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Oral approach-avoidance: A Replication and Extension for European Portuguese Phonation

Abstract

Previous research revealed that mouth movements influence attitudes (Topolinski, et al., 2014). Covert subvocal articulations inducing muscular contractions resembling ingestion-movements were preferred over expectoration-like movements, unveiling a relationship between vocal muscles' wandering and motivational states such as approach and avoidance. These findings, explained in terms of embodied cognition, suggest that specific movements are directly connected to, and more importantly, automatically activate concordant motivational states. The oral approach avoidance effect was replicated using the original stimulus set and a new set of stimulus developed for Portuguese. Results from two high-powered (total $N = 407$), independent replications, reveal that the preference for inward words (over outwards) exists in both sets, but to a greater extent in the pool phonetically adapted for Portuguese.

Key words: articulation, embodiment, metaphors, phonation, replication

Evidence about the way bodily states influence cognition, affect and motivation suggests that specific movements are directly connected to, and more importantly, automatically activate concordant motivational states (Centerbar & Clore, 2006; Chen & Bargh, 1999). Among the bodily-effectors that have been investigated (e.g., fingers, hands, arms, facial-muscles, body-posture, cf., Semin, Garrido, & Palma, 2012, 2013; Semin & Smith, 2013), the articulatory effectors, namely the lips and the tongue, are of particular interest for examining specific affect-motor representations, as they allow the examination of embodied effects without the impact of conscious motivational or emotional states. Accordingly, several lines of recent research have explored the affective consequences of orofacial movements (e.g., Rummer, Schweppe, Schlegelmilch, & Grice, 2014; Topolinski, 2012; Topolinski, Lindner, & Freudenberg, 2014; Topolinski & Strack, 2009, 2010; Topolinski & Türk Pereira, 2012).

Topolinski, Maschmann, Pecher, and Winkielman's (2014) recent research has shown that muscular contractions resembling inward going ingestion versus outward going expectoration movements trigger affective states of positive approach vs. negative avoidance, respectively. The authors hypothesized that subvocal articulations inducing muscular contractions that resemble ingestion-movements (e.g., BADAK, where the consonants wander inwards the mouth) would be preferred over expectoration-movements (e.g., KADAB). In line with predictions, systematic inward in contrast to outward wanderings of consonantal strictures were preferred, unveiling a relationship between the wandering of vocal muscles and motivational states such as approach and avoidance. We will refer to this as the in-out effect in the reminder of this paper.

Across nine experiments Topolinski and colleagues' (2014) research provided empirical evidence for the in-out effect for both English and German speaking participants, framing the stimulus as nonsense words, company names, or person names. These findings

present an innovative research avenue for investigating sensorimotor experience, beyond affective and motivational expectations, across several domains. Moreover, in follow-up studies this effect was generalized to consumer attitudes, where participants reported higher purchase likelihood and willingness-to-pay for products with inward than for products with outward brands (Topolinski, Zürn, & Schneider, 2015). Also, in a recent paper the interaction of this articulation effect with word meaning was explored (Topolinski, Boecker, Bakthiari, & Pecher, 2015). There, it was found that the in-out effect is reduced or even reversed when these words denote objects are associated with a strong expectorative oral action (e.g., bubble gums or toxical chemicals). Finally, Topolinski and Bakhtiari(2015, in press) investigated sequences of approach-avoidance movements within a trial induced by word articulation. The results indicate that such movements, sequentially executed, do not cancel each other, but jointly influence resulting affective responses.

However, to the best of your knowledge, the in-out effect has not been directly replicated by an independent research group. Replication studies are intended to endorse the veracity of previous findings, guaranteeing that the effect occurs under the same conditions, i.e., replicability, and may constitute a valid tool to aid effect size estimations. Psychology research has been inflated by a controversial, but meaningful, debate about the importance of close replications for the development of a reliable and cumulative knowledge base. Following this thrust in psychology in conducting replication research (e.g., IJzerman, Brandt, & van Wolferen, 2013; Pashler & Waagenmakers, 2012), in this paper, we seek to replicate the findings of the research entitled “Oral approach–avoidance: Affective consequences of muscular articulation dynamics” by Topolinski and colleagues (2014).

Westfall, Judd and Kenny (2015) also emphasize the importance of replication studies to introduce not only new samples, allowing to control for eventual sampling error, but also to test new stimulus pools that provide solid evidence that the variance in these experiments

is not biased by the stimulus themselves. Guided by such suggestion and the intention to produce a successful replication that reliably increases confidence about the veracity and size of the reported effect, in the present research we chose to use in a first experiment the set of stimulus used by Topolinski and colleagues (2014) in their Experiment 6 (Pool D) and, in a second study, to develop and test a new stimulus set for European Portuguese (EP) phonation.

The development of stimulus sets adapted to different countries and languages constitutes an important research requirement. This procedure allows a more appropriate selection of stimuli as a function of the cultural context, providing researchers with useful tools to control and effectively manipulate affective states or behaviour in experimental research. Indeed, some effects seem to be dependent upon both linguistic and cultural characteristics. Such cross cultural differences have long been recognized giving rise to the development or adaptation of international normative stimulus sets (e.g., ANEW, Soares, Comesaña, Pinheiro, Simões, & Frade, 2012; IAPS, Soares et al., 2014; IADS-2, Soares et al, 2013; Lisbon Symbol Database, Prada, Rodrigues, Silva, & Garrido, 2015). In the context of the current research, and since languages' phonetic articulation may vary to a great extent (Cho & Ladefoged, 1999), the adaptation of the original stimulus set to Portuguese phonation, acquires particular relevance.

Method

Power Analysis and Sampling Plan

Since statistical power reported in previous literature has been set for at least .80 (Cohen, 1992) up to .95 (Open Science Collaboration, 2012), we conservatively opted to calculate the required sample size to replicate this effect with a larger power (0.95). Indeed as Brandt, et al., (2014) point effect sizes in published empirical research tend to be

overestimates of the true effect size (Greenwald, 1975) so, they suggest, “researchers should err conservatively, toward higher levels of power” (p. 220).Using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) and based on the effect size of Experiment 6 in Topolinski et al., (2014) Cohen’s d_z= 0.44(Cohen, 1988) the required sample size to detect the in-out effect with a power of 0.95 was N = 70. Because we wanted to test the effect with the same stimulus set but with speakers of a different language (study 1) and with an entirely new stimulus set in a different speaking country (study 2) we used larger samples to provide a more robust test of the effect. Nevertheless, in future research, such over-powered studies are not a requirement to replicate the in-out effect.

Participants

Two independent replications were conducted. In the first experiment N = 203 Portuguese native speakers (M_{age} = 45, SD = 11.46; 126 female) completed an online questionnaire. In the second experiment N = 204 Portuguese native speakers (M_{age} = 37, SD = 12.50; 142 female) completed an online questionnaire. Data for the first experiment was collected between April and May 2015, and for the second between July and August of 2015.

Design

As in Topolinski et al., (2014), the dependent variable was participants’ evaluation of a given target word. The independent variable was the sagittal direction of consonantal wanderings, featuring specific consonant wanderings either from the front to rear of the mouth (inward) and from the rear to the front (outward). All the individual word ratings were computed in a mean for inward and for outward words.

Materials and Procedure

Word stimulus pools. There are natural differences in the letter-to-phonation correspondence across languages. The same letter does not mean the same phonation in two

given languages. For instance, while the letter R is an alveolar approximant [ɹ] in English phonation that is generated with the tip of the tongue (so rather in the front of the mouth), the very same letter it is a uvular fricative [ʁ] in German and French phonation that is generated with the back of the tongue (so rather in the rear of the mouth; International Phonetic Association, 1999). Given that the in-out effect depends of the exact articulation spot of consonants, letter-phoneme correspondences have to be taken into account carefully in cross-language replications.

Topolinski et al. (2014) have provided a stimulus pool both for German and for English phonation, respectively. However, the German stimulus pool would be inappropriate for Portuguese speakers since there are major differences in letter-to-phonation correspondences between these two languages. For example, as rear (velar) consonants, G and R were used in the German stimulus pool, but G and R are not always pronounced velar in Portuguese (similar to English)[1]. Thus, we chose to use the English stimulus set provided in Experiment 6 in Topolinski et al. (2014) for our first replication in Portuguese native speakers, because it only includes consonants for which the letter-to-phoneme translation is the same in Portuguese phonation according to the International Phonetic Alphabet (International Phonetic Association, 1999). The consonant groups sampled in that pool were front (labial: B, F, M, P), middle (alveolar: D, L, N, S, T), and rear (K).

For the Portuguese set of stimuli we chose the following consonants from three clearly anatomically distinct articulatory places that are unequivocal in Portuguese phonation: front (labial: P, B, F, V), middle (alveolar: T, N, D), andrear (palatal: C; velar: G). For inward wandering words, we created all possible combinations of these consonants in the order front-middle-rear (e.g., PTC). We then reversed these consonant strings to create outward “mirror” strings (e.g., CTP). At the beginning, middle, and end spots we then inserted all 60 possible combinations of vowels (e.g., AEI, AIO, AOU, EAI, EAO, IAE) to create both inward and

outward words (e.g., inward – BATECO, outward – CATEBO, inward – AFUTEGO, outward – AGUTEFO). With this process we reached a stimulus pool of 17280 words. Subsequently 14448 words were excluded. Such exclusions were made for two main reasons: first due to the similarity between some of the created words to existing Portuguese words, (e.g. BONECA) and secondly because C is only pronounced as [K], and G is only pronounced as a [g] when followed by dark vowels, therefore all words which included C o G and an E or I were removed (e.g. BUTOCI, CENUFO, FONUGE). Finally, we randomly selected 276 words, 138 inward and 138 outward, from the whole pool to include in the final stimulus pool of our questionnaire. Please find the final pool of words created in the appendix section.

Questionnaire. In the questionnaire all word rating were given in a scale ranging from 1 (*I do not like it at all*) to 10 (*I like it very much*). Participants were also asked about demographics, such as gender, age and professional occupation, and to prevent any confounds relative to phonetical differences between languages, they were asked to report their native language. In the end of the questionnaire participants were further asked in what they had based their preference ratings on, and if they had detected anything conspicuous or suspicious, such as systematic features in the target words.

Procedure. In both experiments participants were emailed and asked to participate in an online survey about word ratings. After agreeing to join the survey, participants clicked a link and were directed to Qualtrics platform. Participants were also informed that all the data collected would be treated anonymously and that they could abandon the study at any point by simply closing the browser (for best practices in conducting web surveys, see Barchard & Williams, 2008). After consenting to collaborate in the study participants were instructed to read the target words silently and to rate their preference for each word as spontaneously as

possible. As in the original experiment words were labelled as nonsense stimuli and participants were requested to rate meaningless words.

In order to prevent fatigue and demotivation, each participant was asked to rate a sub-set of symbols from the total pool. Thus both pools were randomly divided into six smaller subsets. In Experiment 1 each subset contained 47 inward and 47 outward words. In Experiment 2 each subset contained 46 inward and 46 outward words. In both studies participants were randomly assigned to one of the subsets. Each trial was presented in a single page of the online questionnaire, with the word on the top centre and the rating scale below. Again, as in the original experiments, stimulus words were presented in a completely randomized order. After completing the task, demographics and control questions were collected. Upon completing the task, participants were thanked and debriefed. Participants took 2 to 5 minutes to accomplish the task and, as in Topolinski and colleagues' Experiment 6 (2014), the word rating was the only task in the experimental session.

Results

In the final debriefing questions none of the participants reported a valid suspicion of the word manipulation. All participants reported to be Portuguese native speakers, except for one participant in Experiment 1 and another in Experiment 2 that reported to be bilingual. Thus, only this two participants were excluded.

The predicted effects were observed in Experiment 1 with the English set of stimuli (that generates the same front, middle, and rear articulation spots in Portuguese phonation, see the method section). Indeed participants preferred inward (M = 4.01, SD = 1.61) words over outward words (M = 3.90, SD = 1. 56), $t(202) = 2.68$, p=.008, d_z = 0.19, mean difference 95% CI [0.03, 0.18]. In Experiment 2, where the pool of word stimuli tested conformed even more closely to Portuguese phonation, results revealed again significant differences between

ratings of words with consonantal stricture transitions inward (M = 3.89, SD = 1.68) and outward words (M = 3.79, SD = 1.64), $t(203) = 3.397$, $p < .001$, $d_z = 0.24$, mean difference 95% CI [0.04, 0.16].

Due to the within-subjects design we chose to estimate the effect size calculating Cohen's *dz* using the formula provided by Rosenthal in 1991 ($d_z = \frac{t}{\sqrt{n}}$). For the English pool in Experiment 1 we found an effect size of the in-out effect similar to Topolinski et al. (2014), namely $d_z = 0.19$. Reflecting the fact that the Portuguese stimulus pool in Experiment 2 corresponded even more closely to Portuguese phonation, the Portuguese pool elicited an even higher effect size of $d_z = 0.24$. This difference in effect sizes, however, was not statistically significant ($t(405) = .028$, $p = .978$).

Discussion

Topolinski and colleagues (2014) found that participants rated more favourably words whose consonantal wandering was similar to ingestion movements (wandering from the front to the rear of the mouth) compared to expectoration movements (wandering from the rear to the front of the mouth). In two high-powered, independent replications of this original study, we replicated this in-out effect for Portuguese native speakers. In our samples, the effect was in the same direction, statistically significant, and showed a similar effect size as the one reported by Topolinski and colleagues (2014). To summarize, in both studies we were able to replicate the effect, having muscular contractions resembling inward (vs. outward) going ingestion movements (vs. deglutition movements) trigger affective states of positive approach (vs. avoidance), in a stronger way, though, with the stimulus pool customized for the Portuguese language.

Our results are also important for future application of the stimulus set created for further research in this area with European Portuguese speaking participants. The availability

of adapted stimulus set allows researchers a more appropriate selection of stimuli according to the context where the experimental paradigm of in-out effect is intended to be applied. Therefore, the adaptation of such stimuli presents a valid and useful contribution for the study of in-out effects in the Portuguese context, allowing the comparability of results with those of other international studies that have used the same type of stimuli production and selection. In fact, the current set may also be used in countries other than Portugal. Portuguese is the official language in nine countries, it is spoken in over 34 countries by more than 230.000.000 speakers (Lewis, 2009). Nevertheless, since there are differences in linguistics (pronunciation and even grammar) and the language is also influenced by cultural specificities, caution should be taken when generalizing the norms for other Portuguese-speaking populations such those in Africa or South America (Pinheiro, Soares, Comesaña, Niznikiewicz, & Gonçalves, 2010).

The fact that the oral approach-avoidance effect was successfully replicated, gives strength to recent research endeavours in oral kinematics such as demonstrations about the movement-object interaction in the oral domain (Topolinski, Zürn, & Schneider, 2015), but more importantly it endows social situated cognition and embodiment theories.

Most of the previous evidence favouring the plausibility of the embodiment framework may present particular confounds. It is likely that experiments where participants are induced to engage in voluntary bodily actions (Wells & Petty, 1980), or assume particular body postures (Heesacker, Brock, & Cacciopo, 1983), may serve as clear cues to participants. Indeed since the bodily manipulations used in previous experiments may have very clear meaning attached (Brinõl & Petty, 2008), the present research path seems to have implications for broader theoretical considerations. We argue that future research should therefore consider bodily effectors whose meaning is not directly accessible to participants.

Furthermore since behaviours may vary across individuals, situations and cultural contexts, cross-cultural research constitutes an interesting approach to validate such apparently exotic phenomena. Activating behaviour indifferent cultural and linguistic conditions is likely to constitute a promising avenue to show the strength of effects being examined.

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Footnotes

[1] There is a way to assure that R would be phonated as a uvular phoneme by a Portuguese native speaker, namely by simplydoubling it (i.e., RR) in the middle or at that end of words, but thisbigram occurs so rarely in natural Portuguese (IPA, 1999; Quaresma, 2008) that we opted against this.

Supporting Material

Table 1

INWARD WORDS	OUTWARD WORDS
ABADELI	ALADEBI
AFINULA	ALINUFA
APENALO	ALENAPO
APONALE	ALONAPE
BEDULO	LEDUBO
EBONULA	ELONUBA
EFUNALI	ELUNAFI
EPIDELA	ELIDEPA
EPUDILA	ELUDIPA
FIDALE	LIDAFE
IFETULA	ILETUFA
IPEDULI	ILEDUPI
IPOTILE	ILOTIPE
OBETOLU	OLETOBU
OPATECO	OCATEPO
OPITALE	OLITAPE
OVODECA	OCODEVA
PENALU	LENAPU
POTALE	LOTAPE
UFIDELU	ULIDEFU
UPETOLI	ULETOPI

UPONILA	ULONIPA
UVODILE	ULODIVE
ABEDALU	ALEDABU
AFONULE	ALONUFE
APENULO	ALENUPO
APUDILE	ALUDIPE
BODILA	LODIBA
EBUNOLI	ELUNOBI
EPADULI	ELADUPI
EPINALU	ELINAPU
EVATOLE	ELATOVE
IBANILO	ILANIBO
IFOTULI	ILOTUFI
IPETILO	ILETIPO
IPUDELO	ILUDEPO
OBITULO	OLITUBO
OPEDULA	OLEDUPA
OPODULI	OLODUPI
OVODILU	OLODIVU
PETOLA	LETOPA
POTULE	LOTUPE
UPADOLU	ULADOPU
UPIDALE	ULIDAPE
UPOTULI	ULOTUPI
UVUDOLA	ULUDOVA

ABIDELO	ALIDEBO
AFOTUCA	ACOTUFA
APETILU	ALETIPU
APUNILA	ALUNIPA
BUDILO	LUDIBO
EBUTALE	ELUTABE
EPEDALO	ELEDAPO
EPITOLA	ELITOPA
EVETULI	ELETUVI
IBENALI	ILENABI
IFUTELI	ILUTEFI
IPIDALU	ILIDAPU
IPUNOLE	ILUNOPE
OFITALE	OLITAFE
OPENILO	OLENIPO
OPONILE	OLONIPE
OVUDOLE	OLUDOVE
PINELO	LINEPO
PUDELA	LUDEPA
UPATILE	ULATIPE
UPIDULO	ULIDUPO
UPUNILO	ULUNIPO
VANILE	LANIVE
ABUTALI	ALUTABI
APADULE	ALADUPE

APINELA	ALINEPA
AVANELI	ALANEVI
BUTALO	LUTABO
EBUTOLE	ELUTOBE
EPEDULO	ELEDUPO
EPODALE	ELODAPE
EVUTELO	ELUTEVO
IBUNALE	ILUNABE
IPADOLE	ILADOPE
IPINOLA	ILINOPA
IVITALO	ILITAVO
OFOTALU	OLOTAFU
OPETILA	OLETIPA
OPUDELI	OLUDEPI
PANELI	LANEPI
PITULA	LITUPA
PUNILE	LUNIPE
UPEDOLU	ULEDOPU
UPINALE	ULINAPE
UVADELU	ULADEVU
VENOLI	LENOVI
ABUTOLI	ALUTOBI
APANULI	ALANUPI
APITOLE	ALITOPE
AVONALE	ALONAVE

EBENILU	ELENIBU
EFANILU	ELANIFU
EPENALI	ELENAPI
EPONELI	ELONEPI
FADELO	LADEFO
IBUTOLA	ILUTOBA
IPATELU	ILATEPU
IPITELU	ILITEPU
IVOTELA	ILOTEVA
OPADOLI	OLADOPI
OPIDALO	OLIDAPO
OPUNOLA	OLUNOPA
PANULE	LANUPE
PODALI	LODAPI
UBOTALI	ULOTABI
UPENILA	ULENIPA
UPITULE	ULITUPE
UVANECO	UCANEVO
VINULE	LINUVE
AFENOLA	ALENOFA
APATILU	ALATIPU
APODELU	ALODEPU
AVUNALO	ALUNAVO
EBINOLE	ELINOBE
EFATICO	ECATIFO

EPETALI	ELETAPI
EPOTILU	ELOTIPU
FEDILA	LEDIFA
IFATOLI	ILATOFI
IPEDALI	ILEDAPI
IPONILU	ILONIPU
OBATOLU	OLATOBU
OPANELU	OLANEPU
OPINELU	OLINEPU
OVIDOLA	OLIDOVA
PATELI	LATEPI
PONELU	LONEPU
UBUTELA	ULUTEBA
UPENULO	ULENUPO
UPODALU	ULODAPU
UVEDILO	ULEDIVO
VONULI	LONUVI