Emotion*, 19(6), 1023–1034. <https://doi.org/10.1037/emo0000502>
- Tolin, D. F., Lohr, J. M., Sawchuk, C. N., & Lee, T. C. (1997). Disgust and disgust sensitivity in blood-injection-injury and spider phobia. *Behaviour Research and Therapy*, 35(10), 949–953. [https://doi.org/10.1016/s0005-7967\(97\)00048-x](https://doi.org/10.1016/s0005-7967(97)00048-x)
- Treger, S., Sprecher, S., & Erber, R. (2013). Laughing and liking: Exploring the interpersonal effects of humor use in initial social interactions. *European Journal of Social Psychology*, 43(6), 532–543. <https://doi.org/10.1002/ejsp.1962>
- Tuttle, E. (1997). The Veneto. In M. Maiden, & M. M. Parry (Eds.). *The dialects of Italy* (pp. 263–270). Routledge. <https://doi.org/10.4324/9780203993880>
- Tybur, J. M., Lieberman, D., & Griskevicius, V. (2009). Microbes, mating, and morality: Individual differences in three functional domains of disgust. *Journal of Personality and Social Psychology*, 97, 103–122. <https://doi.org/10.1037/a0015474>
- Tybur, J. M., Lieberman, D., Kurzban, R., & DeScioli, P. (2013). Disgust: evolved function and structure. *Psychological Review*, 120(1), 65–84. <https://doi.org/10.1037/a0030778>
- van Overveld, M., de Jong, P. J., Peters, M. L., & Schouten, E. (2011). The Disgust Scale-R: A valid and reliable index to investigate separate disgust domains? *Personality and Individual Differences*, 51(3), 325–330. <https://doi.org/10.1016/j.paid.2011.03.023>
- Vehtari, A., Gelman, A., & Gabry, J. (2017). Practical Bayesian model evaluation using leave-one-out cross-validation and WAIC. *Statistics and Computing*, 27, 1413–1432. <https://doi.org/10.1007/s11222-016-9696-4>
- Vehtari, A., Gelman, A., Simpson, D., Carpenter, B., & Bürkner, P. C. (2021). Rank-normalization, folding, and localization: An improved R \hat{R} for assessing convergence of MCMC (with discussion). *Bayesian Analysis*, 16(2), 667–718. <https://doi.org/10.1214/20-BA1221>
- Veillard, S., & Pinabiaux, C. (2019). Spontaneous response to and expressive regulation of mirth elicited by humorous cartoons in younger and older adults. *Aging, Neuropsychology, and Cognition*, 26(3), 407–423. <https://doi.org/10.1080/13825585.2018.1453922>
- Warren, C., Barsky, A., & McGraw, A. P. (2021). What makes things funny? An integrative review of the antecedents of laughter and amusement. *Personality and Social Psychology Review*, 25(1), 41–65. <https://doi.org/10.1177/1088868320961909>
- Westwood, R. I., & Johnston, A. (2013). Humor in organization: From function to resistance. *Humor*, 26(2), 219–247. <https://doi.org/10.1515/humor-2013-0024>
- Woodland, J., & Voyer, D. (2011). Context and intonation in the perception of sarcasm. *Metaphor and Symbol*, 26(3), 227–239. <https://doi.org/10.1080/10926488.2011.583197>
- Yao, Y., Vehtari, A., Simpson, D., & Gelman, A. (2018). Using stacking to average Bayesian predictive distributions (with discussion). *Bayesian Analysis*, 13(3), 917–1003. <https://doi.org/10.1214/17-BA1091>
- Zaleskiewicz, T., Traczyk, J., & Sobkow, A. (2023). Decision making and mental imagery: A conceptual synthesis and new research directions. *Journal of Cognitive Psychology*, 35, 603–633. <https://doi.org/10.1080/20445911.2023.2198066>