School of Social Sciences

Department of Social and Organizational Psychology

Socially Situated Consumer Cognition: From Oral Kinematics to Grounded Marketing

Sandra Marisa da Silva Godinho

Collection of articles presented in partial fulfillment of the requirements for the degree of

Doctor in Psychology

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but it won’t make a difference.

I will always keep on ‘studying more’.

Abstract

Sensory Marketing has long been uncovering surprising relations between the senses and mental experience, that is, how sensorial inputs may influence information-processing. *Grounded Cognition* proposes, however, that sensory but also motor experiences play an instrumental role in cognitive functioning. To further explore and expand knowledge on how muscular contractions and motor simulations cue judgments, we focused on the oral-facial muscular apparatus and examined the recently discovered in-out effect and its potential applications to marketing. Departing from the biomechanical overlap between the alimentation and oral communication functionalities of the mouth, this effect documents a stable preference for words whose consonantal articulation simulates ingestion movements, as opposite to words mimicking expectoration movements. Eight articles featuring 14 experiments (N_{Total}=4879) successfully (a) established the universality of the effect, replicating it in different languages and writing systems; (b) examined the role of fluency in this motor-to-affect link, revealing the lack of support for a mere fluency explanation and the need to test alternative mechanisms; and, (c) tested potential applications and boundary conditions that could potentially threat the effectiveness of using the in-out preference in marketing contexts. Our main contributions may be drawn from the innovative replications, rigorous tests to the alternative accounts and from the inputs provided for future brand name design. Additionally, we believe that our work is relevant to endorse a promising, yet still unresearched, approach. Acknowledging that cognition may rely so deeply in motor simulations and body movements, calls for a critical shift, urging researchers and managers to move towards *Grounded Marketing*.

Keywords: Oral Kinematics, Embodiment, Situated Cognition, Sensory Marketing, Grounded Marketing

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3920 Consumer Attitudes & Behavior

3940 Marketing & Advertising

Resumo

O *Marketing Sensorial* tem vindo a desvendar relações surpreendentes entre experiências sensoriais e mentais, revelando como os estímulos sensoriais influenciam o processamento de informação. A *Cognição Situada* propõe, contudo, que o funcionamento cognitivo depende do sistema sensorial mas também do motor. Para incrementar o conhecimento sobre a forma como as contrações musculares e simulações motoras influenciam os julgamentos, selecionámos o aparelho muscular orofacial para examinar o recém-descoberto efeito *In-Out* e as suas potenciais aplicações ao marketing. Reconhecendo a sobreposição muscular entre as funções de alimentação e comunicação, o efeito in-out demonstra que palavras cuja articulação simula movimentos de ingestão, são preferidas a palavras que mimetizam o movimento oposto – expectoração. Os oito artigos apresentados neste trabalho e as 14 experiências que os compõem (N_{Total}=4879) (a) estabelecem a universalidade do efeito, através da sua replicação em novas línguas e sistemas de escrita; (b) examinam o papel da fluência nesta relação motoro-afetiva, concluindo que não existe evidência suficiente para a reconhecer como a única explicação; e (c) testam potenciais aplicações e condições-limite que possam ameaçar a capitalização desta preferência no marketing. Além do carácter inovador das replicações, do rigor dos exames às explicações alternativas e das sugestões para o design de nomes de marcas, acreditamos que o principal contributo deste trabalho é apoiar uma abordagem promissora, mas ainda pouco explorada. O reconhecimento da centralidade que simulações motoras e movimentos corporais podem ter na cognição, motiva a adoção de uma nova perspectiva, que impele investigadores e gestores a avançar na direção do *Marketing Situado*.

Palavras chave: Cinemática Oral, Corporalização, Cognição Situada, Marketing Sensorial, Marketing Situado.

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SECTION A | INTRODUCTION

1. BACKGROUND AND INTRODUCTION

The modern "marketing that engages the consumers' senses and affects their perception, judgment and behavior" (Krishna, 2012, pp. 332), is in line with the assumption that cognition is grounded in affective and sensorimotor processes (e.g., Barsalou, 2008), is action-oriented and is distributed across the physical and social environment (Smith & Semin, 2004; Semin & Smith, 2013; cf., Semin, Garrido, & Palma, 2012, 2013). However, while there has been a long tradition among marketing professionals in fostering consumer preference by using sensorial information, such as color (e.g., Labrecque & Milne, 2012; for a cross-cultural examination see Velasco et al., 2014; and see also, Singh, 2006 for a review), light (e.g., Areni & Kim, 1994), sound (e.g., Milliman, 1982; Stroebele & de Castro, 2006), smell (e.g., Holland, Hendriks, & Aarts, 2005; Morrin & Ratneshwar, 2000), taste (e.g., Schlosser, 2015), texture (e.g., Ackerman, Nocera, & Bargh, 2010) or even temperature (e.g., Williams & Bargh, 2008), actual practice with concrete body movements and motor stimulations is still being rehearsed.

To increase knowledge about the significant role that the motor system plays in cognition in general, and in consumer behavior in particular, researchers from several fields such as marketing, social and cognitive sciences and neuroscience, have been joining efforts to uncover surprising interactions between motor manipulations and valuation processes. Early demonstrations that action interferes with information processing can be found, for instance, in classic research showing that specific movements influence attitude formation (e.g., head nodding or shaking, Wells & Petty, 1980; arm flexion or extension, Cacioppo, Priester, & Berntson, 1993) or motor congruence effects between approach-avoidance movements and positive-negative stimuli (e.g., Chen & Bargh, 1999; Förster & Strack, 1997, 1998; Solarz, 1960).

In the consumer behavior domain several studies have also documented that flexing one's arm while deciding what to buy increases purchase behavior (e.g., van Den Bergh, Schmitt, & Warlop, 2018), leaning back in a chair while online shopping may affect the options chosen (Larson & Billeter, 2013), firming one's muscles can foster the choice of healthier snack options (Hung & Labroo, 2010), anticipating a high effort to obtain a good, decreases willingness to pay (Gross, Woelbert, & Strobel, 2015), and that the simple act of closing a food menu is sufficient to increase post-decision satisfaction (Gu, Botti, & Faro, 2013).

Addressing consumer-behavior as a situated process, the present work experimentally examines the influence of motor manipulations on basic psychological processes and tests their potential applications for marketing practice. Specifically, the current work is focused on oral articulatory effectors, such as the lips and the tongue, which despite their demonstrated potential in uncovering specific motor-affect representations, seem to remain less explored than other bodily effectors (e.g., fingers, hands, arms, facial muscles, or body posture, cf., Semin & Smith, 2008).

The examination of how the manipulation of covert-subvocalization may affect judgment and decision–making presents a powerful opportunity to investigate sensorimotor experience beyond affective and motivational expectations, because it operates at an unconscious level. Since consumers are unaware of this articulatory manipulation, the in-out effect may represent an interesting tool for marketing practice giving managers the chance to design brand names that are unwittingly preferred. Thus, the likely merits of the present work are the combined contributions in providing evidence for socially situated cognition and simultaneously testing this automatic route to brand preference.

2. ORAL KINEMATICS - EFFECTS OF ARTICULATION DYNAMICS

Our orofacial musculature produces speech, assists feeding, that is, ingesting aliments or spitting harmful substances and, simultaneously, assumes a crucial social role in communicating emotions - trough smile or other facial expressions. In line with the Hebbian principle that what fires together, wires together (cf. Greenwald, 1970), Oral Kinematics research rests on such a multifunctional nature to suggest that the articulatory movements necessary to produce speech convey meaning to words simply because they match particular movements.

To the best of our knowledge, this functional overlap embedded in the orofacial muscular apparatus has been explored with three main approaches: A still embryonic mimicking approach, named Onomatokinesia, suggesting that articulatory movements may resemble the objects' natural oral affordances (e.g., Topolinski, Rohr, Schneider, Boecker, & Winkielman, 2017); An affective approach, called the facial feedback hypothesis, proposing that the motor activity related to vowel pronunciation may drive positive affect, because it activates relevant muscles for emotion-display (e.g., Rummer, Schweppe, Schlegelmilch, & Grice, 2014); And finally, a motivational approach, the so-called in-out effect (Topolinski, Maschmann, Pecher, & Winkielman, 2014), examining the match between oral articulatory movements and two primary survival functions, ingestion and expectoration (Rozin, 1996).

Mimicking Approach: Onomatokinesia

Onomatokinesia proposes that positive affect may result from the behavioral match between the words' meaning and the oral movements involved in their articulation. That is, when the word pronunciation mimics the natural movements made towards particular objects. To illustrate, the articulation movements involved in pronouncing *apical alveolars,* namely /d/, /n/, /l/ and /t/ (as in English LIP or TOP) require touching the soft palate with the tongue tip, which is very similar to the oral act of licking.

As supporting evidence, Topolinski and colleagues (2017) have shown that when naming products, participants have a clear preference for words whose articulation mimics the movements necessary to consume those products (e.g., liking popsicles being matched with words containing consonants that require pressing the tongue against the front palate - e.g., TOLINAD, versus words that do not feature liking-like movements - e.g., BOPIVAS).

Affective Approach: Articulatory-Feedback

The articulatory-feedback hypothesis builds upon the overlap between both communication functions conveyed by the oro-facial musculature, namely to speak and display emotions.

In a seminal work on the facial-feedback effect, Strack, Martin and Stepper (1988) asked participants to rate the funniness of cartoons while holding a pen on their mouths. Participants were either instructed to hold the pen with their teeth, contracting the Zygomaticus Major Muscle (ZMM) or with their lips, contracting the Orbicularis Oris Muscle (OOM). While the contraction of the ZMM is involved in smiling, the OOM muscle has a contrary function to the ZMM, inhibiting smiling or laughing. The authors observed that cartoons were rated as funnier when participants held the pen with their teeth, but not the lips, suggesting that it is possible to manipulate emotional states through the mechanical contraction of the ZMM (about the replication debate see Noah, Schul, & Mayo, 2018; Strack, 2017; Wagenmakers et al., 2016).

Departing from this and other evidence demonstrating that the ZMM contraction affects the comprehension of emotional speech (e.g., Foroni & Semin, 2009) and that vowel articulation may induce oro-facial muscle movements (Zajonc, Murphy, & Inglehart, 1989), Rummer and colleagues (2014) advanced the articulatory-feedback hypothesis. This hypothesis suggests that producing particular sounds may activate the ZMM or the OOM and, by doing so, influence emotional states. More specifically, when pronouncing /i:/ sounds, the ZMM is activated, that is, the same muscle used for smiling, while the pronunciation of words featuring /o:/ sounds requires OOM activation.

The studies examining the association between vowel articulation and emotional states have shown the bi-directional nature of this link. Inducing participants into a positive mood, leads them to generate more words containing /i:/ sounds, than words containing /o:/ sounds (Rummer et al., 2014). In the opposite direction, when asked to name valenced faces or objects, participants created names containing more /i:/ sounds for positive stimuli, when compared to neutral or negative stimuli, and created more names featuring /o:/ sounds for negative stimuli, comparing to positive or neutral stimuli (Rummer & Schweppe, 2018).

Moreover, this bidirectional link between muscular contractions and emotion is also supported by evidence from studies about language comprehension. Positive and negative emotion words activate facial muscles (e.g., Niedenthal, Winkielman, Mondillon, &

Vermeulen, 2009) and inversely, artificially compromising muscle activation, that is, facial expression, impairs the emotional processing of language (e.g., Havas, Glenberg, Gutowski, Lucarelli, & Davidson, 2010).

Motivational Approach: The In-Out Effect

A third approach to the role of peripheral motor feedback in language processing departs from the overlap between the alimentation and the oral communication functions. Acknowledging that consonantal phonemes are articulated in precise locations in the mouth on a sagittal plane from the throat to the lips (e.g., Ladefoged, 2001; Maddieson, 1984), Topolinski and colleagues (2014) showed that people reliably prefer articulation patterns with inward (from the lips to the throat) rather than outward (in the opposite direction) wanderings. For example, the articulation of a word that includes a bilabial consonant (e.g., [b]) and a velar consonant (e.g., [k]) in that order, such as the word BIC, would wander inward, simulating an ingestion movement. Conversely, a word starting with a velar consonant followed by a bilabial consonant, such as the word GAP, would be articulated outwards, resembling an expectoration oral movement.

The articulation of consonantal phonemes requires the combination of three characteristics. *Phonation*, that is, vibrating, or not, the vocal folds (voiced or voiceless consonants). The *manner of articulation*, referring to the way the airflow is obstructed in the vocal tract (full occlusion of the vocal tract, *stops,* e.g., [p], [b], [t], [d], [g], [k]; partial obstruction *fricatives,* e.g., [f], [v], [s], [z]; full obstruction of the mouth airflow *nasals,* e.g., [m], [n]). And, the *place of articulation*. However, since the in-out effect capitalizes on consonantal articulatory patterns, both phonation and manner of articulation are irrelevant for the consonantal classification in this effect. Moreover, this characteristic - *place of articulation*, clearly distinguishes consonants from vowels, whose articulation allows different tongue and lips positions. Finally, the activation of specific spots in the oral cavity, mandatory to the articulation of consonants, is defined by phonemes or speech sounds, and not by particular letters. This means for example, that the phoneme [K] may be induced with the letter C, as in Coca Cola [kokə kolə] or with the letter K as in Kodak [kodæk].

In the present work we will explore further this third approach, suggesting the overlap between the alimentation and the oral communication functions, because of its innovative take on how basic instincts designed for our survival may affect judgments about objects or persons. Moreover, we have chosen the in-out effect because conscious inferences are known

to have the potential to inhibit or even reverse compatibility effects of sensorimotor simulations. Indeed, the in-out preference relies on an exotic manipulation that is hard to detect, excluding the hazards affecting other, easier to guess embodiment manipulations, and thus presents a more promising avenue for future marketing applications.

3. AIMS AND OVERVIEW OF THE RESEARCH

The main goals of the present work are to test the universality of the in-out effect with conceptual replications, to further examine alternative accounts proposed for the underlying mechanism causing the in-out preference and, to rehearse the application of inward wandering names to products or services brands by tackling directly potentially threatening boundary conditions.

Building upon the crucial aspects of consonantal articulation presented in the previous section, in order to test the preference for inward (over outward) wanderings, the research on the in-out effect consistent and unambiguously has relied on pseudo-words that followed these dynamics. However, due to the novelty of this research field, the in-out effect was until recently observed only in German and English, both Germanic languages belonging to the Indo-European family (e.g., Topolinski, et al., 2014).

Aiming to contribute to the establishment of the effect as independent from linguistic and cultural contexts, we replicated the effect in European Portuguese, which belongs to the Italic branch of the Indo-European language family (Godinho & Garrido, 2016), in Turkish, which belongs to the Turkic family and in Ukrainian that, despite belonging to the Indo-European family, uses a non-Latin alphabet, Cyrillic (Godinho, Garrido, & Horchak, 2019). Therefore, the first chapter - The Universality of the In-Out Effect – presented in Section B, presents two distinct but related articles *Oral approach-avoidance: A replication and extension for European–Portuguese phonation* and *Oral approach-avoidance: A replication and extension for Slavic and Turkic phonations*, which provide compelling evidence about the stability of this phonetic effect across different languages and writing systems.

From a theoretical standpoint this robust preference for inward-wanderings was initially assumed to result from a simple oral approach-avoidance mechanism triggered by the similarity between the two consonantal-patterns directions and the oral movements necessary to approach foods or drinks, or to avoid harmful substances. However, the ongoing research stream has fueled the debate about alternative explanations. Thus, the second chapter - Fluency as an Alternative Explanation for the In-out Effect - examines this current line of research that proposes that the effect results from a mere fluency mechanism. Departing from the growing body of evidence on motor fluency, that is, the ease with which a motor movement can be performed, Körner, Bakhtiari and Topolinski (2018) showed that the preference for inward words may be inhibited, or even reversed, with different training

intensities of outward words, concluding that such interaction provides definitive evidence to rule out any other explanation. The role of fluency as the underlying mechanism for the in-out effect, had been previously examined by the same authors (Bakhtiari, Körner, & Topolinski, 2016) but the conclusion was not as definitive. Since fluency failed to fully mediate the in-out effect on liking ratings, the authors were led to conclude that the in-out effect could be explained, but only partially, by articulation fluency.

The need to clarify these competing results namely, whether the effect could be simply driven by a fluency mechanism, directed us to search for further evidence. To this end, we systematically examined the impact of training intensity on the in-out effect modulation (Godinho & Garrido, 2019a) and showed that mild training outward-wandering words increases perceived fluency but does not block or invert the in-out effect, only intense training does so. In another set of studies, we depicted the in-out effect against other fluency sources (using classical font-type and figure-ground contrast fluency manipulations). The results showed that the in-out effect does not behave like any other fluency manipulation, meaning that it does not present additive effects with other fluency sources and persists when manipulated between-participants (Godinho & Garrido, 2019b). These studies are presented in two articles, *The in-out effect: Re-examining the impact of training in the preference for words with inward-wandering consonantal articulation* and *The in-out effect: Examining the role perceptual fluency in the preference for words with inward-wandering consonantal articulation*. Overall, the evidence presented in these articles challenges the assumption that fluency solely accounts for the in-out preference.

Independently of its origin, the in-out effect has proven itself very robustly. It was found to occur both with silent or loud reading (Bakhtiari et al., 2016), minimal manipulations (Topolinski & Boecker, 2016a), extremely brief presentations (Gerten & Topolinski, 2018), and to resist to motor interference (Lindau & Topolinski, 2018). Moreover, the effect was observed with person names (e.g., Silva & Topolinski, 2018), fictitious characters (e.g., Topolinski et al., 2014), food dishes (e.g., Topolinski & Boecker, 2016b), products (Topolinski, Zürn, & Schneider, 2015) or actual brands (e.g., Kronrod, Lowrey, & Ackerman, 2015). However, since particular modulations were also reported in the literature, in the final chapter of section B - Possible Modulations Relevant for Marketing Practice - we explored across four different articles, three boundary conditions that could endorse or threaten the impact of using inward-wandering names for hypothetical persons, service providers or products.

In the paper *Oral kinematics: Examining the role of edibility and valence in the in-out effect*, we built upon the absence of in-out preference reported for objects that trigger expectorative oral actions (e.g., toxical chemical, pill or bubble gum, Topolinski et al., 2017), to systematically examine the in-out preference when naming edible and non-edible products. Results revealed that this motor-to-affect link persists only with edible products, regardless of valence, suggesting that consonant wandering manipulations present an advantage when naming edible products, but may fail to have that effect with non-edible products (Godinho, Garrido, Zürn, & Topolinski, 2019).

Notably, Topolinski and Boecker (2016b) found that the effect of consonantal direction on preference could be disrupted when used to name images of food dishes that are high on palatability cues. Again, aiming to endorse the in-out effect as a possible tool to trigger consumer preference, we used in-out pseudo-words as brand names included in increasingly complex common marketing imagery. In the article *Branding with the in–out effect: The impact of consonantal articulation on brand evaluation*, inward and outward names were inserted in geometrical figures, logos and mock product packaging, to evidence that the effect is resistant to common brand imagery that competitively feeds into consumers' preference judgments (Godinho & Garrido, 2017).

Finally, since the in-out effect was shown to influence general preference (e.g., Topolinski et al., 2014) but also trustworthiness (Silva & Topolinski, 2018) ratings, we tested the effect of the consonant articulation involved in pronouncing the name of an hypothetical person in the assessment of the core dimensions of person perception, that is warmth and competence - *The "ins" and "outs" of person perception: The influence of consonant wanderings in judgments of warmth and competence*. In a pioneer examination of the potential of the in-out effect to inform impression formation dynamics, we demonstrated that, when jugging neutral characters, consonant wandering only affected warmth, but not competence related judgments (Garrido, Godinho, & Semin, 2019).

To further explore this boundary condition in the context of marketing practice, we examined, in another article - *The "ins" and "outs" of products and services marketing: The influence of consonant wanderings in consumers decision-making,* whether the effect could be capitalized for both product and services' names. Across four experiments it was possible to show that the availability of additional information about the targets to be evaluated (being either service providers or products), induces a stable preference for inward wandering names

that generalizes across both emotional and rational-laden judgments (Godinho & Garrido, 2019c).

The general discussion presented in the last section - C, examines the overall contributions of the findings reported from a theoretical and an applied perspective. From a theoretical standpoint we start by emphasizing the fact that the results of the experimental program reported successfully replicate the in-out effect, demonstrating it in other languages and with different stimulus materials. Additionally, some of our studies provide evidence that contributes to the ongoing search for the actual mechanism causing such an established preference for words wandering inward. Moreover, building upon those conceptual outputs, we believe that our work may provide insights on possible marketing applications, supporting the future effectiveness of branding and advertising practice. Final remarks account for the main limitations of our experimental work, acknowledge the small-scale contribution for the ongoing conceptual debate and suggest future research avenues that may tackle the unanswered questions. Finally, we emphasize the insights gained to leverage sensory marketing, as to include these newly discovered motor pathways-to-preference into research and actual practice.

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SECTION B | COLLECTION OF ARTICLES

1. THE UNIVERSALITY OF THE IN-OUT EFFECT

Because of the highly mediatized replication crisis affecting social sciences in the recent years (e.g., Klein et al., 2014; for a critical analysis, Stroebe & Strack, 2014), replication studies have been benefiting from an increased interest. Acknowledging this challenge as particularly relevant when dealing with such a recent finding as the in-out effect, our first research endeavors were directed towards establishing its reproducibility. However, our goal was to go far beyond a direct replication. The experiments reported in this chapter do not present simple replications where the conditions, under which the in-out effect was first described, are completely reproduced. On the contrary, we implemented a more severe test (e.g., Westfall, Judd, & Kenny, 2015) by systematically replicating the conceptual idea of articulation direction dynamics, using different languages and writing systems.

The two articles presented in this section include four highly powered experiments (N_{total} = 681) run in European Portuguese, Ukrainian and Turkish. While validating previous findings regarding the preference for inward-wandering consonantal strings (when compared to outward) and confirming that such preference seem to be universal, that is, observed in other linguistic and cultural contexts, these two articles also contribute for future research by providing stimulus pools, pre-tested and ready to be used by researchers worldwide.

Our efforts were successful since we were able to demonstrate that despite the language differences, implying different letter-to-phoneme equivalences, it is possible to activate, across diverse language branches and families, similar consonantal wanderings. And again, that such wanderings systematically reproduce the same preference pattern described in the in-out seminal literature.

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Oral approach-avoidance: A replication and extension for European-Portuguese phonation[*]

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Abstract

Previous research revealed that mouth movements influence attitudes. 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, revealed that the preference for inward words (over outwards) exists in both sets, but to a greater extent in the pool phonetically adapted for Portuguese.

Keywords: articulation, embodiment, metaphors, phonation, replication

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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, Bakhtiari, & Pecher, 2017). 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 (2016) 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, that it is replicable, 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 behavior 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 labeled 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 these 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, & Cacioppo, 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 behavior 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 simply doubling it (i.e., RR) in the middle or at that end of words, but this bigram 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

Oral approach-avoidance: A replication and extension for Slavic and Turkic phonations[*]

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Abstract

Words whose articulation resembles ingestion movements are preferred to words mimicking expectoration movements. This so called in-out effect, suggesting that the oral movements caused by consonantal-articulation automatically activate concordant motivational states, was already replicated in languages belonging to Germanic (e.g., German and English) and Italic (e.g., Portuguese) branches of the Indo-European family. However, it remains unknown whether such preference extends to the Indo-European branches whose writing system is based on the Cyrillic rather than Latin alphabet (e.g., Ukrainian), or whether it occurs in languages not belonging to the Indo-European family (e.g., Turkish). We replicated the in-out effect in two high-powered experiments (N = 274), with Ukrainian and Turkish native speakers, further supporting an embodied explanation for this intriguing preference.

Keywords: in-out effect, oral kinematics, approach-avoidance, embodiment

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Words combining consonantal sounds featuring front-to-back wanderings in the mouth (inward e.g., BENOKA) are preferred to words with the opposite, back-to-front, consonantal-wandering (outward, e.g., KENOBA). This intriguing phenomenon called in-out effect (Topolinski, Maschmann, Pecher, & Winkielman, 2014), suggests that the similarity between the movement of the oral muscles when articulating words, and when ingesting food or expectorating harmful substances, triggers approach-avoidance affective states, respectively.

This motor-to-affect link has been firmly established (e.g., Bakhtiari, Körner, & Topolinski, 2016; Godinho, Garrido, 2017; Kronrod, Lowrey, & Ackerman, 2014), its boundary conditions examined (e.g., Garrido, Godinho, & Semin, 2019; Gerten & Topolinski, 2018; Godinho, Garrido, Zürn, & Topolinski, 2018; Lindau, & Topolinski, 2018; Topolinski & Boecker, 2016a; Topolinski & Boecker, 2016b), and replications were made in Indo-European family languages, namely in those belonging to the Germanic (see Silva & Topolinski, 2018; Topolinski, Boecker, Erle, Bakhtiari, & Pecher, 2017, for a replication in German and English, respectively) and Italic branches (see Godinho & Garrido, 2016, for a replication in European Portuguese).

There is an ongoing debate about the mechanism causing such a small, but robust effect (Bakhtiari et al., 2016; Körner, Bakhtiari, & Topolinski, 2018; Godinho & Garrido, 2019a, 2019b). Nevertheless, according to the seminal work where the effect was first demonstrated (Topolinski et al., 2014), the preference for inward wandering consonantal strings results from the functional overlap among oro-facial peripheral nerves and musculature. Since they share communication and alimentation functions, language understanding is believed to be contaminated by the affective (and survival) meanings of swallowing aliments and spiting toxic substances. This reasoning therefore suggests that the in-out effect relies on an approach-avoidance mechanism that ultimately occurs because cognition is embodied.

Previous research suggests that cross-cultural and language variations can affect pre-wired embodiments (e.g., approach-avoidance behavioural tendencies, Elliot, Chirkov, Kim, & Sheldon, 2001; or colour perception, Özgen, 2000). Indeed, linguistic and cognitive research often underestimate linguistic diversity (Majid & Levinson, 2010; Majid, 2012), which may give rise to misleading conclusions about language-specific sound-emotion regularities (e.g., Taylor & Taylor, 1965). The present work examines whether the preference for inward wandering words (over outward words) varies across different cultural contexts,

such as the Eastern Europe and Middle-east, and across languages with different roots. To the best of our knowledge the in-out effect was never examined with (a) a language within a different branch of the Indo-European family; (b) a language using a non-Latin alphabet; and, (c) a language from a different family.

A language family refers to a group of languages, related and descent from a common ancestral language, that is, the proto-language of that family. For instance, the Indo-European languages used so far in the in-out research share the same alphabet, some vocabulary, grammatical features, and arguably cultural and geographic backgrounds. Given the striking nature of the in-out effect, heavily dependent upon small phonetic nuances, its replication in languages that do not belong, as in the previous experiments (Godinho & Garrido, 2016; Topolinski et al., 2014), to the same family, constitutes a valuable conceptual replication.

While direct replications use the same materials and/or procedures and control for eventual sampling errors to make assumptions about the veracity of seminal scientific reports, conceptual replication studies fulfill the previous, but provide simultaneously new stimulus pools (Westfall, Judd, & Kenny, 2015) that may contribute to endorse (or refute) the universality of the effects. Moreover, these new stimulus pools are also relevant for future research endeavours, promoting ecologically sound experiments that overcome potential sampling limitations (Henrich, Heine, & Norenzayan, 2010; Speed, Wnuk, & Majid, 2018).

Since our research efforts were focused on the Black Sea region, it was possible to examine the in-out effect in the Slavic branch of the Indo-European language family, in the Turkic branch of Altaic language family (for a review about the controversy on the Altaic family, see Starostin, 2016) and with a different writing system. Thus, the present work not only presents a cross-language replication (e.g., Shrum, Lowrey, Luna, Lerman, & Liu, 2012), but also contributes to further establish the universality of the phonetic effect as independent from particular cultural settings, grammar characteristics or even visual effects derived from the written alphabet.

Method

Power Analysis and Sampling Plan

Using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) and the estimate of the effect size from Experiment 2 by Godinho and Garrido (2016), Cohen's d_z= .24, the required sample size to detect the in-out effect with a power of 0.85 (Cohen, 1992) was N = 126. To account for potential dropout, data collection was set to stop at the end of the day it reached

the number of participants defined. This strategy resulted in sample sizes that do not exactly correspond to the initial estimate. All the manipulations, measures used, and data exclusions are reported.

Participants

Two independent replications were conducted. In Experiment 1, six participants that were not Ukrainian native speakers were excluded. In Experiment 2, five participants were excluded (three for being bilingual and two for not being Turkish native speakers). One hundred and fifty Ukrainian native speakers (M_{age} = 21, *SD* = 6.71; 115 female) and 124 Turkish native speakers (M_{age} = 25, *SD* = 6.88; 88 female) were classified as valid participants and included in the data analysis.

Design

Both experiments featured a simple 2 (Consonantal articulation direction: inward vs. outward; within) design. The dependent variable was participants' evaluation of a given target word (Topolinski et al., 2014) and the independent variable was the sagittal direction of consonantal wanderings either front-to-back in the oral cavity rear (inward) or back-to-front (outward).

Materials and Procedure

Word stimulus pools. Given that the in-out effect depends on the exact manipulation of consonantal articulation spots, language-specific letter-to-phonation correspondence, and phonetic articulation (Cho & Ladefoged, 1999), we recruited native speakers to assist stimuli development. Therefore, the words for each experiment were created by two social scientists, native-speakers of each language. To create the set of stimuli, consonants with distinct articulation spots were selected and subsequently ordered either in an inward or outward wandering direction (Topolinski et al., 2014; Godinho & Garrido, 2016). Consonantal selection as well as the detailed explanation on how the two lists of words were created will be presented next.

Ukrainian language belongs to the Slavic branch of the Indo-European proto-language, being spoken both in Ukraine and Transnistria. Written Ukrainian uses a variant of the Cyrillic alphabet that comprises 33 letters, representing thirty-eight phonemes. There are 23 letters representing consonants (К, М, Т, Б, В, Г, Ґ, Д, З, Й, Л, Н, П, С, Ф, Ж, Ц, Ч, Ш, Щ, Р, Х, Дж), and 10 representing vowels (А, Е, Є, И, І, Ї, О, У, Ю, Я). For the Ukrainian set of words, we chose consonants articulated in three clearly anatomically distinct places in

the mouth: frontal labial [Б(B), П(P), В(V)], middle [Ч(CH), Ш(Sh)], and for the back a velar and a uvular [К(K), Ґ(G)]. Inward wandering words were created merging all combinations of these consonants in the front-to-back order [e.g., Б(B), Ч(CH), К(K)], and outward words by reversing the same consonants [(e.g., К(K), Ч(Ch), Б(B)]. Then we randomly inserted vowels [e.g., А(A), Е(E), И(I), О(O), У(U)] after the first, second and third consonants (not allowing for repetitions). By using this method, we created a list with 196 words (98 inward and 98 outward).

Altaic is the name of the family of languages spread across Central Asia and the Far East that includes five language branches: Turkic, Mongolic, Manchu-Tungusic and (arguably) Japonic and Korean (Starostin, 2016). Within the Turkic branch, Turkish is the foremost spoken language and shares with the proto-language characteristics such as vowel harmony, extensive agglutination, lack of noun classes and grammatical gender. Turkish speakers use a Latin-script alphabet with 29 letters, being eight vowels (A, E, I, İ, O, Ö, U, Ü) and the remaining consonants (B, C, Ç, D, F, G, Ğ, H, J, K, L, M, N, P, R, S, Ş, T, V, Y, Z). Please note that because the Turkish language has specific phonetic requirements it uses seven letters (Ç, Ş, Ğ, I, İ, Ö, Ü) that were modified from the original Latin-script alphabet (as Germanic languages use it). Such letters were not used in the present work, though.

For the Turkish words we selected as frontal labial consonants (F, V), middle (N) and for the back a velar (K). Similar to the method used to create the previous words, consonants were ordered in both wandering directions (e.g., inward F, N, K; outward K, N, F) and vowels (a, E, O) were randomly inserted after the first and second consonants (without repetition). This resulted in a total of 24 words (12 inward and 12 outward). Due to the particular characteristics of the Turkish language a smaller number of consonants were chosen for each position (front, middle and back). Thus, the final list for Turkish has fewer words (24) than the Ukrainian (196). We will discuss this aspect further in the discussion.

The final lists of words are presented as supplementary material.

Procedure. The procedure was similar in both experiments. University professors received an email requesting them to forward our message to their students. Participants then received and email from their professors, asking them to participate in an online survey aiming to understand how people from different languages understand and rate nonsense words. After agreeing to join the survey, participants were directed to the Qualtrics platform and agreed to the informed consent. Finally, they were instructed to read the target words

silently and to rate each word as fast as possible on a scale from 1- *do not like it at all* to 10 – *like it very much*.

The Turkish participants rated the entire list of stimuli created, 24 words (12 inward and 12 outward). Given that the Ukrainian stimuli list included 196 words, each Ukrainian participant was asked to rate a random subset of 20 words (10 inward and 10 outward).

Following the procedure of our previous experiments (Godinho & Garrido, 2016; 2017; Godinho et al., 2018) each trial was presented on a single page with the word centered at the top, and the rating scale below. Also, the same demographic variables used in previous studies (native language, gender and age) were collected. Lastly, participants were asked to explain which criteria they used to rate the words.

Results

None of the participants reported a valid suspicion of the word manipulations. Raw data may be found online as supplementary material.

Subject-level analysis

Ukrainian participants in Experiment 1 preferred inward words (M = 4.36, SD = 1.66) over outward words (M = 4.20, SD = 1.70), $t(149) = 2.43$, $p = .016$, $d_z = .20$, mean difference 95% CI [.04, .36].

Results from the Turkish sample (Experiment 2) revealed again significant differences between ratings of words with inward (M = 4.37, SD = 1.76) and outward-wanderings (M = 3.93, SD = 1.59), $t(123) = 3.82$, $p < .001$, $d_z = .34$, mean difference 95% CI [.19, .49].

Item-level analysis

Since item-based analyses are recommended (e.g., Clark, 1973) to test the robustness of the effects against item-level variations, we designed an item-level analysis featuring a simple 2 (Test word: inwards vs. outwards; between) independent samples t-test for each data set.

While a marginal main effect of articulation direction concordant with the in-out effect was observed with the 196 words developed for the Ukrainian phonation, being inward words (M = 4.36, SD = .70) preferred to outward (M = 4.20, SD = .64), $t(194) = 1.69$, $p = .092$, $d_z = .12$, mean difference 95% CI [-.02, .26]; a main effect of test words was observed for the 24 words developed for the Turkish phonation, being again inward words (M = 4.37,

SD = .06) preferred to outward ones (*M* = 3.93, *SD* = .18), *t*(22) = 2.36, *p* = .028, d_z = .49, mean difference 95% CI [.05, .92].

Discussion

Topolinski and colleagues (2014) found a preference for words whose consonantal-articulation dynamic mimics ingestion movements, compared to expectoration movements. This so-called in-out effect has been replicated in more than 15 papers, but these replications occurred exclusively in the Germanic and Italic branches of the Indo-European language family.

In two high-powered independent experiments, we replicated the effect in the Slavic branch of the Indo-European family, Ukrainian, and in a language from a different family, Turkish - Altaic. Furthermore, the effect was for the first time replicated with a different written alphabet, Cyrillic. In both replications there was a statistically significant main effect of consonantal articulation direction, being inward-words preferred over outward.

The item-based analysis supported the reproducibility of the effect, both with the Turkish words and with the larger, more heterogeneous, list of Ukrainian words (although, marginally significant because of the increased item-variance). The asymmetry between the sizes of the word lists created (the Turkish list had fewer words than the Ukrainian) seems to cause the differential effect-sizes found in the item-based analysis.

By providing stimulus sets adapted to different languages, these replications present a noteworthy contribution for current experimental practice on oral kinematics and will surely trigger more geographically diverse and ecologically sound research. Moreover, this evidence is also conceptually relevant. The successful replication in such distinct linguistic and cultural contexts endorses phonetic embodiment theory as a casual mechanism, demonstrating that the link between the oral-muscles movements made to articulate words and approach-avoidance affective states is deeply rooted. These repeated demonstrations of an oral motor-to-affect link support the hypothesis that cognition can be directly shaped by muscular activity, without mediation of any higher cognitive mechanism, cultural or linguistic distinctions.

Electronic Supplementary Materials

The supplementary material of the article is available at https://osf.io/xfzh9/?view_only=a9a6e3eb1a134988ae952b5e889198c2

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Supplemental material

List of words for Ukrainian phonation

Inward words	Outward words
БАШЕҐО	ҐАШЕБО
БЕШОҐА	ҐЕШОБА
БОШАҐЕ	ҐОШАБЕ
БЕШАҐО	ҐЕШАБО
БАШОҐЕ	ҐАШОБЕ
БОШЕҐА	ҐОШЕБА
БУШИҐЕ	ҐУШИБЕ
БИШЕҐУ	ҐИШЕБУ
БЕШУҐИ	ҐЕШУБИ
БЕШИҐУ	ҐЕШИБУ
БУШЕҐО	ҐУШЕБО
БИШУҐЕ	ҐИШУБЕ
БАШУҐИ	ҐАШУБИ
БАШИҐУ	ҐАШИБУ
БОШИҐА	ҐОШИБА
БОШУҐИ	ҐОШУБИ
БУШОҐИ	ҐУШОБИ
БИШОҐА	ҐИШОБА
БУШАҐО	ҐУШАБО
БИШАҐО	ҐИШАБО
ПАЧЕҐО	ҐАЧЕПО
ПЕЧОҐА	ҐЕЧОПА
ПОЧАҐЕ	ҐОЧАПЕ
ПЕЧАҐО	ҐЕЧАПО
ПАЧОҐЕ	ҐАЧОПЕ
ПОЧЕҐА	ҐОЧЕПА
ПУЧИҐЕ	ҐУЧИПЕ
ПИЧЕҐУ	ҐИЧЕПУ
ПЕЧУҐИ	ҐЕЧУПИ
ПЕЧИҐУ	ҐЕЧИПУ
ПУЧЕҐУ	ҐУЧЕПУ
ПИЧУҐЕ	ҐИЧУПЕ
ПАЧУҐИ	ҐАЧУПИ
ПАЧИҐУ	ҐАЧИПУ
ПОЧИҐА	ҐОЧИПА

ПОЧУЋИ	ЋОЧУПИ
ПУЧОЋИ	ЋУЧОПИ
ПИЧОЋА	ЋИЧОПА
ПУЧАЋО	ЋУЧАПО
ПИЧАГО	ЋИЧАПО
ВАЧЕКО	КАЧЕВО
ВЕЧОКА	КЕЧОВА
ВОЧАКЕ	КОЧАВЕ
ВЕЧАКО	КЕЧАВО
ВАЧОКЕ	КАЧОВЕ
ВОЧЕКА	КОЧЕВА
ВУЧИКЕ	КУЧИВЕ
ВИЧЕКУ	КИЧЕВУ
ВЕЧУКИ	КЕЧУВИ
ВЕЧИКУ	КЕЧИВУ
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ВАЧИКУ	КАЧИВУ
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ПАШЕКО	КАШЕПО
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ПЕШАКО	КЕШАПО
ПАШОКЕ	КАШОПЕ
ПОШЕКА	КОШЕПА
ПУШИКЕ	КУШИПЕ
ПИШЕКУ	КИШЕПУ
ПЕШУКИ	КЕШУПИ
ПЕШИКУ	КЕШИПУ
ПУШЕКО	КУШЕПО
ПИШУКЕ	КИШУПЕ
ПАШУКИ	КАШУПИ
ПАШИКУ	КАШИПУ

ПОШИКА	КОШИПА
ПУШОКИ	КУШОПИ
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ПУШАКО	КУШАПО
БАЧЕКО	КАЧЕБО
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БУЧИКЕ	КУЧИБЕ
БИЧЕКУ	КИЧЕБУ
БЕЧУКИ	КЕЧУБИ
БЕЧИКУ	КЕЧИБУ
БУЧЕКО	КУЧЕБО
БИЧУКЕ	КИЧУБЕ
БАЧУКИ	КАЧУБИ
БАЧИКУ	КАЧИБУ
БОЧИКА	КОЧИБА
БОЧУКИ	КОЧУБИ
БУЧОКИ	КУЧОБИ
БИЧОКА	КУЧОБА
БУЧОКЕ	КУЧАБЕ
БИЧАКО	КИЧАБО

List of words for Turkish phonation

Inward words	Outward words
BENOK	KENOB
BENAK	KENAB
BANEK	KANEB
BANOK	KANOB
BONAK	KONAB
BONEK	KONEB
VENOK	KENOV
VENAK	KENAV
VANEK	KANEV
VANOK	KANOV
VONAK	KONAV
VONEK	KONEV

2. Fluency as an Alternative Explanation for the In-out Effect

The in-out effect was initially presented as an affective spill from ingestion-related to articulation-related movements that occurred because ingestion and expectoration are felt as approach-avoidance motivational tendencies to either seek pleasure or avoid pain (Topolinski, Maschmann, Pecher, & Winkielman, 2014).

However, contrary to other approach-avoidance demonstrations, where positive stimuli always trigger or facilitate approach movements in contrast to negative stimuli that promote or facilitate avoidance movements (e.g., Chen & Bargh, 1999; Lavender & Hommel, 2007; Rotteveel & Phaf, 2004), the in-out effect seems to be disconnected from the valence of the denoted objects. In the demand for a different mechanism that could plausibly explain this robust preference for inward consonantal wanderings, researchers step outside embodied cognition literature, wondering whether inward consonantal strings could be simply processed more fluently (e.g., Bakhtiari, Körner, & Topolinski, 2016).

Departing from recent work arguing that, since the in-out effect can be overruled by training, it results from a motor fluency process (Körner, Bakhtiari, & Topolinski, 2018), we conducted a set of experiments presenting more controlled training manipulations to clarify such results. Moreover, adding to previous approaches examining this alternative explanation (e.g., evaluate the speed of pronunciation, prevalence among real languages word corpus), we tested whether the in-out effect behaves like any other fluency manipulation, that is, how the in-out effect interacts with classical perceptive fluency manipulations and whether it emerges (or not) in between-participants designs.

The nine experiments (N_{total} = 1648) presented in the following articles tackle the fluency hypothesis directly, confirming that fluency manipulations seem to be powerful enough to disrupt the preference for words wandering inward but may not account for the in-out effect. While controlling for the effectiveness of the training manipulation, it was possible to demonstrate that only intense training affects the in-out effect. Crucially, our results revealed that the in-out effect does not operate like other fluency manipulations, failing to behave additively and persisting even in between-participants designs.

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The in-out effect: Re-examining the impact of training in the preference for words with inward-wandering consonantal articulation[*]

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Abstract

The preference for words whose consonantal-articulation spots wander inward (vs. outward) – *In-out Effect* - has competing explanations: A direct, unconscious approach-avoidance mechanism, arguably driven by inward/outward articulatory movements that resemble ingestion and expectoration oral-functions; or, a subtle fluency-based mechanism, fostering preference because inward-words are easier to pronounce. Training oral motor-sequences was recently shown to affect processing-fluency and therefore, to modulate this well-established preference. Across three high-powered experiments (n=525) the training effect was re-examined, while measuring inward-outward preference and perceived fluency simultaneously. Intense training affected perceived fluency, disrupting the in-out effect. Milder training only affected perceived fluency, not disrupting the inward-words preference. Importantly, mediation analyses suggested that the training condition does not affect preference directly, but through perceived fluency and only after intense training. Results confirm the role of fluency in shaping the in-out effect but cast doubts on whether it may be the sole mechanism driving such a robust preference.

Keywords: In-Out Effect, Approach-Avoidance, Fluency, Sequence Training, Motor Fluency, Embodiment

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Words whose consonantal articulation points wander from the front to the rear in the mouth are preferred over words with the same phonemes arranged in the reverse order, wandering from the rear to the front in the mouth. Take as an example the inward-wandering word BETOKA, that includes the labial phoneme [b] pronounced with the lips, the alveolar [t] pronounced with the front part of the tongue and, at the end, the velar [k] pronounced with the rear of the tongue. In contrast, the outward-wandering word KETOBA involves the exact same phonemes, but in the reverse order.

In the original demonstration of the in-out effect, that is, the preference for inward versus outward-wandering words, Topolinski, Maschmann, Pecher and Winkielman (2014) proposed that oral muscles' movements used to articulate words prime specific motivational states. According to the authors, the congruence between inward-wandering words and ingestion movements elicits positive affect and approach-behavior and, the congruence between outward-wandering words, simulating expectoration movements, triggers avoidance-behavior. Nevertheless, this automatic trigger of affect by the biomechanical resemblance with oral deglutition/expectoration has been recently scrutinized (Bakhtiari, Körner, & Topolinski, 2016) to examine whether processing fluency may present an alternative explanation for the in-out effect.

The current work re-examines the role of fluency (Bakhtiari et al., 2016) in shaping the in-out effect, specifically the recent evidence demonstrating that the effect is modulated by consonant direction training (Körner, Bakhtiari, & Topolinski, 2019). Three experiments explore whether the impact of consonantal wandering dynamics on affect may be directly attributed to a processing-fluency mechanism.

Evidence about underlying mechanisms for the in-out effect

The dynamic of the in-out effect seems very simple: Consonantal oral articulation requires muscle contractions; each consonantal articulation recruits specific oral muscles that produce motor activity in precise mouth locations. For instance, [b] or [p] are pronounced with the lips, while [k] is pronounced in the rear. Using such variations of the articulation spots, it is possible to manipulate oral muscles contractions during articulation so that they resemble ingestion (e.g., BATEKO) or expectoration (e.g., KATEBO).

Topolinski and colleagues (2014) advanced with an original explanation for such a surprising yet robust phenomenon. Picking up the notion that oral motor movements support two main functions - articulation and ingestion (Rozin, 1996), the authors proposed that the

in-out effect results from an approach-avoidance survival mechanism. The muscular activity resulting from consonants' pronunciation produces specific wandering patterns. When those patterns match the oral kinematics from these two basic functions, ingestion and expectoration, the respective motivational state is triggered. The argument predicts that while consonantal inward-wandering patterns resembling ingestion movements trigger positive affect/approach, consonantal outward-wandering patterns resembling expectoration movements trigger negative affect/avoidance.

Furthermore, it is proposed that the actual motor movements are unnecessary since even silent reading implies a motor simulation that enables the effect. Accordingly, the effect was not observed in patients with aphasia, supposedly because of their impairment in brain areas involved in subvocalizations (Topolinski et al., 2014). Supporting an explanation related to the mimic of ingestion functions, Godinho, Garrido, Zürn and Topolinski (2018) recently tested the role of edibility and valence in shaping the in-out effect and found a compelling dissociation: inward words are only preferred for edible products, regardless of valence.

Still, recent research has been suggesting another distinct but indisputably related alternative explanation for the mechanism underlying the in-out effect: the experienced ease (or difficulty) felt when pronouncing words may play a role in the influence of consonantal wandering on explicit preferences. Since easy to pronounce words are preferred (Song & Schwarz, 2009) and ingestion movements are not only more frequent, but also more pleasant, it is not surprising that inward-wandering words trigger more positive affect. Such difference between inward and outward-wandering words was first recognized by Topolinski and colleagues (2014), namely that inward and outward articulation wanderings may "differ in their complexity or required neuromuscular orchestration and thereby trigger affect" (Topolinski et al., 2014, pp.892).

Bakhtiari et al., (2016) further examined this alternative fluency hypothesis and proposed that because inward-wandering words are processed more fluently, positive affect is triggered, and preference judgments are biased. Specifically, the authors established that: a) English and German languages have more words with inward dynamics; b) inward-wandering words are pronounced faster and c) rated as easier to pronounce. Nevertheless, and despite this evidence suggesting that fluency may account for the preference for inward words, in one last study, fluency did not fully mediate the in-out effect failing to rule out the

approach-avoidance explanation. Bakhtiari and colleagues concluded that fluency contributes only partially, to the preference for inward over outward-wandering words.

More recently, the same authors (Körner et al., 2019) concluded otherwise, proposing that fluency plays a pivotal role in explaining the in-out effect. After demonstrating that the preference for inward-wandering consonantal strings over outward ones is disrupted when participants train particular consonantal-sequences, the authors conclude that abstract oral motor sequences may be learned implicitly and, therefore, that the in-out effect depends upon a fluency mechanism. However, across the four experiments presented it also became clear that training intensity interacted with the in-out effect. While manipulations requiring participants to memorize 60 outward words (Experiments 1 and 4a), attenuated the in-out effect; even more intense training of outward words (120 words in Experiments 2 and 3) reversed the effect. Such results suggest that the modulation only occurs when a particular threshold of training intensity is crossed. Crucially if such modulation depends upon the training intensity, it becomes plausible to assume that training intensively particular consonantal-sequences simply masks the real mechanism underlying the preference for inward-wandering words.

Supporting this work hypothesis that fluency does not fully account for the in-out effect, recent evidence specifically testing fluency as the underlying mechanism (Godinho & Garrido, 2019), indicates that the in-out effect fails to behave experimentally as any other fluency source. The results from six experiments, using different fluency manipulations, showed that, contrary to other fluency manipulations, the in-out effect does not have an additive effect when operating simultaneously with other fluency sources (Whittlesea, 1993) and persists in within-participants designs (Wänke & Hansen, 2013, 2015).

Moreover, the argument that the in-out effect relies in an oral motor-fluency mechanism advanced by Körner et al. (2019) was never examined in light of evidence demonstrating that classic oral motor-fluency sources have been repeatedly disrupted experimentally with oral motor interference (e.g., mere exposure effect, Zajonc, 1968, reported modulation, Topolinski & Strack, 2009a; false-fame effect, Jacoby et al., 1989; reported modulation, Topolinski & Strack, 2010), but the in-out effect could not be disrupted with concurrent motor tasks such as chewing gum and executing meaningless tongue movements or concurrent verbalizations (Lindau & Topolinski, 2018).

Overview of the Present Research

To train motor fluency with each articulation pattern, participants were asked to read carefully either inward or outward words and, afterwards, to provide likeability ratings (Experiment 1), or to provide both likeability and easiness to pronounce ratings (Experiments 2 and 3). When measuring preference (likeability ratings) and fluency (easiness to pronounce ratings) simultaneously, it becomes possible to confirm if (even the mildest) training manipulations have an effective impact on perceived fluency judgments. Therefore, importantly for the manipulation control, if the training manipulation is effective, the training condition should produce a main fluency effect, with the trained words being rated as easier to pronounce.

Regarding the main hypothesis, whether the in-out effect results from a processing fluency mechanism, the addition of another fluency source (motor-fluency induced by training) should have a direct additive effect on participants' preference. Specifically, words benefiting from two (arguably) concomitant fluency manipulations (e.g., inward words in the inward-training condition) should be rated higher than the words presented in any other condition. Such effect should be independent of the training intensity conditions. The expected pattern of results is therefore, that inward words should be preferred when participants train inward words both mild (Experiments 1 and 2) and intensively (Experiment 3) and, that training outward-wandering words should disrupt (or even reverse) the in-out effect across experiments, that is, independently of training intensity.

Experiments 1 and 2

Method

Power analysis. To ensure sufficient power, we followed Körner et al. (2019) calculations used in Experiment 3. Using these parameters (η_p^2 = .089 [as calculated by SPSS], 1-β = .99, α = .05) the power analysis suggested a sample size of 192. Since data collection was set to finish at the end of the day that each condition reached the ideal sample size, and that some cases were excluded, the final samples do not exactly correspond to that estimate.

Participants. Seven participants were excluded from Experiment 1 (five for not being Portuguese native speakers and two bilinguals); three participants were excluded from Experiment 2 (two for not being Portuguese native speakers and one bilingual). Participants were randomly distributed across Experiments 1 and 2 and training conditions. The final

sample in Experiment 1 was 189 participants (75 female, M_{age} = 34, *SD* = 11.7) and in Experiment 2, 199 participants (60 female, M_{age} = 42, *SD* = 13.6).

Design. Both experiments shared the same design with 3 (training condition: control-inward/outward; vs. inward; vs. outward), between-participants X 2 (articulation direction: inward vs. outward), within-participants. However, in Experiment 1 participants were only requested, as in most of the previous experiments investigating the in-out effect (e.g., Godinho & Garrido, 2017; for an exception see Garrido, Godinho & Semin, 2019), to respond to likeability ratings. In experiment 2, in addition to likeability, participants were also asked to rate how easy were the words to pronounce (Bakhtiari et al., 2016).

Materials and procedure. All manipulations and measures are reported. The key manipulation in Experiments 1 and 2 was the training materials used in different conditions. Control condition: participants trained both inward (8) and outward words (8). Inward condition: participants trained inward-wandering words only (16). Outward condition: participants trained outward wandering words only (16). The words were randomly selected from a pool of 90 words (45 inward; 45 outward) pre-tested for Portuguese (Godinho & Garrido, 2016).

Inspired by the manipulation used by Dijksterhuis and Smith (2002) participants were asked, at this training phase, one random question about each word to guarantee encoding and deep processing of the words. Each word was presented alone, and participants could take as long as necessary to memorize it. When they felt ready, they would voluntarily advance in the experiment, making the question replace the word. The questions were: The first letter of the word was a consonant or a vowel; which was the last vowel of the word; and, how many letters did the word feature? Answers to the manipulation questions were not analyzed.

At the test phase, participants were asked to rate 30 words (15 inward; 15 outward) randomly selected from the same word pool (Godinho & Garrido, 2016). Importantly, to rule out mere exposure effects (Zajonc, 1968), the words used in the training task were different from those rated afterwards.

The procedures were also identical for Experiment 1 and 2: Participants were recruited online by email or through Prolific platform and invited to join a study in Qualtrics about how unknown words are remembered and rated. After reading the ethical statement and providing informed consent, instructions highlighted the need to provide fast and spontaneous ratings. Finally, besides demographics (gender, age and professional occupation) and native

language, participants were inquired about the reasons for their ratings and whether they had detected anything conspicuous or suspicious in the target words.

The only difference between Experiments 1 and 2 was that, while in the former participants were only asked to rate the words on a likeability scale, from 1- *I do not like it at all*, to 10- *I like it very much*; in Experiment 2 participants were asked to use the same likeability scale and an additional easiness to pronounce scale. Therefore, to measure fluency, participants indicated how easy to pronounce each word was from 1- *Very hard to pronounce* to 10- *Very easy to pronounce*.

Results and Discussion

Control questions revealed no valid suspicion about the in-out manipulation.

Experiment 1 presented a clear main effect of articulation direction on the likeability ratings, $F(1,186) = 25.23$, $p < .001$, $\eta_p^2 = 0.12$, 90% CI [.06, .19]. Participants preferred inward ($M = 4.66$, $SE = .12$) over outward words ($M = 4.43$, $SE = .11$), $t(180) = 5.04$, $p < .001$, $d_z = .38$, 90% CI [.025, .50]. There was no main effect of training condition, $F(1,186) = 1.45$, $p = .238$, nor an interaction effect, $F(2,186) = .90$, $p = .409$.

It might be objected that the training manipulation was simply too weak to obtain a moderation and that participants simply did not benefit from an increased motor-fluency by training such a small number of outward wandering words. Such critic was addressed in the second experiment with the introduction of a fluency measure (easiness of pronunciation), to control the manipulation effectiveness.

However, previous research has shown that participants may interpret, even if unconsciously, and make their ratings in terms of the dimensions salient in the experimental tasks (e.g., Whittlesea & Price, 2001). It could be the case that by asking participants to make easiness of pronunciation ratings, they would attribute their word preferences to fluency and reduce their bias in the in-out liking judgments. Experiment 1 had a determinant role in establishing the persistence of the in-out effect in mild training conditions, but above all, it provided a baseline to compare the results obtained in Experiment 2.

Experiment 2 included an additional fluency measure (see, Bakhtiari et al., 2016) to control for manipulation effectiveness, providing simultaneously a valid replication of Experiment 1 and a clarification on whether the persistence of the in-out effect was caused by

the weak nature of the fluency manipulation used or if, indeed, motor fluency does not have a plain additive effect on the in-out preference.

The results regarding the motor-fluency training manipulation – easiness of pronunciation ratings – indicated an interaction between training condition and articulation direction, $F(2,196) = 2.82$, $p = .062$, $\eta_p^2 = .01$, 90% CI [.00, .05]. As expected, in the inward-training condition, participants rated inward words ($M = 6.47$, $SE = .27$) as more fluent than outward ones ($M = 6.17$, $SE = .27$, $M_{diff} = .302$, $p < .001$). However, after training outward words, participants rated outward words ($M = 6.30$, $SE = .25$) as equally fluent as inward words ($M = 6.40$, $SE = .24$, $M_{diff} = .09$, $p = .179$). When training both inward and outward-wandering words (control condition) the inward fluency ratings ($M = 7.29$, $SE = .21$) were higher than the outward ones ($M = 7.16$, $SE = .22$, Control $M_{diff} = .13$, $p = .021$).

Not relevant for the manipulation control, but interesting to understand the effect, a main effect of the training condition was observed. Fluency ratings were higher in the control condition, that is, after training both types of words ($M = 7.23$, $SE = .21$) than after training words with only one articulation direction, both inward ($M = 6.32$, $SE = .27$) or outward ($M = 6.35$, $SE = .24$), $F(1,196) = 5.14$, $p = .007$, $\eta_p^2 = 0.03$, 90% CI [.00, .07], suggesting that the diversity in the training phase benefited the general articulation of the nonsense words.

Additionally, the results also show a main effect of articulation direction in the easiness of pronunciation ratings. Participants rated inward-wandering words ($M = 6.72$, $SE = .14$) as easier to pronounce than outward wandering ones ($M = 6.55$, $SE = .14$), $F(1,196) = 22.09$, $p < .001$, $\eta_p^2 = 0.10$, 90% CI [.04, .17].

Importantly, when examining the likeability ratings in Experiment 2, the main effect of articulation direction persisted despite the training condition, $F(1,196) = 4.78$, $p = .030$, $\eta_p^2 = 0.02$, 90% CI [.00, .07]. Participants revealed a preference for inward ($M = 4.52$, $SE = .13$) over outward wandering words ($M = 4.44$, $SE = .12$), $t(198) = 2.10$, $p = .037$, $d_z = .15$. As in Experiment 1, training condition did not affect participants likeability ratings, that is, participants did not prefer the words that were trained to the untrained words $F(2,196) = .34$, $p = .713$. No interaction effects were observed, $F(2,196) = 1.01$, $p = .336$.

Experiment 3

Experiments 1 and 2 revealed that, despite being effective to increase fluency, mild training did not reduce the established inward preference. Experiment 3 was designed to set a

comparison with previous research demonstrating that intensive training may destroy the in-out effect. Successfully replicating the modulation of the in-out effect with an intensive training manipulation demonstrates that the results obtained in Experiments 1 and 2 do not result from a replication failure caused by our experimental procedures.

Method

Power analysis. Since there were only two experimental conditions in Experiment 3 the sample size was recalculated following Körner et al., (2019) Experiment 1, where participants also trained 60 words. Therefore, a minimum sample size of 84 was calculated using the following parameters: (η_p^2 = .09, 1-β = .80, α = .05). Again, more data was collected because of the stopping rule adopted.

Participants. One-hundred-and-thirty-seven participants (87 female, M_{age} = 44, *SD* = 9.8) joined the experiment, but two were excluded for not being Portuguese native speakers (N_{total} = 135).

Design. Experiment 3 featured a 2 training (inward vs. outward), between-participants X 2 articulation direction (inward vs. outward), within-participants.

Materials and procedure. All manipulations and measures are reported. The key manipulation in Experiment 3 was the number of training stimuli that was almost four times larger than in the previous experiments. As in Körner et al., (2019; Experiment 3), participants trained 60 inward-wandering words in the inward training condition and 60 outward-wandering words in the outward training condition. The words were selected from the same word pool used for Experiments 1 and 2 (Godinho & Garrido, 2016). In the training phase, we used the same manipulation as in Experiments 1 and 2 (Dijksterhuis & Smith, 2002). However, to shorten the experiment duration, only 30 questions were randomly asked about the total number of 60 words. The remaining procedure was very similar to the previous experiments, but to further strengthen the manipulation we added the following questions to those used in the previous experiments: what was the first syllable of the word; what was the last syllable of the word; what was the second letter of the word presented; what was the third letter of the word presented; what was the last letter of the word presented; and, write down the word that you just read.

During the test phase, participants rated a new list of 30 words (15 inward; 15 outward) randomly selected from the same stimulus pool (Godinho & Garrido, 2016). Again,

to rule out mere exposure effects (Zajonc, 1968), the words used in the training task were different from those rated afterwards.

As in Experiment 2, participants were requested to use the likeability scale and the easiness to pronounce scale. The remaining procedures were all identical to the previous experiments.

Results and Discussion

Control questions revealed no valid suspicion about the in-out manipulation. The critical interaction effect between training and articulation direction observed $F(1,135) = 28.16$, $p < .001$, $\eta_p^2 = 0.01$, 90% CI [.00, .05], confirms the manipulation effectiveness. After training inward-wandering words, the fluency ratings for inward words ($M = 6.50$, $SE = .24$) were higher than outward fluency ratings ($M = 6.03$, $SE = .24$, $M_{diff} = .42$, $p < .001$) while when training outward words, participants rated outward words ($M_n = 5.71$, $SE = .24$) as equally fluent as inward words ($M = 5.64$, $SE = .24$, $M_{diff} = -.070$, $p = .294$). While the main effect of training condition was not significant, a main effect of articulation direction indicated that participants rated inward-wandering words ($M = 6.05$, $SE = .17$) as easier to pronounce than outward words ($M = 5.87$, $SE = .17$), $F(1,135) = 14.60$, $p < .001$, $\eta_p^2 = .10$, 90% CI [.03, .18].

Finally, the results of Experiment 3 have shown a main effect of articulation direction in the likeability ratings, $F(1,135) = 4.93$, $p = .03$, $\eta_p^2 = .04$, 90% CI [.00, .10]. Participants preferred inward ($M = 4.08$, $SE = .16$) over outward wandering words ($M = 3.97$, $SE = .15$), $t(136) = 2.15$, $p = .034$, $d_z = .18$, 90% CI [.04, .33]. Again, training condition did not affect participants likeability ratings, that is, participants did not prefer the words that were trained to the untrained words $F(1,135) = .49$, $p = .482$. However, with the stronger fluency manipulation implemented in Experiment 3, a significant interaction between training and articulation direction was observed, $F(1,135) = 7.781$, $p = .006$, $\eta_p^2 = 0.06$, 90% CI [.01, .13]. After training inward-wandering words the inward likeability ratings ($M = 4.25$, $SE = .23$) were higher than outward ones ($M = 4.01$, $SE = .22$, $M_{diff} = .24$, $p = .001$) while after training outward words, participants reported liking them ($M = 3.93$, $SE = .22$) as much as inward words ($M = 3.90$, $SE = .22$, $M_{diff} = -.03$, $p = .687$).

Mediation analysis

To further examine the previous results and test if processing fluency mediates the in-out effect, we used the PROCESS macro (Hayes, 2013) for SPSS. Specifically, the mediation analysis was intended to test if training affected the in-out preference at all (which is different from overshadowing it) and if that was the case, to what extent was the in-out effect mediated by the increased fluency of trained words. Departing from the previous results our predictions were that mild training would not explain in-out preference, but that intense training would affect perceived fluency and, consequently, have an impact on the in-out preference.

As recommended, we used a bootstrapping method to overcome Type I errors, resampling data 10,000 times. We projected two models, the first with data from Experiment 2 pertaining a soft training manipulation (16 words) and a second with data from Experiment 3 with a more intense training manipulation (60 words).

In both models (Figure 1), training condition was the predictor variable (*X*), In-out fluency perception was the mediator variable (*M*), and In-out preference the outcome variable (*Y*). Both fluency and preference evaluations were computed as the difference between the ratings given to the inward word minus the ratings given to outward counterpart word (e.g., Rating BATECO – Rating CATEBO). Products were mean centered prior to the analysis.

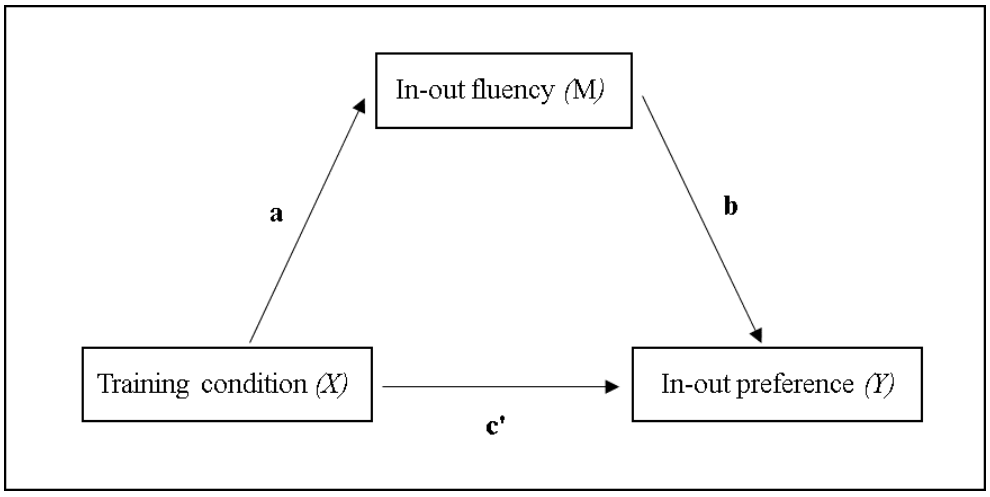

Figure 1. Path diagram illustrating the direct effects and causal paths linking training condition to In-out preference.

Results are presented in Table 1. The first consideration to be made is about our main hypothesis that the in-out effect would not be predicted by training conditions. Indeed, in the overall model tested with mild training, the total effect was not significant (b = 0.14, SE = .01, p = .158, 95% CI [-0.06, 0.35]). Since the XY relationship was not significant based on Model 1 and given that such relation is fundamental for the test, we did not analyze the

indirect effects (still, for the sake of transparency, all results are presented in Table 1). Such decision was made based on the assumption that it is advisable to accept the null hypothesis of no relationship, avoiding false positives (Wagenmakers et al., 2011) and without artificially generating additional explanations for non-significant relationships (Agler & de Boeck, 2017).

When the training manipulation was intense, however, the total effect of training in in-out preference was significant (b = 0.27, SE = .19, p = .006, 95% CI [0.08, 0.45]). Regression coefficients revealed that intense training significantly increased perceived fluency (b = 0.49, SE = .09, p < .001, 95% CI [0.31, 0.67]) as well as the in-out preference (b = 0.42, SE = .08, p = .000, 95% CI [0.26, 0.58]). Furthermore, there is no direct effect of training in the in-out preference (b = 0.06, SE = .10, p = .544, 95% CI [-0.13, 0.25]), but only an indirect effect (b = 0.21, SE = .06, 95% CI [0.10, 0.33]), revealing that the increased perceived fluency mediates the impact of intense training in the in-out effect.

Table 1: Path coefficients, indirect effects, and 95% bias-corrected confidence interval predicting in-out Preference

(Model 4)	Coefficient	BootLLCI	BootULCI	*SE*	*t*	*p*
Experiment 2 - Low intensity training (*N* = 199)						
Total Effect (c)	0.14	-0.06	0.35	0.10	1.42	.158
Direct effect (c')	0.07	-0.12	0.27	0.10	0.73	.467
a	0.22	0.03	0.40	0.10	2.26	.025
b	0.34	0.19	0.48	0.07	4.68	.000
Indirect effect	0.07	0.00	0.17	0.04	-	-
Experiment 3 - High intensity training (*N* = 137)						
Total Effect (c)	0.27	0.08	0.45	0.10	0.29	.006
Direct effect (c')	0.06	-0.13	0.25	0.10	0.61	.544
a	0.49	0.31	0.67	0.09	5.31	.000
b	0.42	0.26	0.58	0.08	5.21	.000
Indirect effect	0.21	0.10	0.33	0.06	-	-

Notes:
Experiment 2 - The manipulation had three training conditions (1= Control; 2 = Outward; 3 – Inward). To ease data presentation and comprehension the (X2) contrast between Inward and Outward conditions is presented
Experiment 3 -The manipulation had two training conditions (1 = Outward, 2 = Inward).

The mediation analysis showed therefore, that training is effective in increasing processing fluency and that there is a direct and positive relation between perceived fluency and participants' preference for words, either inward or outward. Thus, these results support previous evidence about the impact of training in the in-out preference (Körner, et al., 2019),

but go further by revealing that processing fluency may not be accountable for the in-out effect to begin with. In other words, participants' preferences may be modulated by training (through increased processing fluency), but the initial preference is still not proven to result from a fluency mechanism.

General Discussion and Conclusion

The role of motor-fluency as an alternative account for the in-out effect was re-examined by providing participants with intense but also mild training. The preference for words with inward (vs. outward) consonantal wanderings was consistently observed (Experiments 1 and 2) and only with a highly powerful motor-fluency manipulation requiring an intensive training of outward wandering words, it was possible to increase the preference for an outward consonantal articulation direction (Experiment 3).

To rule out possible alternative explanations about the manipulation effectiveness, participants' perceptions of fluency were measured alongside likeability (Experiments 2 and 3). The effect of motor fluency induced by the training manipulation was present in all experiments but was clearly stronger in Experiment 3. Such finding simply informs that an intensive motor-fluency training manipulation had, as expected, a higher impact than a mild motor-fluency training manipulation. The measure was designed precisely to access whether motor-fluency caused by training was being effective and to what extent.

Interestingly, while both levels of training succeeded in affecting perceived fluency (easiness to pronounce ratings), only intense training affected the preference for inward-outward wandering words. Indeed, Experiment 3, featuring a more intense training period, was designed to replicate previous research (Körner et al., 2019) but leveraging the understanding on how different degrees of training affect the in-out effect. After training outward-wandering words, the in-out effect disappeared, and participants rated outward words as equally likeable as inward-wandering words. However, relevant for our conclusion, a dissociation between preference and fluency ratings was also observed, that is, different degrees of training do not have the same effect in fluency and preference.

The acknowledgment that a motor-fluency manipulation fails to operate additively across training conditions (Experiments 2 and 3) challenges the role of fluency as the main underlying mechanism for the in-out effect. If fluency was the single mechanism underlying the in-out effect, both training-intensity conditions should have had a straightforward effect in the in-out preference, measurable with likeability and fluency ratings. Since training only

modulated the in-out effect when it implied the intense examination of outward words, the hypothesis that there is a threshold, after which processing fluency overcomes the power of the in-out effect, becomes a plausible one.

Theoretically it would be possible to counter argue that the dissociation between perceived fluency and likability rating observed in Experiment 2, does not necessarily mean that the in-out effect has a non-fluency source but instead, that mild training might instantly bias ease of pronunciation, still lacking power to impact likeability ratings. However, previous evidence on the sensitivity to fluency manipulations of both likeability and fluency measures revealed that, if such a difference exists, fluency ratings are less sensitive to fluency variations, than likeability ratings (Topokinski & Strack, 2009b). While testing the competing role of fluency and affect for intuitions about semantic coherence, the authors found that participants liked word triads that were coherent more than incoherent ones but did not rate them as being more fluent in processing.

Yet another argument that could explain the results would be that, if the in-out effect results from a fluency mechanism, adding the ease of pronunciation rating, could cue participants about the fluency manipulation and lead them to control for the impact of fluency on preference ratings (e.g., Schwarz & Clore, 1983). However, such effect was not observed in Experiment 2 because the effect of training was evident in the fluency ratings.

Finally, the mediation analysis provided deeper insights about the role that increased fluency induced by training may play in the in-out effect. While a mild training seems not to affect the in-out preference, intense training modulated the in-out preference. Such modulation seems to follow an indirect path, though, working through the increased easiness of pronunciation perceptions. Perceived fluency completely mediated the potential impact of intense training in the in-out preference, supporting the suspicion that training is a stronger manipulation than the pre-existing preference for inward-wandering consonantal strings.

Since mild training did not affect the in-out preference, while intense training (working through a fluency mediation) did, we are led to conclude that there is enough evidence not to fully accept a fluency explanation for the in-out effect. Overall, findings from the current and previous research, suggest that strong fluency manipulations may have such a powerful impact on word preference that, any other pre-existing preference may become shadowed. In fact, despite its robustness, the in-out effect presents generally smaller effect sizes than fluency manipulations.

The statistical grounding for our conclusions might raise some general questions about the validity of the present interpretations. To begin with, our conclusion that an increased motor-fluency is not causing the in-out effect is based on the interpretation of a null effect. That is, mild training did not moderate the in-out effect (more liking of inward-wandering words), although it had a significant effect on fluency ratings (Experiment 2). Nevertheless, such conclusion is supported by the acknowledgment that training-induced fluency variations were strong enough to influence ratings. The manipulation effectiveness was successfully confirmed and the statistical power to detect any inward advantage (both in likeability and easiness to pronounce ratings) was even higher in the critical experiment pertaining a mild training manipulation ($N_{\text{Experiment2}} = 199$; $N_{\text{Experiment3}} = 137$).

Second, the use of the mediation analysis (MA) to further support our conclusions might also seem controversial since MA tests "the significance, and maybe the effect size of a hypothetical mediator, assuming it is the actual mediator. However, MA is mute about the viability of the premise that the assumed intervening variable truly is a mediator. MA does not even allow for probabilistic inferences about the likelihood that the focal variable is a mediator as long as we do not know the likelihood distribution of all other potential mediators and alternative causal models of the relation between the independent, the dependent and the intervening variable." (Fiedler, Schott, & Meiser, 2011, pp. 1231). We agree that correlation statistics are insufficient to prove that any mechanism is causally responsible for an effect. That is why, to overcome such weakness, mediation statistics are used to test concrete hypothesis and theoretical models (Agler & de Boeck, 2017). Also, we used MA to compare competing demonstrations of the effect, not to support any isolated prediction about the 'validity' or 'plausibility' of a particular approach.

Even if not providing a definite solution about the underlying mechanism for the in-out effect, using a null hypothesis as means to test a hypothesized process is likely to present a valid approach because it may support the avoidance of a false positive. Our main conclusion is, therefore, simple: the theoretical proposition arguing that the in-out effect results from a mere fluency mechanism is not supported by the present results.

Concluding that the influence of the covert pronunciation of inward or outward-wandering words on affective judgments does not necessarily result from different degrees of fluency involved in such sensorimotor simulations implies that, to rule out a motivational orientation as a possible explanation for the in-out effect, further direct tests to the originally proposed mechanism of approach-avoidance are required. Since the in-out effect is a small

but highly replicable phenomenon, this is surely a worthwhile endeavor. Probing and challenging the fluency explanation, opens an important avenue for examining other possible mechanisms of such an intriguing effect.

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The in-out effect: Examining the role of perceptual fluency in the preference for words with inward-wandering consonantal articulation*

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Abstract

Words whose consonantal articulation spots wander inward, simulating ingestion movements, are preferred to words featuring the opposite consonantal articulation direction, that is, resembling expectoration movements. The underlying mechanism for this so called in-out effect is far from settled. Contrary to the original explanation proposing an oral approach-avoidance mechanism, recent evidence has been used to support an oral motor-fluency mechanism, suggesting that inward-words are preferred because they may be more common and/or easier to pronounce. Across six experiments (n=1123) we examined the impact of different fluency sources in the emergence of the in-out effect. The preference for inward-wandering words persisted both with classical font-type and figure-ground contrast fluency manipulations, and no systematic additive effects were observed. The in-out effect was also replicated for the first time with a between-participants design. These results suggest that the in-out effect may be permeable to fluency-manipulations, but it is not dependent upon a plain fluency-mechanism.

Keywords: in-out effect, approach-avoidance, fluency, embodiment

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Written language requires the ability to read visual codes and to associate them in a meaningful way. Yet, recent evidence has been demonstrating that the way in which the muscular apparatus is recruited in the oral cavity during word articulation, even in silent reading, may present an alternative source of information.

The *In-out effect* documents a small, yet highly replicable, preference for words that are articulated with muscular contractions wandering inward in the oral cavity, by opposition to words whose pronunciation implies outward wandering muscular contractions. The word BATEKO, for instance includes the labial phoneme [b] that is pronounced with the lips, the alveolar [t] pronounced with the front part of the tongue and, finally, the velar [k] pronounced with the rear of the tongue. In contrast, the outward-wandering word KATEBO, involves the same consonantal articulation spots, because it combines the same phonemes, but arranged in the reverse order. After the initial demonstration of the in-out effect, Topolinski, Maschmann, Pecher and Winkielman (2014) argued that this effect could be explained by approach-avoidance motivational states that are automatically triggered by the biomechanical resemblance between the movement caused by word articulation and deglutition/ expectoration movements. More recently there has been an interesting stream of evidence suggesting that the preference for inward-words may be caused by an oral motor-fluency mechanism instead (Bakhtiari, Körner, & Topolinski, 2016; Körner, Bakhtiari, & Topolinski, 2019).

The role of subjective experiences naturally occurring during the processing of information in shaping judgment is a well-established finding (e.g., Schwarz et al., 1991). This subjective feeling associated with cognitive processing is also known as fluency, that is, the ease with which a target may be perceived or examined. Such metacognitive experiences occurring during judgment (for a review, see Schwarz, 2004) may occur in several stages: when the content is seen (visual fluency), perceived (perceptual fluency), understood (conceptual fluency), or remembered (retrieval fluency). Fluency has been shown to feed into a wide range of judgments such as attractiveness (e.g., Reber, Winkielman, & Schwarz, 1998), preference (e.g., Beilock & Holt, 2007), frequency (e.g., Schwarz et al., 1991), familiarity (e.g., Koriat & Levy-Sadot, 2001; Monin, 2003), representativeness and categorization (e.g., Oppenheimer & Frank, 2008), impression formation (e.g., Laham, Koval, & Alter, 2012), truth (e.g., McGlone & Tofighbakhsh, 2000; Reber & Schwarz, 1999), fame (e.g., Jacoby, Kelley, Brown, & Jasechko, 1989), risk for disease (e.g., Rotliman & Schwarz, 1998) or economic performance (e.g., Alter & Oppenheimer, 2006).

Historically the literature about fluency effects on preference judgments has grouped most of these multi-level processes and manipulations under two fluency types (Winkielman, Schwarz, Fazendeiro, & Reber, 2003). Conceptual fluency refers to basic metacognitive feelings experienced because of the semantic relatedness of the stimuli to previous knowledge structures, that is, the easiness / difficulty when facing high-level operations such as attribution processes (e.g., Whittlesea, 1993). Perceptual fluency refers to the metacognitive feeling resulting from the stimuli physical properties, that is, the easiness / difficulty when facing low-level operations such as the visual features of the stimulus (e.g., Reber & Schwarz, 1999).

Recent accounts have gathered evidence on other fluency sources and related manipulations (e.g., linguistic fluency, McGlone & Tofighbakhsh, 2000; retrieval fluency, Schwarz et al., 1991). Additionally, inspired by an embodied cognition perspective emphasizing the link between cognition and action, motor-fluency has also been advanced as another fluency source (e.g., Milhau, Brouillet, & Brouillet, 2015; Topolinski, 2010). Indeed, it has long been established that positive (or negative) feelings that spill over the judgment process may occur due to unrelated tasks that provide bodily feedback and ease stimuli processing (e.g., Stepper & Strack, 1993; Strack, Martin, & Stepper, 1988, about the unsettled replication debate see Strack, 2017, a recent failed attempt to replicate the effect Wagenmakers et al., 2016 and an interesting pacifying approach, Noah, Schul, & Mayo, 2018). One of such fluency manipulations is training, which not only accelerates action - because stimuli become easier to process, but has also exerts a positive impact on stimuli evaluation (e.g., Körner et al., 2019; Van den Bergh, Vrana, & Eelen, 1990).

Critically, it has already been established that all of these metacognitive processes, even if not always categorized under the fluency framework (Topolinski, 2013), satisfy "the definition of fluency as the subjective experience of ease associated with processing information" (Alter & Oppenheimer, 2009, p.224). Fluency, or processing fluency as an integrative term, is conceptualized as a general metacognitive cue, referring to the easiness/difficulty when processing external information, that may result from a wide range of cognitive processes (Schwartz, 2004). To that extent, processing fluency researchers have been "using a vast array of techniques, which, despite their diversity, produce remarkably similar judgmental consequences" (Alter & Oppenheimer, 2009, p.219; for a discussion about fluency as a unitary construct see Unkelbach & Greifeneder, 2013).

The converging effects of different fluency sources can be illustrated by the work of Whittlesea, Jacoby, and Girard (1990) demonstrating that perceptual fluency (manipulated by visual clarity and presentation duration) increased liking for the stimulus in the same way as repeated exposure does. Repeatedly showing words to participants leads to pronunciation simulation (even if covertly). Given that simulating an action makes it easier to repeat (Topolinski & Strack, 2009), processing fluency increases and feelings of familiarity with those words are enhanced (Yang, Gallo, & Beilock, 2009).

Empirically, all these sources of fluency have been shown to have a similar influence, skewing liking judgments of fluent stimuli to the right (for a review, see Winkielman, Schwarz, Fazendeiro, & Reber, 2003) and thus, may be confidently folded under the general umbrella of processing fluency (Schwartz, 2004).

One exception to this converging literature reporting how apparently different fluency types result in the same general emotional contagion comes from non-affective judgments. There are reports about domain specificity in the use of fluency as a cue for particular judgmental domains such as recognition, memory or truth judgments (e.g., Olds & Westerman, 2012; 2014; Silva, Garcia-Marques, & Mello, 2016; Whittlesea, 1993). Nevertheless, reports about how the positive affect generated by fluency can cue judgments in virtually any situation (Winkielman, Halberstadt, Fazendeiro, & Catty, 2006) emphasize the significant role of fluency on cognitive and affective processes.

Fluency can either act as a direct cue toward judgment or work indirectly through other pathways such as emotion. The feelings-as-information model, for instance, argues that feelings can be used as a source of information (e.g., Schwarz & Clore, 1983; for a review see Schwarz & Clore, 1996). Therefore, it is plausible to suspect that a feeling of easiness caused by inward words, when compared to outward words, can directly prompt preference, or other positive feelings like familiarity, that can be misread as preference.

The in-out evidence making the case for this alternative oral-motor fluency explanation demonstrated that: there are more inward than outward words in English and German; that inward-consonantal strings are pronounced faster and rated as easier to pronounce than those wandering outward (Bakhtiari et al., 2016); and more recently, that training words with each consonantal direction may affect the in-out preference (Körner et al., 2019). Nevertheless, evidence supporting the original oral approach-avoidance argument

persists and needs to be conciliated with this new evidence supporting an alternative oral motor-fluency explanation.

The fluency explanation fails to predict a set of modulations of the in-out effect reported over the past years. For example, the effect was shown to be present only when naming edible products, that is, words congruent with the ingestion function of the oral apparatus (Godinho, Garrido, Zürn, & Topolinski, 2018) and seems to be pertinent for warmth, but not for competence-related judgments (Garrido, Godinho, & Semin, 2019). Additionally, contrary to what was observed in support for an oral motor-fluency mechanism for the mere exposure effect (Zajonc, 1968; reported modulation Topolinski & Strack, 2009) and for the false-fame effect (Jacoby et al., 1989; idem, Topolinski & Strack, 2010) - the in-out effect could not be disrupted by oral motor interference (Lindau & Topolinski, 2018). Moreover, even in the first work arguing in favor of a fluency explanation for the in-out effect, fluency failed to fully mediate the in-out effect in a crucial mediation test (Bakhtiari et al., 2016). Finally, in a recent work showing that training articulation-sequences modulates the effect (Körner et al., 2019), training 60 outward-wandering words (Experiment 1) led to a marginally significant attenuation of the in-out effect, and only with intense training (120 outward-wandering words, Experiments 2 and 3) it was possible to reverse it. Such evidence suggests that the in-out effect can be modulated or even overruled by (intense) fluency manipulations, simply because fluency effect sizes are larger, but that its underlying mechanism remains elusive.

The current research further tests the fluency explanation as the underlying mechanism for the observed preference for inward when compared to outward-wandering words.

Overview of the Present Research

The first set of experiments presents inward/outward words with varying degrees of perceptual fluency manipulations. Common readability manipulations play with font type (e.g., Carr, Rotteveel, & Winkielman, 2016; Novemsky, Dhar, Schwarz, & Simonson, 2007), figure-ground contrast (e.g., Unkelbach, 2007), as well as other features such as the amount (e.g., Tsai, Klayman, & Hastie, 2008) or familiarity of the information (e.g., Zajonc, 1968).

Relative preference for inward versus outward words was measured as a function of established fluency manipulations such as font type (Experiments 1a and 1b), and figure-ground contrast (Experiments 2a and 2b).

Our predictions were grounded in Whittlesea's (Experiment 5, 1993) contrasting processing fluency manipulated by previous exposure (similar to the training manipulation in Körner et al., 2019) and conceptual fluency, manipulated with a semantically predictive context. The results revealed that these two fluency sources produced an additive effect on pleasantness ratings because "fluency from multiple sources has greater impact on the pleasantness decision than fluency from one source" (1993, p.1245). The cumulative impact of fluency manipulations was also reported in Reber, Zimmermann and Wurtzs' work (2004) showing that words, normally associated with greater fluency (in comparison with nonwords), are judged as having higher contrast, and larger font sizes. These results indicate that the greater fluency resulting from a particular fluency source (previous exposure to particular letter combinations) can be extended to judgments of fluency regarding other fluency sources.

Our rationale was built upon the assumption that if the in-out effect rests upon a fluency mechanism, the introduction of another fluency source (visual) should have a direct additive effect on participants' preference. Specifically, words benefiting from two simultaneous fluency sources (e.g., inward words with high visual fluency) should be rated higher than in any other condition (the reverse being outward wandering words presented in the low visual fluency condition).

Finally, previous research shows that perceptual fluency effects work best (if not solely) in within-participants designs (Wänke & Hansen, 2013, 2015). The extension of this evidence to motor fluency is supported by the acknowledgment that different fluency sources have similar impact on affective judgments (Schwartz, 2004). Nonetheless, there is already some evidence available suggesting that motor or processing fluency manipulations are not effective with between-participants designs.

Classical work about how letter-dyads typed with different fingers (vs. same-finger) are preferred by skilled typists (but not by novice typists), suggests that the previous training in typing particular letter-dyads increases the perceived motor fluency and affects the affective judgments of such keyboard sequences (Beilock & Holt, 2007; Van den Bergh et al., 1990). However, most of these experiments measured whether skilled or novice-typists significantly prefer different-finger letter combinations vs. same-finger, and raw liking-scores, that could allow comparisons between-groups, are not available. More recently, while researching whether fluency arising from the motor system also impacts recognition memory, Yang, Gallo and Beilock (2009) asked both skilled-typists and novices whether they liked

each letter dyad (*yes* or *not* liking rating) and conducted a 2 (typing expertise: expert, novice) X 2 (dyad type: same-finger, different-finger) ANOVA to compare directly the expert–novice difference. The absence of a main effect of typing expertise in the observed ratings suggests that these motor-fluency manipulations are only effective within-participants. In other words, the fluency advantage is dependent upon the comparison between the trained and the untrained letter-dyads combinations and when that comparison is not possible, motor-fluency effects on preference judgments are not observed.

Experiments 3 and 4 present an innovative between-participants test of the in-out effect. Departing from previous evidence, we predict that if the in-out effect results from a fluency mechanism (that requires the simultaneous exposure to the contrasting fluency conditions), in a between-participants manipulation of consonantal articulation direction, inward and outward words should be equally preferred.

Experiments 1a, 1b, 2a and 2b: The role of Perceptual Fluency

Experiments 1a and 2a had a between-participants design - 2 (fluency: high vs. low; between) X 2 (articulation direction: inward vs. outward; within). In Experiments 1b and 2b, all manipulations were within-participants - 2 (fluency: high vs. low; within) X 2 (articulation direction: inward vs. outward; within). Inward and outward words were presented with a fluent versus disfluent font (1a, 1b), or, with a high versus low color figure-ground contrast (2a, 2b).

Experiments 1a and 1b

Method

Power analysis. Sample sizes were determined based on previous research about the in-out effect in Portuguese speaking samples (Godinho & Garrido, 2017). The effect sizes from the four experiments in that work were averaged (with sample size weighting), $d_z = .40$. With a power of .95, $\alpha = .05$, the required sample size was 84. The calculation of effect sizes based on experiments using similar fluency manipulations (e.g., Alter, Oppenheimer, Epley, & Eyre, 2007; Carr et al., 2016) would require smaller samples. Because data collection was set to stop at the end of the day the sample reached the required number of participants, the sample in Experiment 1b is larger. The final sample in Experiment 1a was slightly smaller, because some participants were excluded. Nevertheless, no preliminary analyses were made prior to the end of the data collection period.

Participants. Seventy-nine Portuguese-speaking adults (41 female, M_{age} = 45, *SD* = 10.5, $N_{\text{high fluency condition}}$ = 35) were included in the final sample for Experiment 1a and 95 (69 female, M_{age} = 39, *SD* = 13.9) in Experiment 1b. Prior to any data analysis, five participants in Experiment 1a and four in Experiment 1b were discarded for not being Portuguese native speakers. Participants were randomly distributed across experiments and conditions.

Design. The key manipulation in Experiments 1a and 1b was the font (high vs. low fluency fonts) in which the stimuli (inward vs. outward words) were presented. To examine the role of fluency in articulation direction, explicit preferences for words presented in each condition were measured between (1a) and within-participants (1b). Materials were the same in both experiments.

Materials and procedure. All manipulations and measures are reported. Stimuli were randomly selected from a pool validated for Portuguese phonation (Godinho & Garrido, 2016). For each word a high-fluency and low-fluency version was created using Calibri (high fluency) and Blackadder ITC (low fluency, Oppenheimer & Frank, 2008) fonts. Calibri font was chosen because of its visual size equivalence to the disfluent font.

In Experiment 1a, participants rated 48 randomly selected nonsense words (24 inward; 24 outward) presented either in a fluent or a disfluent font. In Experiment 1b, participants rated 48 random stimuli composed of 12 inward words presented in a fluent font; 12 inward words in a disfluent font; 12 outward words in a fluent font and, 12 outward words in a disfluent font.

Apart from the between/within-participants design, the procedure was identical. An invitation was sent by email for participants to join a research about the role of distracting elements in stimuli evaluation. After following a link leading to the Qualtrics platform and agreeing with the informed consent, participants were asked to provide quick and spontaneous ratings. All words were presented in random order. To measure words' relative preference, participants rated each word in a Likeability scale, ranging from 1- *I do not like it at all*, to 10 - *I like it very much*. Afterwards, besides demographics (gender, age and professional occupation) and native language, participants were further required to reason about their ratings and whether they had detected anything conspicuous or suspicious in the words.

Results and Discussion

None of the participants revealed a valid suspicion about the in-out manipulation.

In Experiment 1a, a clear main effect of articulation direction emerged, $F(1,77) = 16.35$, $p < .001$, $\eta_p^2 = .18$, 90% CI [.06, .30]. Participants preferred inward ($M = 3.59$, $SE = .23$) over outward words ($M = 3.42$, $SE = .23$). To provide relevant data for future meta-analysis about the in-out effect, pairwise comparisons were also computed, $t(78) = 3.94$, $p < .001$, $d_z = .45$, 90% CI [.25, .64]. No main effect of fluency was observed, $F(1,77) = 2.10$, $p = .151$, meaning that the difference between the ratings of the words presented in the fluent font ($M = 3.18$, $SD = 1.83$) and in the disfluent font ($M = 3.83$, $SD = 2.09$) was not significant, $t(77) = -1.45$, $p = .151$. The interaction between fluency and consonant wandering was also not significant, $F(1,77) = 1.14$, $p = .289$, (high-fluency condition: $M_{inward} = 3.29$, $SE = .34$; $M_{outward} = 3.07$, $SE = .34$; low-fluency condition: $M_{inward} = 3.89$, $SE = .30$; $M_{outward} = 3.77$, $SE = .30$).

In Experiment 1b, inward-wandering words ($M = 3.56$, $SE = .16$) were again preferred over outward-wandering ones ($M = 3.45$, $SE = .16$), $F(1,94) = 10.53$, $p = .002$, $\eta_p^2 = .10$, 90% CI [.02, .20], $t(94) = 3.25$, $p = .002$, $d_z = .33$, 90% CI [.16, .51]. However, there was also a fluency main effect, $F(1,94) = 40.24$, $p < .001$, $\eta_p^2 = .30$, 90% CI [.18, .41]. Words presented in Calibri ($M = 4.08$, $SE = .20$) were preferred to those presented in the disfluent font ($M = 2.94$, $SE = .17$). Importantly an interaction effect, $F(1,94) = 7.78$, $p = .006$, $\eta_p^2 = .08$, 90% CI [.01, .17], revealed that the in-out effect was not observed in the low-fluency condition ($M_{inward} = 2.95$, $SE = .17$; $M_{outward} = 2.92$, $SE = .17$, $t(94) = 1.08$, $p = .284$), but it emerged in the high-fluency condition ($M_{inward} = 4.17$, $SE = .20$; $M_{outward} = 3.99$, $SE = .20$, $t(94) = 3.65$, $p < .001$, $d_z = .37$, 90% CI [.20, .55]).

The in-out effect was observed in both experiments. While in Experiment 1a the main effect of fluency was not observed, confirming previous research showing that between-participants fluency manipulations are not effective (e.g., Hansen, Dechene, & Wänke, 2008); In Experiment 1b, there was a significant main effect of fluency, with higher ratings for all the stimuli presented with a fluent font. Critically, the additive effect of the two manipulations was not found: the preference for inward-words was observed in the fluent font condition but was blocked in the disfluent font. If the in-out effect is a fluency effect, the preference for inward-wandering consonantal strings should have been present even in the disfluent condition.

Nevertheless, an alternative explanation is also possible, namely that in the disfluent condition the font was so hard-to-read, that participants were not able to encode the phonetic

features of the words presented, and thus disrupting the word articulation manipulation. Experiments 2a and 2b were designed to clarify these results.

Experiments 2a and 2b

To further test the role of fluency in shaping the in-out effect, in Experiments 2a and 2b another well-established fluency manipulation was used: figure-ground contrast.

Method

Power analysis. Effect sizes in experiments using the figure-ground contrast manipulation (e.g., Reber & Schwarz, 1999; Unkelbach, 2007) are smaller than those observed with the previous fluency manipulation. Therefore, a power of .95, $\alpha = .05$ and the smallest effect size obtained in the last set of experiments for the in-out effect ($\eta_p^2 = .10$) determined a sample size of 124 participants. The size of our samples was slightly larger because data collection was set to stop at the end of the day each sample reached the required number participants. No preliminary analyses were made.

Participants. One-hundred-and-thirty-four Portuguese-speaking adults (70 female, $M_{age} = 49$, $SD = 10.5$, $N_{\text{high fluency condition}} = 65$) were included in the final sample in Experiment 2a, and 130 (81 female, $M_{age} = 48$, $SD = 10.1$) in Experiment 2b. Prior to any data analysis, four participants were discarded in Experiment 2a: one for being bilingual and three for not being Portuguese native speakers. In Experiment 2b, three participants were excluded for not being Portuguese native speakers. Participants were randomly distributed across experiments and conditions.

Design. Again, fluency was manipulated both between (2a) and within-participants (2b). Materials were the same for both experiments. Two fluency conditions (high and low) manipulated the figure-ground contrast in which inward and outward words were presented.

Materials and procedure. High contrast has been shown to increase perceptual fluency (Reber & Schwarz, 1999; Reber, Zimmermann, & Wurtz, 2004). All words were presented in the same fluent font (Calibri, e.g., Unkelbach, 2007) with red letters against the white background. However, while in the high fluency condition the color had a high contrast, in the low fluency condition it had a low contrast. Contrast was manipulated with RGB (red, green, blue) component of the red color, using the combination of R _255, G_100, B_100 for high contrast (fluent) and R_255, G_240, B_240 for low contrast (disfluent).

The same large word pool from Experiments 1a and 1b was used (participants rated a subsample of 48). Each word was duplicated across high-fluency and low-fluency versions. Aside from the materials being prepared differently (font vs. figure-ground contrast) the procedures from the previous experiments were replicated: number of stimuli rated, number of stimuli per condition, sample recruitment, instructions as well as the rating scale, demographic and control questions.

Results and Discussion

Control questions revealed no valid suspicion about the in-out manipulation.

Results from Experiment 2a presented a clear main effect of articulation direction, $F(1,132) = 41.30$, $p < .001$, $\eta_p^2 = 0.24$, 90% CI [.14, .34], $t(133) = 6.46$, $p < .001$, $d_z = .56$, 90% CI [.40, .71]. Participants preferred inward ($M = 3.65$, $SE = .14$) over outward words ($M = 3.45$, $SE = .14$). No main effect of the fluency condition, $F(1,132) = .01$, $p = .942$, with similar ratings for words presented in the fluent ($M = 3.54$, $SD = 1.72$) and in the disfluent font ($M = 3.56$, $SD = 1.58$, $t(132) = -.072$, $p = .942$), nor interaction effects were observed, $F(1,132) = .28$, $p = .598$ (high-fluency condition: $M_{inward} = 3.64$, $SE = .21$; $M_{outward} = 3.45$, $SE = .21$; low-fluency condition: $M_{inward} = 3.67$, $SE = .20$; $M_{outward} = 3.45$, $SE = .20$).

In Experiment 2b, inward-wandering words ($M = 3.45$, $SE = .15$) were preferred over outward wandering ones ($M = 3.36$, $SE = .15$), $F(1,129) = 9.91$, $p = .002$, $\eta_p^2 = 0.07$, 90% CI [.02, .15], $t(129) = 3.18$, $p < .001$, $d_z = .28$, 90% CI [.13, .43]. As in Experiment 1b, there was a fluency main effect, $F(1,129) = 39.23$, $p < .001$, $\eta_p^2 = 0.23$, 90% CI [.13, .33]. Words presented with high figure-ground contrast ($M = 3.63$, $SE = .17$) were preferred to words presented with low contrast ($M = 3.18$, $SE = .15$). Importantly there was a marginal interaction effect, $F(1,129) = 3.37$, $p = .059$, $\eta_p^2 = 0.03$, 90% CI [.00, .09], indicating that the in-out effect was attenuated in the high fluency condition. This effect indicated that while inward wandering words ($M = 3.25$, $SE = .15$) were preferred to outward wandering ones ($M = 3.11$, $SE = .15$) in the low fluency condition, $t(129) = 3.43$, $p < .001$, $d_z = .30$, 90% CI [.15, .45], the preference for inward ($M = 3.65$, $SE = .17$) over outward words ($M = 3.60$, $SE = .17$) was not observed in the high fluency condition, $t(129) = 1.33$, $p = .187$. In line with the results obtained in Experiments 1a and 1b, the main effect of consonantal wandering direction persisted. Again, there were no main or interaction effects of fluency in Experiment 2a, and a main effect of fluency and an interaction emerged in Experiment 2b.

Experiments 1a and 2a, replicated previous literature showing that fluency effects do not hold-on in between-participants designs. Such findings do not contribute directly to the present argument, so they will be further addressed in Experiments 3 and 4.

The distinct interaction patterns between articulation direction and fluency condition (Experiments 1b and 2b) are at odds with simple fluency account of the in-out effect. In Experiment 1b the fluency manipulation disrupted the in-out effect in the low fluency condition while in Experiment 2b, the fluency manipulation (marginally) disrupted the in-out effect only in the high fluency condition. The confirmation of a fluency hypothesis was dependent upon additive effects, where all fluency manipulations would either increase or decrease word preference. Since Experiments 1b and 2b are sufficiently powered, the distinct interaction patterns found seem to support our argument that the relation between the in-out effect and fluency is not as straightforward as a mere fluency explanation for the in-out effect would predict.

To further support this conclusion, an alternative design could have been used to contrast the effects directly. One example could have been to ask participants to rate inward-wandering words in disfluent font and outward-wandering words in a fluent font. If the in-out effect results from a fluency-mechanism, it would be expected that the competing fluency manipulations would cancel each other and the differences in preference for inward and outward words would not emerge. Such design (and similar ones) would present, however, one crucial flaw: Fluency manipulations have larger effect sizes than the in-out effect (regardless of what the real underlying mechanism for the in-out effect might be). Therefore, we argue that a decisive way to test whether the in-out effect is based in a fluency-mechanism would be to test it in a condition where fluency manipulations are not effective, that is, with a between-participants design.

Experiments 3 and 4

In the previous experiments we systematically addressed the complex interactions between fluency and the in-out effect. These two arguable sources of fluency did not produce systematic additive effects in the preference for inward and outward wandering words. Moreover, Experiments 1a and 2a conveniently demonstrated that fluency manipulations are not effective in between participants' designs, suggesting a simple but parsimonious way to test the role of fluency as the potential trigger of the in-out effect. If fluency manipulations are only effective when the contrasting fluency conditions are presented simultaneously (e.g.,

Hansen et al., 2008), and the in-out preference results from the increased fluency of inward words, when compared to outward wandering words, the in-out effect should not be observed in a between-participants design.

Method

Power analysis. Due to the novelty of this test, in Experiment 3 we decided to force a large sample and defined a total of 125 participants for each articulation-direction condition (N_{Total} = 250). However, the final sample was slightly smaller because a few participants were excluded.

Experiment 4 was designed as a pre-registered replication study (Godinho & Garrido, 2019). A power of .90, α = .05 and the effect size obtained in Experiment 3 for the in-out effect (*d* = .28) determined a sample size of 440 participants.

Prior to any data analysis, seven participants were discarded in Experiment 3 for not being Portuguese native speakers and two for being bilingual. In Experiment 4 no exclusions were made.

Participants. Two-hundred-and-forty-five native Portuguese-speaking adults (154 female, M_{age} = 41, *SD* = 11.0, $N_{\text{InwardCondition}}$= 120) were included in the final sample in Experiment 3 and 440 native English speaking-adults (279 female, M_{age} = 36, *SD* = 12.7, $N_{\text{InwardCondition}}$= 220) in Experiment 4.

Participants were randomly distributed across conditions.

Design. To examine the role of articulation direction we asked participants to rate either inward or outward words (2 Consonantal Direction; between).

Materials and procedure. All manipulations and measures are reported. Participants in both experiments rated 30 inward or 30 outward words presented in a random order. In Experiment 3 the words were randomly selected from the same stimulus pool validated for Portuguese phonation used in the previous experiments (Godinho & Garrido, 2016), while for Experiment 4, conducted in English, words were randomly selected from a stimulus pool validated for English phonation (Topolinski et al., 2014). All the procedures were similar to the ones used in the previous experiments.

Results and Discussion

Again, no one reported a valid suspicion about the in-out manipulation.

In Experiment 3, a clear main effect of articulation-direction emerged, $t(243) = 2.23$, $p = .035$, $d = .14$, 90% CI [.04, .25]. Participants preferred inward ($M = 4.00$, $SD = 1.57$) over outward-wandering words ($M = 3.60$, $SD = 1.41$).

The results from Experiment 4 replicated the main effect of articulation-direction, $t(438) = 2.57$, $p = .010$, $d = .13$, 90% CI [.04, .20]. Participants preferred inward ($M = 4.71$, $SD = 1.36$) over outward-wandering words ($M = 4.36$, $SD = 1.50$).

General Discussion and Conclusion

The role of fluency as an alternative account for the in-out effect was tested by probing the in-out effect against classical fluency manipulations and, for the first time, by examining it in a between-participants design. While the effect of fluency manipulations was only observed in within-participants designs, the in-out effect was observed across all experimental designs. Critically, the additive effects that a fluency-explanation for the in-out effect would theoretically suggest were not observed.

Overall the present evidence speaks against the operation of a fluency mechanism as the origin for the in-out effect, supporting instead, that perceptive fluency manipulations interact with the actual underlying mechanism. Such conclusion supports previous evidence showing an inverse relation between the intensity of the fluency manipulations used and the effect size of the in-out effect (Körner et al., 2019). In other words, as fluency manipulations get stronger, the preference for inward wandering consonantal strings (over outward) decreases or even disappears.

Nevertheless, it may still be the case that the subtle mechanism causing the preference for consonantal sequences that wander inward in the oral cavity results from a deeply rooted fluency-source caused by a lifetime training-experience (of swallowing and pronouncing words), that has a stronger effect than perceptual fluency manipulations (for a review, Silva, Garcia-Marques, & Mello, 2015). However, after being established that different fluency-sources (including those resulting from covert oral-motor simulations caused by word repetition, that is, by training) have equivalent impact on affective judgments, this alternative explanation seems implausible.

Moreover, since the impact of fluency seems to be dependent upon the direct contrast between fluency conditions, the prevalence of the in-out effect observed with a between-participants design also speaks against a fluency explanation as the underlying mechanism. Indeed, in such a design it is not plausible to argue that participants might have had a strong

default comparison anchor for the consonantal wandering direction. While a disfluent font type could be easily recognized in a between-participants design as such, because there is a clear baseline on how a fluent font should look like, the differences in consonantal wandering direction in such a design, are hardly distinguishable. It is difficult to argue that the preference for inward versus outward wandering words, observed in a between-participants design (in the absence of the contrasting experimental condition), derives from participants' ability to recognize and process these differences.

Acknowledging that the in-out effect fails to behave as any other fluency source and suggesting that it results from a mechanism other than fluency is likely to guide future research endeavors namely by emphasizing the need for further the empirical examination of the originally proposed mechanism of oral approach-avoidance.

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3. POSSIBLE MODULATIONS RELEVANT FOR MARKETING PRACTICE

As outlined in the introduction, one of our main goals was to examine how manipulating the articulatory effectors could be influential for consumer decision-making and behavior. Unveiling the best ways to trigger motor-to-affect representations with consonantal sequences is likely to benefit the design of new brand names but may also help promoting brands already in the market more efficiently, saving precious resources. Despite the encouraging results of previous rehearsals made with the in-out effect in the domain of consumer decision-making (for a review, Topolinski, 2017), previous evidence also suggested some circumstances under which the effect might fail to deliver a competitive advantage (e.g., Topolinski & Boecker, 2016).

For that reason, in the present chapter we addressed three boundary conditions that are likely to threaten the effective application of the in-out effect to branding and advertising. Namely, that the effect might be sensitive to the objects' oral affordances but not to their valence; that inward-wandering names might be overruled by highly suggestive visual information simultaneously presented; or that the in-out preference leads to increased warmth-related but not competence-related judgments.

Taken together the findings reported across 14 experiments (N_{Total} = 2550) show that (only) edible products named with inward consonantal sequences are likely to benefit from increased preference, independently of their valence; such beneficial impact will not be faded by competitive visual information provided by the logo or other packaging materials traditionally used to market products attractively and; that this preference may be extended to a marketing context. Indeed, despite inward names did not present a competitive advantage for competence judgments of neutral targets or service providers, our results suggest that in real life scenarios, where the service providers are distributed across professional groups traditionally associated with a warmth or a competence dimension, using inward wandering names is likely to induce consumers preference. A similar pattern was observed regarding hypothetical food products that were systematically judged as more hedonic and utilitarian when named inward.

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Oral kinematics: Examining the role of edibility and valence in the in-out effect*

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Abstract

Previous research has revealed a stable preference for words with inward consonantal-articulation patterns (from the front to the back of the mouth; e.g., BENOKA), over outward-words (from the back to the front; e.g., KENOBA). Following the oral approach-avoidance account suggesting that the *in-out effect* is due to the resemblance between consonantal-articulations patterns and ingestion/expectoration, recent findings have shown that when judging inward-outward names for objects with particular oral functions, valence did not modulate the effect while the oral function did. To replicate and examine further the role of edibility and valence in shaping the in-out effect, we asked participants (N = 545) to rate inward and outward names for edible and non-edible products while controlling for valence. Results revealed that the motor-to-affect link was only observed for edible products, regardless of valence.

Keywords: in-out effect, oral kinematics, approach-avoidance, valence, edibility

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Recent research on oral kinematics in language has shown that people prefer words with certain articulation patterns. This effect has been explored both for vowels (Rummer, Schweppe, Schlegelmilch, & Grice, 2014) and consonants (Topolinski, Maschmann, Pecher, & Winkielman, 2014). Specifically, regarding consonantal articulation, the so-called *in-out effect* refers to a robust preference for words whose consonantal articulation spots wander from the front of the mouth to the back (inward) compared to words with the opposite direction (outward). The word PATEKO, for example, presents a front-rear consonantal stricture dynamic. To pronounce it, the consonantal sequence recruits muscle strictures wandering inward, that is, from the front (lips) to the back of the mouth (rear tongue). The word KATEPO has the exact same consonantal phonemes, but arranged in the reverse order. That is, it features outward muscle strictures, from the back of the mouth (rear tongue) to the lips. This preference for inward over outward wandering words has been demonstrated in a wide variety of experimental settings (e.g., Godinho & Garrido, 2017; Lindau & Topolinski, 2018a, 2018b; Silva & Topolinski, 2018; Topolinski & Boecker, 2016a; Topolinski, Zürn, & Schneider, 2015) and across different languages and research groups (Godinho & Garrido, 2016; Kronrod, Lowrey, & Ackerman, 2014; Topolinski & Bakhtiari, 2016).

Although being robust and replicable, there is an ongoing debate about the mechanisms underlying this effect. Originally, it was proposed that the effect is based on ingestion-related multi-modal associations between articulation and food intake (Topolinski et al., 2014; Topolinski, 2017), suggesting a motor-to-affect link that is grounded in the resemblance between the articulation-patterns and vital oral functions (Rozin, 1996). Specifically, inward successions of articulation actions resemble positive oral acts like eating and drinking, while outward successions resemble aversive oral motor actions during expectoration (like coughing or even vomiting). Accordingly, it was hypothesized that these motor resemblances between articulation movements and ingestion-related oral acts trigger the respective affective connotations thereby making inward words more positive than outward words. Supporting this conjecture, it has been shown that inward compared to outward naming of foods makes dishes more appealing (Topolinski & Boecker, 2016b) and even increases the intake of these foods (Rossi, Pantoja, & Borges, 2015; Rossi, Pantoja, Borges, & Werle, 2016, 2017).

Despite some attempts to find alternative explanations such as fluency (e.g., Bakhtiari, Körner, & Topolinski, 2016), the initial "oral approach-avoidance" hypothesis considering multi-modal associations between articulation movements and oral ingestion-

related acts remains the primary theoretical explanation and is used in most of the recent dozen or so publications on this effect (see references above). Interestingly, this explanation has not undergone many thorough tests. One obvious way to test this assertion is to manipulate the meaning of the objects that are denoted by inward and outward words. If the in-out effect is based on a multi-modal overlap between articulation movements and eating-related mouth movements, then these associations should be stronger when the denoted object is eating-related, and they should be weaker when the denoted object is not eating-related. This is because the semantic meaning of the denoted object (for instance, when the participant thinks that the word BAKU refers to a lemonade) already activates eating-related representations that should strengthen the associative link between articulation movements and eating-related ingestive acts.

The only paper starting to test this logic is Topolinski, Boecker, Erle, Bakhtiari and Pecher (2017) who manipulated the meaning of objects denoted by inward and outward words. For instance, they found a strong in-out effect when the word denoted an ostensible lemonade brand, but a diminished effect when it denoted an ostensible name for a toxic chemical. However, in that paper, across eight experiments, valence of the denoted objects was a strong confounding factor (a toxic chemical is simply more negative than lemonade), and the authors struggled to find relevant exemplars of objects that orthogonally varied in valence and oral use. The objects chosen presented either a valence asymmetry that was not balanced between conditions (e.g., lemonade – positive edible, vs. toxical chemicals – negative non-edible) or involved confounds (e.g., mouthwash associated with an ingestion-related affordance and not expectoration as the authors expected). In sum, the studies reported in that paper did not find systematic modulations of the in-out effect that occurred reliably as a function of the eating-related meaning of an object that was denoted either with an inward or outward word.

To overcome these confounds, the present study manipulated the eating-relatedness of objects denoted by inward and outward words while carefully keeping the valence constant (instead of orthogonally manipulating the valence). By doing so, we sought to present a valuable contribution to the ongoing debate about the mechanisms underlying the in-out effect. Specifically, we asked participants how well a given word would be a good brand name for edible and non-edible products. If the driving mechanism is eating-related, then participants should report a preference for inward over outward brand names for edible but not for non-edible products.

Method

Pre-Test of the Products' Valence

We tested the valence for different products in a pilot test with an independent group of Portuguese speaking participants (N = 51). Participants were recruited online through emails collected randomly and asked to rate the following products on a scale from 1 (negative) to 10 (positive). Edible: water (Portuguese ÁGUA), beer (Portuguese CERVEJA), and fuzzy-drink (Portuguese REFRIGERANTE); and, non-edible: shampoo (Portuguese CHAMPÔ), detergent (Portuguese DETERGENTE), and bleach (Portuguese LIXÍVIA). The mean valence ratings obtained were: water M = 9.65, SD = 1.02, beer M = 5.94, SD = 2.64, fuzzy-drink M = 3.73, SD = 2.20, shampoo M = 7.08, SD = 2.25, detergent M = 6.33, SD = 2.26 and bleach M = 5. 10, SD = 2.69. Across the products, the valence of the edible (M = 6.44, SD = 1.22) and the non-edible (M = 6.17, SD = 1.87) products did not differ significantly, $t(50) = .902$, $p = .37$.

Power-Analysis

Power calculations were made using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007). Conservatively assuming the small effect size of the 2 X 2 interaction obtained in Topolinski and colleagues Experiment 1b (2017), $\eta p^2 = 0.03$ (Cohen, 1988), with a power of .85 and $\alpha = .05$, the required sample size was 76 participants. To ensure that the potential exclusion of participants would not compromise the sample size, we increased the calculation by 10% (N = 84). Furthermore, since the six product types would be manipulated between participants, we set this sample size for each condition being the total sample size estimated to be $N_{required}$ = 504. Because data collection was set to stop at the end of the day it reached the required number of participants, our sample had slightly more participants. All the manipulations, measures used, and data exclusions are reported.

Participants and design

The final sample included N = 545 (350 female; M_{age} = 41 years, SD_{age} = 11) native Portuguese speaking participants, recruited online and randomly distributed across six conditions (product type - three edible, three non-edible products). Twelve participants were excluded: 11 for not being Portuguese native speakers and one bilingual.

Materials and procedure

Participants received an email invitation to join a survey about brand evaluation. As with the pre-test, the email invitations were sent to email addresses collected randomly online in websites such as blogs with giveaways, university contacts' pages, and discussion groups. After entering the Qualtrics platform, and providing their informed consent, participants were asked to silently read potential brand names and to rate them as quick and spontaneously as possible. For each word participants answered the question - *How well does this name match with this product?* - on a scale from 1 *not at all* to 10 *very much*.

Each participant rated a subset of 20 words (10 inward and 10 outward) randomly selected from a stimulus pool of 80 words (40 inward 40 outward) tested for Portuguese phonation (Godinho & Garrido, 2016). Please note that in linguistics there is also the notion of front and back vowels, and therefore one might question whether vowel direction was not manipulated. However, previous research has shown that vowels do not evoke an in-out effect (Topolinski & Boecker, 2016a), probably because they involve larger muscle structures and articulation spots that are not that well-circumscribed.

Furthermore, each participant rated only one of the six product types, either edible or non-edible. The edible products evaluated were water, beer and fuzzy-drink, the non-edible were shampoo, detergent and bleach. Besides demographic questions and native language, participants were asked, at the end, to justify their ratings and whether they found the words suspicious.

Results

Suspicion Check

None of the participants could correctly identify the articulation manipulation or reported any valid suspicious about the survey rationale.

Main Effects

A 2 (product type: edible vs. non-edible; between) X 2 (articulation direction: inwards vs. outwards; within) factorial mixed-model design revealed a main effect of articulation direction, $F(1,543) = 10.483$, $p = .001$, $\eta_p^2 = .019$, 90% CI [.005, .042], indicating that, overall, inward words ($M = 2.37$, $SE = .81$) were preferred over outward words as product names ($M = 2.30$, $SE = .80$). There was no main effect of product type, $F(1,543) = 1.875$, $p = .172$. Crucially, there was an interaction between product type and articulation direction, indicating that the products' affordance modulated the in-out effect, $F(1,543) = 5.068$, $p =$

.025, η_p^2 = .009 90% CI [.001, .027]. When rating names for edible products, inward wandering words (*M* = 2.32, *SE* = .08) were preferred to outward wandering words (*M* = 2.19, *SE* = .07), *t*(271) = 4.006, *p* < .001, d_z = .24. However, for non-edible products, there was no preference for inward wandering words (*M* = 2.42, *SE* = .09) over outward wandering words (*M* = 2.40, *SE* = .09), *t*(272) = .677, *p* = .499.

To further control for both participant and item effects we fitted a multi-level model to the data using the lme4 package for R (Bates, Maechler, Bolker, & Walker, 2015). Specifically, we regressed the ratings on two contrast coded variables (product type: edible = 0.5, articulation direction: out = 0.5) as well as their interaction. Moreover, we estimated random intercepts and slopes for participants and random intercepts for products and words. Degrees of freedom were approximated with the Satterthwaite procedure implemented in the lmerTest package for R (Kuznetsova, Brockhoff, & Christensen, 2017), which also calculates *p*-values based on this approximation.

In addition to a significant intercept (β = 2.36; *t*(11.23) = 29.02; *p* < .001), this analysis yielded a marginally significant preference for non-edible over edible products (β = -0.30; *t*(2.96) = -2.66; *p* = .078) and, more importantly, a significant preference for inward words over outward words (β = -0.08; *t*(4552.86) = -3.65; *p* < .001). Crucially, the interaction parameter was also significant (β = -0.09; *t*(4552.90) = -2.16; *p* = .031). Therefore, we conducted the regression analysis separately for edible and non-edible products with the same random factors as before. For edible products, the preference for inward over outward product words prevailed (β = -0.12; *t*(3412.27) = -3.965; *p* < .001). In contrast, for non-edible, inward words were not significantly preferred over outward words (β = -0.03; *t*(327.52) = -1.05; *p* = .297).

In sum, these results suggest that inward words are preferred over outward words only if they are associated with edible products. In addition, the analysis points toward a preference of non-edible over edible products in the current sample. However, the random slopes for edible vs. non-edible products showed a considerable amount of variance, which indicates that this preference was shared among all our participants.

Product Level Comparisons

We recalculated the in-out effect based on the individual ratings given to each product. Table 1 summarizes data from the pairwise comparisons run for each product and

shows that the preference for inward wandering words prevails for edible but not for non-edible products. Water presented a clear exception.

Such exception main be due to a spurious statistical fluctuation (Pashler & Harris, 2012), but it can also be related to the ambivalent function of this object. Both beer and fuzzy-drinks are highly palatable and have exclusively drinking-related functions. Water on the other hand, is also used for non-oral purposes (e.g., washing, watering plants). In the face of the valence ratings this null-finding is of special conceptual interest: the most positive product did not trigger an in-out effect, which further speaks against valence modulating the in-out effect.

Table 1: Pairwise comparisons per product

Product			*M (SE)*	*Test*
Edible	Water	In	2.01 (.13)	$t(77) = -1.074$, $p = .286$
		Out	2.06 (.13)	
	Beer	In	2.70 (.15)	$t(82) = 5.323$, $p < .001$, $d_z = .58$
		Out	2.36 (.13)	
	Fuzzy-Drink	In	2.25 (.12)	$t(110) = 2.159$, $p = .033$, $d_z = .20$
		Out	2.15 (.12)	
Non-edible	Shampoo	In	2.79 (.20)	$t(81) = 1.035$, p = .304
		Out	2.72 (.19)	
	Detergent	In	2.08 (.11)	$t(109) = -.712$, p = .472
		Out	2.11 (.12)	
	Bleach	In	2.52 (.15)	$t(80) = .875$, $p = .384$
		Out	2.46 (.15)	

Discussion

In a highly powered experiment, we replicated both the in-out effect (Topolinski et al., 2014) as well as the recent findings about its' interplay with ingestion-related features of objects (cf., Topolinski, et al., 2017). Going beyond earlier attempts, however, we controlled for possible valence differences between eating-related and eating-unrelated objects. We found that participants preferred inward words more than outward for edible products (even with an effect size very close to earlier publications, $d_z = 0.24$), but no such effect for non-edible products. This interaction cannot be attributed to valence, since we kept valence of the

denoted products comparable between edible and non-edible products, and there was also no main effect of product type in the resulting preferences (it was not the case that, overall, non-edible products triggered lower ratings).

This data provides one of the very few (cf., Topolinski et al., 2017) tests of the eating-related explanation of the in-out effect that is used by most of the recent publications in this domain, stimulating further research that manipulates eating-related features of denoted objects, such as palatability, caloric content, and healthiness. Furthermore, the present data shows a clear boundary condition of the in-out effect that has been proven so stable and invulnerable in past experiments (e.g., Lindau & Topolinski, 2018a): it does not occur when the denoted object is non-edible. This boundary condition also presents a highly relevant implication for marketing and managerial application of the in-out effect to branding: Using inward articulation to foster positive consumer attitudes towards products might be futile for non-edible products.

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Branding with the in–out effect: The impact of consonantal articulation on brand evaluation*

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Abstract

Recent research has shown that mouth movements, produced even during silent reading, can affect stimulus evaluation. Words featuring systematic wanderings of consonantal stricture spots ranging from the front to the rear of the mouth (inward) are preferred to words with wanderings in the opposite direction (outward). In four experiments, the authors extended this in-out effect from a basic laboratory setting to a more ecologically relevant domain and examined the boundary conditions of possible applications to marketing. In this research, the inward/outward-words presented were embedded in common brand imagery such as labels, logos and product packages. Either with plain graphic information or with more visually informative packaging, inward names were always preferred (all *p-values* < .001). These results indicate that concurrent information that competitively feeds into the preference judgment, did not have diagnostic value when compared to the articulation direction. Such prevalence of the effect even when embedded in more complex stimulus, emphasizes the relevance of investigating oral kinematics effects and the need to further research other sensorimotor phenomena in consumer behavior.

Keywords: approach-avoidance; branding; oral articulation; embodiment

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Approach actions towards positive stimuli, and more importantly avoidance from negative stimuli seem to constitute survival mechanisms that facilitate the detection and reaction to sensory inputs. Several studies have been priming approach and avoidance motivational states showing that specific movements, concordant with either approach or avoidance, affect the evaluation of neutral stimuli (e.g., Cacioppo, Priester, & Berntson, 1993; Centerbar & Clore, 2006). For example, when participants perform (e.g., arm-flexion) or experience (e.g., viewing a target moving closer) approach behavior, they react faster to positive and slower to negative stimuli. In the same way, if asked to engage in avoidance behavior, such as arm-extension or viewing the target moving away, participants react faster to negative and slower to positive stimuli (Chen & Bargh, 1999; Neumann & Strack, 2000). Since most of the previous evidence was not conclusive regarding the nature of the link between affect and approach-avoidance motivational states or behavior, some debate about the automaticity of the phenomena remains (Bargh & Chartrand, 1999; for a review and meta-analysis see Phaf, Mohr, Rotteveel, & Wicherts, 2104). In other words, whether valenced stimuli prime approach-avoidance directly and automatically or indirectly after conscious assessment of the particular situation is yet to be fully known.

Recent research has, however, been successful manipulating approach-avoidance motivational states outside participant's awareness (Topolinski, Maschmann, Pecher, & Winkielman, 2014). This innovative approach known as the in-out effect, uses a simple oral approach-avoidance mechanism mimicking either ingestion or expectoration movements, allowing the examination of sensorimotor experiences' impact in cognition without the influence of affective or motivational expectations. Biomechanically, beyond the speech function, the mouth entails two determinant food-related functions: intake of foods and liquids, performed by swallowing or licking; and expectoration of inedible substances, performed by vomiting or spitting. These movements present a clear evolutionary function: the incorporation of aliments (swallowing) and the expulsion of potentially harmful substances (spitting). The muscular activity necessary to complete both actions involves two distinct sequences of muscle tensions starting either in lips, over the middle and to the rear of the mouth for ingestion (Goyal & Mashimo, 2006) or wandering in the opposite direction for expectoration. As Topolinski et al. (2014) suggested, in the same way as flexor and extensor movements ease concordant motivational states, muscular contractions mimicking either in-going or out-going oral actions trigger, respectively, positive affect/approach or negative affect/avoidance motivational states.

Research conducted with this paradigm has already demonstrated that even in silent reading conditions, participants prefer words whose consonantal articulation wanders inward (from the front to the back of the mouth, as in the word BATECO) to words with opposite wandering (outward, from the back to the front of the mouth, e.g., CATEBO). Since the impact of consonantal articulation direction of words has been demonstrated in several experiments, conducted by Topolinski and colleagues (Topolinski et al., 2014; Topolinski & Boecker, 2016; Topolinski, Boecker, Erle, Bakhtiari, & Pecher, 2017; Topolinski, Zürn, & Schneider, 2015), and extended in a set of replications, by other independent research labs (Godinho & Garrido, 2016; Kronrod, Lowrey, & Ackerman, 2015), it seems safe to assume that inward (outward) words induce approach (avoidance) states and, accordingly, more positive (negative) attitudes.

The motivational explanation proposed, in which inward wandering words are preferred due to their resemblance to the oral-action of ingestion, is theoretically dependent of some sort of sub vocalization process that seems to occur even in silent reading conditions. Such assumption was corroborated by the absence of the in-out effect in aphasia patients, whose impairment is suggested to block or distort pronunciation simulations (Topolinski et al., 2014). Other authors suggest though, that the positive affect evoked by inward wandering words is due to a natural fluency of such phonetic strings. Probably because inward words are easier to read and more frequent in natural language (Bakhtiari, Körner, & Topolinski, 2016).

Regardless of whether the affect is due to more fluency or to a direct motor-affect link, the research conducted on the in-out effect provides significant input to the debate about the automaticity of the link between affect and approach-avoidance. Importantly, it constitutes a promising research avenue to manipulate approach-avoidance without asking participants to engage in conscious and voluntary motor actions. Thus, despite the in-out effect has predominantly been tested in controlled lab settings, it may hold promising outcomes, not only for experimental endeavors in the broader embodiment field, but also in more applied research domains such as consumer behavior.

Naming Brands: From Semantics to Oral Kinematics

Branding has become a hot topic. Evidence about the impact of brands' names in consumers' evaluation of both products and brands is robust (e.g., Yorkston & Menon, 2004) and effective brand naming is already considered a crucial way to build brand equity (Roche, Shrum, & Lowrey, 2015).

After establishing that particular features of the brand name may affect consumers' attitudes, several researchers have attempted to define guiding principles for brand name design, and to isolate the factors that could foster brand memorability and preference (Lerman & Garbarino, 2002; Lowrey & Shrum, 2007; Maheswaran, Mackie, & Chaiken, 1992; Meyers-Levy, 1989). In the last two decades, several researchers from social psychology, linguistics and marketing have examined the impact of suggestive and meaningful names (Keller, Heckler, & Houston, 1998); whether such names should be similar to familiar ones already existing in the market (Bellman, 2005; Kronrod & Lowrey, 2016) or unique (Samu & Krishnan, 2010); if conceptual and perceptual fluency would increase brand evaluation (Lee & Labroo, 2004); if consumers prefer brands whose names include sounds conveying product attributes (Lowrey & Shrum, 2007) or even sounds that present a multimodal correspondence to products' taste, label and package shape (see Spence, 2012, for a review).

In recent contributions to this body of knowledge, oral kinematics researchers have already rehearsed the applications of the in-out effect to brand names. While the in-out effect was initially established by presenting participants with nonsense words, out of any meaningful context, currently the effect is being tested in more applied settings. For example, matching the features of denoted objects, that is, matching the preference for inward or outward-words with oral actions related products that are ingestive - lemonade, mouthwash - or expectorative - chemicals, bubble gum (Topolinski et al., 2017).

In a very recent set of experiments, the in-out manipulation was also tested while additional visual information about products was presented (Topolinski & Boecker, 2016). Participants were asked to rate pictures of very attractive food dishes, as well as less appealing or differentiating images (e.g., wine bottle, juice glass, cheese). These images were labeled either with inward or outward names. Results indicated that, when dealing with vivid and suggestive visual information of food dishes, participants did not reproduce the preference for inward names. It seems that, the palatability cues of the pictorial information provided faded the in-out effect, leading the authors to conclude that such strong visual information on palatability is a boundary condition for the emergence of the effect.

Product expectations are formed upon various elements besides name or actual image. Indeed, since design features composing a brands' visual identity are known to influence consumers' responses and increase purchase intentions, product design has been recognized as a crucial advantage for positioning brands in the market. A large amount of evidence

emphasizes the relevance of features such as the color of a logo (Bottomley & Doyle, 2006), the font type used (Doyle & Bottomley, 2004), the shape of a package (Becker, van Rompay, Schifferstein, & Galetzka, 2011; Velasco, Salgado-Montejo, Marmolejo-Ramos, & Spence, 2014) or its "actionability" cues (Eelen, Dewitte, & Warlop, 2013), just to name a few.

Therefore, when aiming to apply the in-out effect to actual marketing practice, it becomes vital to understand if: the preference for inward wandering names elicited by an approach motivation extends to brand evaluation. Moreover, whether inward wandering brand names generate favorable responses from consumers, even when brands present simultaneously other design features that are known to have a large impact in consumer responses. To examine further applications as well as possible boundary conditions for the emergence of the in-out effect, specifically those that may be relevant for marketing purposes, four experiments examining the in-out effect with varying degrees of brand imagery were conducted.

Overview of the Experiments

Across four experiments, a stimulus pool of 15 inward and 15 outward-words was used to examine the impact of the consonantal articulation direction (inward vs. outward) and visual information on the evaluation of mock brands. In these experiments, participants were asked to evaluate brands presented as simple labels (Experiment 1), logos (Experiment 2), product-packages (Experiment 3) and in a last experiment, the paradigm was extended to the evaluation of products (Experiment 4).

Across all four experiments both consonantal wandering direction and brand imagery were manipulated as within-subjects factors. Inward and outward-words were randomly selected from a stimulus pool of nonsense words (e.g., Inward – VATECO, IPONECA, PANEGU; Outward – CATEVO, IGONEPA, GANEPU), specifically adapted for Portuguese phonation and validated in a set of two high-powered replications (see Godinho & Garrido, 2016, for detailed information). The authors also tested all possible combinations between the 15 inward and 15 outward-words and the four types of labels (Experiment 1), 15 different logos (Experiment 2), and 15 different packages (Experiments 3-4), which resulted in a total of 120 stimuli in the first experiment and 450 in each of the subsequent experiments.

Using a conservative large power estimate (.95) and based on the average effect size (Cohen's d_z = 0.33; Cohen, 1988) obtained in Topolinski & Boecker (2016; Experiments 1 and 3), a priori power analysis (G*Power; Faul, Erdfelder, Lang, & Buchner, 2007) would

indicate that the sample size required to detect the effect would be N = 90. Nevertheless, in order to provide solid evidence for the robustness of the effect, and due to the extensive amount of stimuli being used (each participant only rated 30 stimuli), the experiments were slightly over-powered. A minimum of 90 participants for Experiment 1 and 150 participants for Experiments 2-4 was defined, and data collection was set to stop at the end of the day that each sample reached the defined size. By doing so, some samples became slightly larger.

Data were collected online using Qualtrics platform. Email contacts were randomly collected online and participants received a message inviting them to join a survey about brand evaluation (Experiment 1-3) or about product evaluation (Experiment 4). Each email only received a single invitation to avoid having the same person participating in more than one experiment.

Experiments 1 and 2

The main goal of the first two experiments was to demonstrate that brands presented as inward-words would be preferred over brands presented as outward-words, even when embedded in brand imagery. The first, more conservative experiment, used basic geometric figures, while the second experiment included more detailed logos.

Method

Participants

From the total of participants that agreed to complete both online surveys about brands, three (3%) were excluded from Experiment 1 and two (1.3%) from Experiment 2. In both cases, excluded participants were either non-native speakers of European Portuguese or bilinguals. Since none of the remaining participants reported a valid suspicion of the word manipulation in the final control questions, a total of 97 participants (61 female; *Mean age* = 37.4, *SD* = 12.61) and 151 participants (89 female; *Mean age* = 41.5, *SD* = 13.00) from very diverse professional backgrounds were included in Experiments 1 and 2, respectively.

Materials and Procedures

In the first experiment, inward and outward-words were paired in all possible combinations with four distinct geometrical figures (oval, rectangle, hexagon or triangle) resulting in 120 different stimuli. In the second experiment, the same words were embedded in 15 distinct mock logotypes resulting in 450 different stimuli. The geometric figures used

were selected from Microsoft Office basic shapes. Mock logotypes were designed online using an open source software (Figure 1).

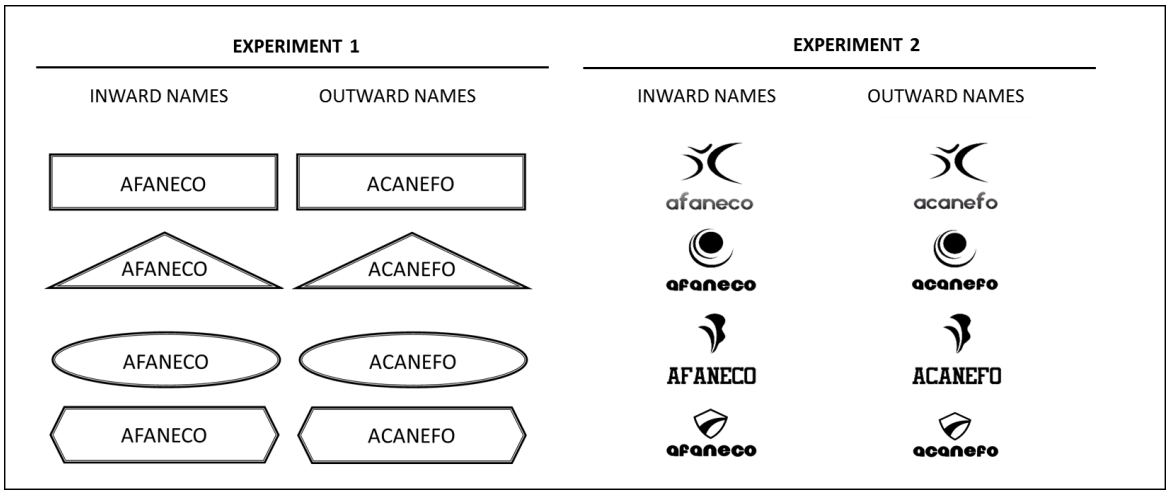

Figure 1. Examples of materials used in Experiments 1 and 2.

Participants in Experiment 1 rated a random set of 30 stimuli from the 120 pairs of words and geometric figures. Participants in Experiment 2 rated a random set of 30 stimuli from the 450 combinations of words and logotypes. The presentation of each stimulus (word-image either geometric shape or logo) was completely randomized for each participant anew.

After entering the survey platform, participants were asked to read and agree with the informed consent. Then, they were informed that their task would be to silently read brands' names, and to rate each brand in a 10-point scale, ranging from 1 (Don't like it at all) to 10 (Like it very much). Each word, embedded in the respective imagery, was presented (one per page) along with the rating scale. Answers were not time-limited and the stimuli were visible until the rating was provided. This was the only task requested from the participants. After rating the 30 brands (15 inward and 15 outward), participants were asked to complete socio-demographic questions such as gender, age, professional occupation and native language. At the end, two control questions were added do detect possible awareness of word manipulation (Godinho & Garrido, 2016).

Results and Discussion

Experiment 1

The in-out effect was replicated even in the presence of additional visual information. A one-way within-subjects ANOVA indicated that brands with inward-words (M = 3.61, SE = .15) were preferred over those with outward-words (M = 3.27, SE = .14), $F(1, 96) = 32.89$, $\eta_p^2 = .255$, $p < .001$, $d_z = .59$, mean difference 95% CI [3.15, 3.72]. No other statistically significant main (geometric shape, $p = .300$), or interaction effects ($p = .144$) were observed. Because participants saw each geometric figure twice, either with an inward or outward brand name, mere exposure effects (Zajonc, 1968) were also ruled out, $t(150) = 1.643$, $p = .103$.

Experiment 2

The results of a one-way within-subjects ANOVA with inward vs. outward-words embedded in more complex visual contexts (logotypes) revealed that, logotypes including inward-words (M = 3.78, SE = .12) were rated more positively than those with outward-words (M = 3.59, SE = .12), $F(1, 149) = 23.47$, $\eta_p^2 = .136$, $p < .001$, $d_z = .40$, mean difference 95% CI [3.45, 3.91]. A main logotype effect was also observed $F(14, 2086) = 6.81$, $\eta_p^2 = .315$, $p < .001$. However, despite a natural preference for some of the random logotypes used, there was no interaction between logo and consonantal articulation direction ($p = .577$). Logotypes received equivalent ratings when presented for the first or the second time, $t(150) = 1.643$, $p = .103$.

Overall, Experiments 1 and 2 replicated the in-out effect in an evaluative task of brand names. Brands with inward names (vs. outward) were preferred, independently of being embedded in more angular or round shapes, or in multi-shaped mock logotypes. No main effects were observed regarding the order of stimuli presentation, suggesting that a second exposure to a particular shape or logotype (albeit combined with different words) did not produce more positive evaluations. The replication of the in-out effect in this new enriched scenario, with stimuli that present concurrent visual information, substantiates the robustness and generalizability of the effect.

Experiments 3 and 4

Experiments 3 and 4 were designed to further establish the in-out effect in the context of a visually complex and ecologically valid scenario, with relevant applications to branding. In these two experiments, product packages similar to those found in consumers' daily lives were used. This type of stimuli constitutes a more severe test of the boundary conditions of the in-out effect. Packages convey concurrent visual information with expected higher diagnosticity. The affordances suggested by different package types (e.g., Lin & Lo, 2015)

and other particular design features of each package, are more likely to interfere with the in-out effect (Reimann, Zaichkowsky, Neuhaus, Bender, & Weber, 2010).

In Experiment 3, the stimuli set was designed to include images of products with inward and outward-words printed in the package surface, while keeping the instructions of the previous experiments (rate brand preference). In Experiment 4, participants were asked to rate the product itself, instead of the brand. This last instruction introduced an important twist. Instead of studying the emergence of the in-out effect in the evaluation of brands, and whether the effect was shadowed by other concurrent visual cues, the focus was in examining if the affective states produced by in-out articulations could be extended to the evaluation of a product.

Method

Participants

From the total of participants that agreed to join both online surveys, five were excluded from the final data analysis: one participant (0.6%) from Experiment 3, and four (2.7%) from Experiment 4, reported being non-native European Portuguese speakers. None of the remaining participants reported a valid suspicion of the word manipulation in the final control questions, thus, a total of 155 participants (94 female; *Mean age* = 38.0, *SD* =13.07) and 146 participants (105 female; *Mean age* = 40.8, *SD* = 12.97) were included in the present samples. As in the first two experiments, participants were from diverse professional backgrounds.

Materials and Procedures

In Experiments 3 and 4 participants were presented with all the words in the stimuli pool (15 inward and 15 outward-words), framed in all possible combinations with 15 distinct product packages randomly selected from online open source databases. There is a fair amount of empirical evidence built upon ecologically valid material for product packaging extrapolations, such as realistic images of packages (Ares & Deliza, 2010) or even pictures of actual products (Koo & Suk, 2016; Westerman, et al., 2013). However, aiming to refrain participants from associating the packages used to specific products or brands in the market, in the present set of experiments mock packages (Velasco, et al. in 2014) were used. Packages included featured, bottles for drinkables, tetrapack, plastic bottles for toiletries, card boxes of different sizes and shapes, and foldable packages. A total of 450 different stimuli

resulted from the combination of each package and both the inward and outward names (Figure 2).

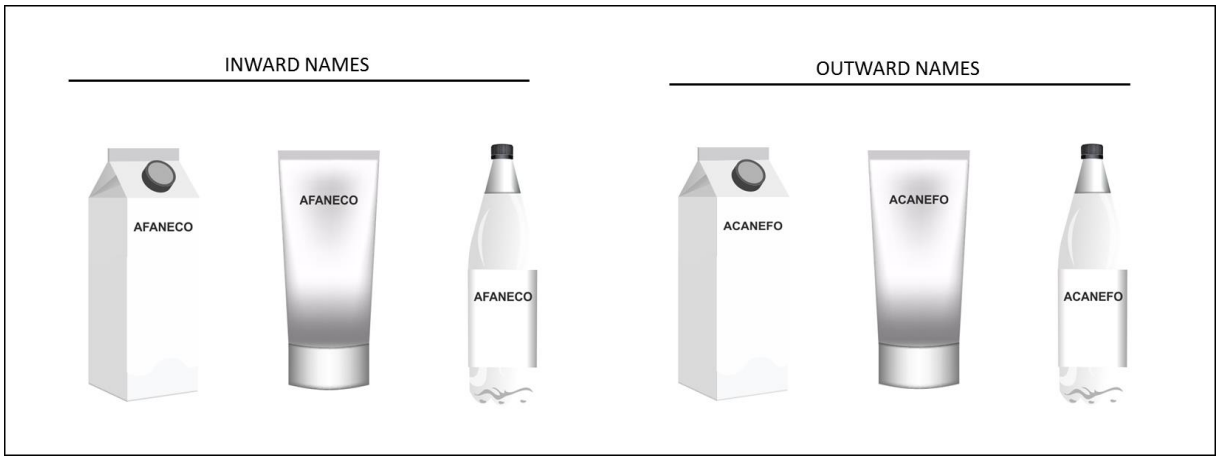

Figure 2. Examples of materials used in Experiments 3 and 4

While in Experiment 3 participants were asked to report their preferences about each brand, in Experiment 4 participants were asked to rate their preference for each product. The order of presentation of inward and outward-words was completely randomized for each participant anew.

Across the two experiments, both consonantal word wandering as well as the brand visual imagery (presented as a package) were manipulated within participants. Thus, each participant always received 30 words embedded in a random subset of 15 packages, viewing a total of 30 stimulus (15 inward and 15 outward).

Results and Discussion

Experiment 3.

A one-way within-subjects ANOVA revealed the expected main effect of consonantal stricture direction, $F(1, 144) = 22.64$, $\eta_p^2 = .136$, $p < .001$, $d_z = .40$, mean difference 95% CI [3.05, 3.60]. Brands with inward-words ($M = 3.43$, $SE = .14$) were preferred over the ones with outward-words ($M = 3.22$, $SE = .14$). A main effect of package was also found, $F(14, 2016) = 2.55$, $\eta_p^2 = .208$, $p = .001$, mean difference 95% CI [3.05, 3.60], indicating that some packages were preferred over others but no interaction effects ($p = .249$) were observed.

Again, the order by which stimuli were presented was not significant, $t(153) = 1.767$, $p = .079$.

Experiment 4.

The results of a one-way within-subjects ANOVA showed a main in-out effect, this time regarding the evaluation of products. Products with inward-words ($M = 3.45$, $SE = .15$) were rated higher than those with outward-words ($M = 3.32$, $SE = .15$), $F(1, 141) = 12.10$, $\eta_p^2 = .079$, $p = .001$, $d_z = .29$, mean difference 95% CI [3.10, 3.67]. Again a package main effect was observed $F(14, 1974) = 4.83$, $\eta_p^2 = .242$, $p < .001$, indicating that some packages were preferred over others. However, these preferences did not interact with the in-out effect ($p = .200$). Stimuli presentation order did not affect evaluations, $t(145) = .828$, $p = .409$.

Results from Experiment 4 indicate that the in-out effect is not only robust, prevailing even in the presence of concurrent information, but more importantly that the affective judgments triggered by the word articulation extend to product evaluation.

General Discussion

Research on the effect of oral muscles wanderings caused by consonantal subvocal pronunciation, also known as the in-out effect, has uncovered the impact of certain phonetic characteristics of words in their evaluation (Topolinski et al., 2014). Words with articulatory patterns resembling ingestion are associated with positive affect, and those resembling expectoration muscular dynamics are associated with negative affect. In the current set of studies, the in-out effect, typically observed in research laboratory settings, was extended to a more ecologically relevant domain of consumer behavior, and the boundary conditions to its possible applications to current marketing practice were examined. For that purpose, the authors tested the effect of presenting inward and outward-words (as brands) embedded in varying degrees of brand imagery (labels, logotypes, and mock product packages) in the evaluation of brands and products. Results have consistently shown the robustness of the in-out effect, even in the presence of competitive visual information. These results encourage the effort in bridging oral kinematics research and branding practice.

In a previous set of experiments with pictures of food dishes, the in-out effect was shown to fade away in the presence of pictures high in palatability cues (Topolinski & Boecker, 2016). In the present work, the visual information provided, that also competitively feed into participants' information processing, did not block the effect of consonantal wanderings in affective judgments. Indeed, more abstract visual information or even haptic

cues such as shapes of product packages did not interfere with the effect, emphasizing its relevance and potential for branding. Further research is required to examine the concurrent role of specific visual information (e.g., aesthetic appeal, familiarity, complexity, Prada, Rodrigues, Silva, & Garrido, 2016) in the emergence of the in-out effect namely in the consumer behavior domain.

Current marketing practice has been favoring meaningful names for branding since they are easier to remember and seem to induce more positive affect than non-meaningful names (Klink, 2001). Nevertheless, since companies' portfolios are growing, brand names are required to become more permeable and adaptable to several products (see Chun, Park, Eisingerich, & MacInnis, 2015, for a discussion of the variables affecting successful brand extensions). In other words, establishing a particular connection between the name and the product is increasingly difficult. Moreover, since brand names assume different meanings in different languages, marketing professionals managing international brands are currently facing growing challenges.

A phonetic toolkit to develop new brand names is likely to constitute a possible solution for such a challenge. Sound symbolism seems to have been so far the only phonetical approach tested by academics and used by marketing practitioners to develop brand names for new products. Sound symbolism or phonetic symbolism (e.g., Sapir, 1929) postulates that the phonological characteristics of the speech may function as a map for semantic meaning. When facing nonsense or unfamiliar words, sound symbolism is used to extract meaning from the name and couple it with the referenced object. For example, voiced consonants are associated with heavy or strong products (Klink, 2001), while silent consonants seem more connected to faster or smaller products (Yorkston & Menon, 2004). Indeed, in the marketing domain there is already a considerable amount of evidence about the influence of certain sounds in consumers' product evaluations (Lowrey & Shrum, 2007; Yorkston & Menon, 2004), price perception (Coulter & Coulter, 2010) and decision–making, that is, the final choices made (Argo, Popa, & Smith, 2010). Thus, the in-out effect may constitute an interesting tool to use in conjunction or as an alternative to sound symbolism.

Despite the absence of a strong body of research comparing both alternatives it can be argued that: (a) Names created within the sound symbolism approach may hold some cross-languages differences, but are more likely to be perceived as similar by consumers worldwide than names built upon the in-out effect. The perceptions of brand names based on inward or outward sub vocalizations may be more heterogeneous, because the letter to phoneme

translation varies significantly across languages, changing the precise location of the articulation of the consonant in the mouth, and therefore threatening the effectiveness of the in-out effect; (b) On the other hand, the in-out effect seems to be more adaptable to different product types. It does not convey any particular meaning or link to any product type, but an overall positive (negative) affect and approach (avoidance) motivation; (c) Finally, research has shown that the mere exposure effect constitutes a greater advantage for brands with nonsense names than for brands with meaningful names (Kohli, Harich, & Leuthesser, 2005). Since brand equity is built over long periods of time, using nonsense names is likely to be the best option in the long run. Yet, it remains to be known whether a brand would benefit even more if the name featured both approaches - wandering inward and simultaneously conveying phonetic meaning. Further research about the impact of oral kinematics will surely find a fruitful ground in the marketing domain.

From a theoretical standpoint, the successful replication of the in-out effect renews the strength of the embodiment perspective and of the overall social situated cognition framework (see Semin & Garrido, 2015; Semin, Garrido, & Palma, 2012, 2013) by providing evidence that perception and action are shaped by aspects of the physical body and of the contextual setting. The importance of sensorimotor activity in shaping cognition was (again) demonstrated by the effect of specific (oral) muscular patterns in decision-making and preference. With the several replications of the in-out effect across different experiments and settings, it also becomes evident that this manipulation is a reliable alternative to the most commonly used primes for approach-avoidance motivations. Importantly, this manipulation removes the "awareness" confound that may arise from asking participants to perform conscious and voluntary actions or by forcing them to consciously adopt particular body postures or muscle restrains. Moreover, due to the simplicity of the procedure, the in-out effect may assume special relevance in future experimental manipulations of approach-avoidance.

Overall, the robustness and generalizability of the in-out effect revealed across four experiments with increasingly complex and ecologically valid stimuli, clearly supports the application of oral kinematics to branding, and encourages further research on other sensorimotor phenomena in consumer behavior and overall consumer decision-making.

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The "ins" and "outs" of person perception: The influence of consonant wanderings in judgments of warmth and competence*

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Abstract

In five studies (N = 638), we extended the in-out effect to person perception, examining the influence of oral approach-avoidance movements activated by word articulation, on preference, sociability and competence judgments of mock-usernames. Users with inward, in contrast to outward-usernames, were always preferred and judged as warmer. However, they were judged as equally competent. The differential impact of the in-out effect in the core dimensions of social perception suggests that the phenomenon relies on the affective mechanism of approach-avoidance that is only pertinent to judgments related to the warmth dimension. The present research provides further support for the link between the activation of oral muscles and impression formation, emphasizing the relevance of the in-out effect for the person perception domain and embodied social cognition.

Keywords: oral articulation, embodiment, impression formation, warmth, competence.

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When forming impressions of persons, people rely on a variety of sources such as physical appearance, occupation or social behavior (Asch, 1946; see, Uleman, Saribay, & Gonzalez, 2008 for a review). Recent research has however emphasized that personality judgments are based on more than the objective information readily available about a target, suggesting that, to fully understand impression-formation processes, embodied and contextual aspects must also be addressed (e.g., Semin & Smith, 2013). The role of physical experiences in shaping social information processing suggests that the social attribution of central traits such as warmth and competence is cognitively inferred from body and action (e.g., from facial, Kanazawa, 2011; and body cues, Chandler & Schwarz, 2009; see also Abele & Wojciszke, 2014, for a review), depend on modality-specific systems (e.g., Meier, Moeller, Riemer-Peltz, & Robinson, 2012) and can be grounded in physical (e.g., IJzerman, & Semin, 2009; 2010) and social environments. Moreover, recent findings uncovering the role of oral muscles articulation in preference judgments, the so-called *in-out effect* (e.g., Topolinski, Maschmann, Pecher, & Winkielman, 2014), documented the impact of sensorimotor experiences in cognition based on a simple oral approach-avoidance mechanism. The five studies reported in this paper examine the influence that the articulatory activity involved in pronouncing a person's name is likely to exert upon the impressions people form.

Representational and embodied perspectives on impression formation

Asch's (1946) seminal research on impression formation established that particular "central" personality traits (e.g., warmth and cold) shape the interpretation of subsequent traits and, importantly, the overall impression formed. Later on, Semin (1989) utilized a dictionary of synonyms and antonyms to compute the semantic overlap between Asch's (1946) stimulus traits and the trait lists presented on the response scales used by participants, demonstrating that the lexical context, namely mere semantic relations alone, was sufficient to reproduce the same results. These findings speak for a purely representational outcome beyond an active participant's responses revealing a configural pattern of semantic relationships.

This representational perspective can also be found in Rosenberg, Nelson, and Vivekananthan's (1968) dimensional model of social perception, suggesting that personality judgments are made upon a limited number of domains (such as warmth and competence), and also falls into the category of symbolic representational research found elsewhere in personality research (see Semin, 1990). A continuation of this research has found expression

in dimensional models of naïve personality judgments (e.g., warmth and competence, see Abele & Wojciszke, 2007; Fiske, Cuddy, & Glick, 2007). Moreover, these "Big Two" (Paulhus & Trapnell, 2008) dimensions of person perception seem to be present in social judgments across different cultures (e.g., Judd, James-Hawkins, Yzerbyt, & Kashima, 2005).

The labels of these two dimensions have varied over time, ranging from social to intellectual desirability (Rosenberg et al., 1968), agency and communion (Abele & Wojciszke, 2007), competence and warmth (e.g., Fiske et al., 2007; Judd et al., 2005), or even other- and self-profitability (Peeters & Czapinski, 1990). For the sake of simplicity, we adopt Fiske, Cuddy, Glick, and Xu's (2002) terminology and refer these two dimensions as warmth (anchored by positive traits such as warm, honest and negative traits such as cold, unreliable) and competence (anchored by positive traits such as competent and assertive and negative traits such as inefficient, passive).

As can be seen from this brief review, research has adopted an information-processing framework, analyzing cognition in terms of representational structures drawing on the fundamental concepts and principles of computer science (e.g., Newell & Simon, 1972; Vera & Simon, 1993). This is in contrast to a socially situated cognition approach, which adopts a "… biological metaphor [emphasizing] that all cognition and action constitute an adaptive regulatory process that ultimately serves survival needs […] and invites us to consider cognition and action as embodied - constrained and directed by the nature of our bodies" (Smith & Semin, 2004, p. 56).

Complementing the representational perspective and research is recent evidence that is consistent with the socially situated cognition perspective. This research has shown that social warmth or coldness can be induced by experiences of *physical* warmth or coldness. For example, Williams and Bargh (2008) have shown that the manipulation of warm (vs. cold) objects increased interpersonal liking and generosity (see also, IJzerman & Semin, 2009; Semin & Garrido, 2012). This metaphorical link between physical and social temperature seems to be bidirectional, that is, social proximity or distance can be induced physically (e.g., social exclusion; Zhong & Leonardelli, 2008), but more importantly physical proximity (distance) increased perceptions of higher (lower) temperature (IJzerman & Semin, 2010). To the best of our knowledge, the grounding of competence in the physical world has not yet been well-established. However, recent studies have shown the relationship between forward body movements and approach-oriented posture in competence judgments (Horchak, Giger, & Garrido, 2016).

The research, driven by the representational perspective, on the one hand, and by a situated cognition approach, on the other, suggests a convergence between the two perspectives on impression formation. Here, we introduce a new perspective on this research by examining the representational-embodied interface with an entirely new and subtle embodied manipulation and the two general dimensions of warmth and competence.

The 'In-Out Effect' and Impressions of Personality

Recently, the so-called *in-out effect* opened a new page into embodiment research by documenting the impact of a very simple sensorimotor experience induced by oral approach-avoidance movements. Words whose consonantal articulation activates movements similar to ingestion have been shown to be preferred over words with the opposite consonantal direction, that is, simulating expectoration movements (e.g., Topolinski et al., 2014). So far, this phenomenon has been tested and replicated in different research labs (e.g., Godinho & Garrido, 2015). The preference for inward-wandering words (over outward-wandering ones) has also been observed in different contexts such as food pictures (Topolinski & Boecker, 2016) or brands (Godinho & Garrido, 2017). In the person perception domain, inward (vs. outward) names of foreign politicians, online users or villains were always preferred (Topolinski, et al., 2014). Recently, Silva and Topolinski (2018) have demonstrated that usernames of online sellers inducing inward movement were rated as more trustworthy than usernames inducing outward wanderings. What has not been examined is whether consonantal articulation affects other traits aside from trustworthiness. In other words, do inward names increase preference ratings influencing target perceptions as warmer and/or more competent?

Classic and contemporary research on impression formation has demonstrated the paramount importance of interpersonal warmth as compared to competence. Several authors recognized that these two dimensions are fundamentally different. Asch's pioneer work had already established a primacy-of-warmth effect, emphasizing the role of warmth-related as compared to competence-related judgments in impression-formation (e.g., Abele & Wojciszke, 2007; Fiske, et al., 2007; Study 1). Fiske and colleagues (2007), also proposed a primacy for the warmth dimension because of its survival value: "from an evolutionary perspective, the primacy of warmth is fitting because another person's intent for good or ill is more important to survival than whether the other person can act on those intentions (pp. 77). In other words, warmth traits may be processed preferentially because they convey relevant information for critical approach-avoidance decisions (Abele & Bruckmüller, 2011).

The question addressed here is whether a simple sensorimotor experience induced by an oral approach-avoidance mechanism will differentially lead to the endorsement of mock usernames on the warmth dimension. However, such a mechanism is not expected to modulate competence related judgments. This reasoning is also consistent with some evidence demonstrating that approach-avoidance responses facilitate warmth judgments but not judgments on competence related stimuli (Wentura, Rothermund, & Bak, 2000). Similar evidence is supplied by Freddi, Tessier, Lacrampe, and Dru (2014) namely that approach and avoidance movements affect the evaluation on the warmth dimension (but not the competence dimension). Overall this evidence suggests that only warmth judgments are modulated by approach-avoidance manipulations.

Experiments 1a-1c

The first three experiments examined the evaluation of mock usernames that in their articulation activate inward (outward) movements. The experiments had similar designs and measured independently, general preference (1a); competence judgments (1b); and social warmth (1c), as a function of consonantal wandering direction of mock usernames which was a within-subjects variable.

Replicating previous findings, we expected a general preference for usernames activating an inward articulation in Experiment 1a. For Experiments 1b and 1c we expected that inward articulation of usernames would lead them to be rated as warmer but not as more competent. The latter prediction was based on the nature of the inward and outward articulation processes, which involve an approach-avoidance mechanism that is orthogonal to the competence dimension (e.g., Freddi et al., 2014). The three experiments were run independently to avoid the potential of the dependent variables confounding each other.

Method

Power Analysis and Sampling Plan. Sample size was determined before any data analysis. The sample sizes were defined by using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) and were based on the average effect size of Cohen's $d_z = 0.33$ (Cohen, 1988) obtained in Topolinski and Boecker (2016; Experiments 1 and 3). The required sample sizes to replicate the in-out effect with a larger statistical power (0.95) (Open Science Collaboration, 2012) were N = 90. Nevertheless, because we set data collection to stop at the end of a sampling day on which each sample had reached the defined size, some samples were somewhat larger.

Participants. Ninety Portuguese participants (*M*age = 26, *SD* = 9.8; 51 female) participated in Experiment 1a, 94 (*M*age = 31, *SD* = 14.3; 61 female) in Experiment 1b and 108 (*M*age = 26, *SD* =10.2; 79 female) in Experiment 1c. Participants were recruited by emails sent to personal contacts and more broadly through social media platforms (e.g., Facebook), and were asked to join an online study about the way people evaluate online usernames.

Stimuli. Thirty inward and outward-words were randomly selected from a larger stimulus pool, specifically adapted for Portuguese phonation and validated in two high-powered replications (see Godinho & Garrido, 2015, for detail). These pre-tested stimuli were merged with @gmail.com resulting in usernames such as bateco@gmail.com (inward) or catebo@gmail.com (outward).

Procedure. Data were collected online using the Qualtrics platform. In line with the host institution ethical guidelines, after entering the survey platform participants were asked to read and agree with the informed consent, being assured that all data collected would be treated anonymously and would only be published in scientific outlets. Participants were informed that the study was designed to understand the way people perceive usernames. They were further informed that their task was to evaluate a set of those usernames and that there were no right or wrong answers. Then they were asked to silently read the usernames and to rate each of them according to their 'preference' (Experiment 1a; 1-Do not like it at all to 10-Like it very much); according to the users' perceived 'competence' (Experiment 1b; 1-Incompetent to 10-Competent); and perceived 'social warmth' (Experiment 1c; 1-Cold to 10-Warm).

Each participant was exposed to a total of 30 stimuli (15 inward and 15 outward) that were presented one at the time in a random order. There was no time limit for answering and the stimuli were visible until the ratings were given. After the rating task, participants were asked to provide socio-demographic information such as gender, age, professional occupation and native language. At the end, two control questions were added do detect possible awareness of the word manipulation (Godinho & Garrido, 2015).

In these studies, we report all measures, manipulations and exclusions. Three participants in Experiment 1a, one in Experiment 1b and six in Experiment 1c reported to be non-European Portuguese native speakers and were discarded. None of the remaining participants reported any valid suspicion of the manipulation.

Data Analysis. A T-Test for paired samples was performed on data from each experiment to determine the effect of the consonantal direction articulation of the usernames, on the three depended variables assessed.

Results

Experiment 1a–General Preference. The consonantal articulation direction of the usernames exerted a significant impact on participants' preference, $t(89) = 3.995$, $p < .001$, $d_z = 0.42$, 95% CI [0.20, 0.64]. Usernames wandering inward ($M = 3.98$, $SE = .17$) were preferred to those wandering in the opposite direction ($M = 3.73$, $SE = .17$).

Experiment 1b–Competence. The consonantal articulation direction of the usernames did not affect participants' ratings of the user competence, $t(93) = 1.031$, $p = .305$. Usernames with inward wanderings ($M = 4.27$, $SE = .19$) obtained similar ratings to those wandering outward ($M = 4.23$, $SE = .19$).

Experiment 1c–Social Warmth. When participants were asked to judge the social warmth conveyed by the usernames the in-out effect was statistically significant, $t(107) = 4.184$, $p < .001$, $d_z = 0.40$, 95% CI [0.21, 0.60]. Inward wandering usernames ($M = 4.32$, $SE = .18$) were rated as warmer than those wandering outward ($M = 4.04$, $SE = .18$).

Overall, the results indicate that while judgments of warmth were affected by the words' consonantal wanderings, competence judgments remained unaffected. Such differential impact of the in-out effect on the core dimensions of social perception seems to suggest that the judgments are driven by the affective mechanism of approach-avoidance, that shapes warmth related but not competence related judgments.

Experiments 2a-2b

Experiments 1a-c examined the in-out effect in the person perception domain, by asking participants to rate usernames according to their general preference, warmth or perceived competence. Although the results were extremely robust, we designed a second set of experiments where consonantal wandering direction but also trait ratings were manipulated within-subjects.

In Experiments 2a and 2b, we replicated the previous experiments by asking participants to rate the perceived warmth and competence of the usernames presented. In Experiment 2a we started cautiously (to avoid for example halo effects), by asking the trait ratings in two separate blocks presented sequentially. Thus, participants completed all the

evaluations of one dimension, and only after were asked to rate another set of usernames regarding the other dimension (counterbalanced). Experiment 2b presents a full within-subjects design were participants were asked to randomly rate inward and outward usernames regarding their warmth and competence.

Method

Power Analysis and Sampling Plan. Sample sizes were determined before any data analysis. Despite the within-subjects design we decided to keep the sample size estimates of N = 90 per condition (N_{Total}=180). However, since some participants were excluded, Experiment 2b had slightly less participants than our initial estimate.

Participants. One hundred and eighty-four participants in Experiment 2a (*M*age = 25, *SD* = 10.0; 121 female) and 162 in Experiment 2b (*M*age = 38, *SD* = 13.4; 97 female) participated in the studies. As in the previous experiments, participants were recruited by email and social networks and requested to join a survey aimed at examining how different people evaluate online usernames.

Stimuli. Thirty-two inward and outward-words were randomly selected from the same stimulus pool (Godinho & Garrido, 2015) used for the first three experiments and merged with the @gmail.com.

Procedure. Data were collected online using the Qualtrics platform. Upon entering the survey platform participants received the informed consent form, after being assured that all data treatment would be anonymous and used for scientific purposes only.

As in the previous two experiments, participants were asked to silently read and rate each username according to their perceived competence (1-Incompetent to 10-Competent) and perceived social warmth (1-Cold to 10-Warm). In Experiment 2a we created two counterbalanced blocks with 16 competence ratings and 16 warmth ratings. Approximately half of the participants were asked to provide competence ratings first and subsequently the warmth ratings, while the remaining answered in the reverse order. Participants' distribution between the two conditions was random. In Experiment 2b the order of the same 32 competence and warmth trait ratings was completely randomized for each participant.

In both experiments, after providing the ratings participants were asked to complete the same socio-demographic questions and control questions to detect possible awareness of word manipulation (Godinho & Garrido, 2015).

In these studies, we report all measures, manipulations and exclusions. In Experiment 2a, three participants were excluded for not being Portuguese native speakers. In Experiment 2b, four participants were not native speakers and four did not report their native language and were also excluded. None of the remaining participants reported any valid suspicion of the manipulation.

Data Analysis. A repeated-measures analysis of variance (ANOVA) was performed on the data in order to determine the effect of the consonantal direction articulation of the usernames on the participants' perception of their warmth and competence.

Results

Experiment 2a. The consonantal articulation direction exerted a significant impact on participants' evaluations of the usernames, $F(1,182) = 4.170$, $p = .043$, $\eta_p^2 = 0.02$, 95% CI [0.00, 0.08]. Overall participants provided higher ratings for inward wandering ($M = 4.44$, $SE = .11$) than outward wandering usernames ($M = 4.34$, $SE = .11$), independently of the trait being rated. Importantly, the interaction between consonantal articulation direction and the trait being rated was also significant, $F(1,182) = 8.734$, $p = .004$, $\eta_p^2 = 0.05$, 95% CI [0.01, 0.12]. Indeed, as indicated by pairwise comparisons, when judging the warmth of usernames, participants preferred inward wandering usernames ($M = 4.45$, $SE = .13$) to those wandering in the opposite direction ($M = 4.24$, $SE = .13$), $t(182) = 3.106$, $p = .002$, $d_z = 0.23$, 95% CI [0.08, 0.38]. This pattern was not observed in competence ratings, that were similar for inward ($M = 4.44$, $SE = .13$) and outward wandering usernames ($M = 4.47$, $SE = .13$), $t(182) = -.537$, $p = .592$). The order by which the ratings were made (competence first or warmth first) was also significant, $F(1,182) = 6.461$, $p = . 012$, $\eta_p^2 = 0.03$, 95% CI [0.00, 0.10]. When competence ratings were made first ($M = 4.11$, $SE = .16$), evaluations were generally lower than when warmth ratings were made first ($M = 4.67$, $SE = .15$). No other main or interaction effects emerged.

*Experiment 2b***.** Like in Experiment 2a, we found a significant main effect of consonantal direction of the usernames, $F(1, 161) = 10.425$, $p = .002$, $\eta_p^2 = 0.06$, 95% CI [0.01, 0.14]. Inward wandering usernames ($M = 4.19$, $SE = .13$) were preferred to outward wandering ones ($M = 4.06$, $SE = .14$), independently of the trait being rated. There was also a main effect of the trait being rated, $F(1, 161) = 5.586$, $p = .019$, $\eta_p^2 = 0.03$, 95% CI [0.00, 0.10] . Warmth ratings were consistently lower ($M = 4.07$, $SE = .134$) than competence ratings ($M = 4.18$, $SE = .135$). Importantly, the interaction effect between consonantal

wandering direction and trait was also observed, $F(1, 161) = 6.477$, $p = .012$, $\eta_p^2 = 0.04$, 95% CI [0.00, 0.11]. Pairwise comparisons indicated that the in-out effect was only observed in warmth ratings. Inward wandering usernames were rated as warmer ($M = 4.18$, $SE = .14$) than outward wandering ones ($M = 3.95$, $SE = .13$), $t(161) = 3.980$, $p < .001$, $d_z = 0.31$, 95% CI [0.15, 0.47], while inward wandering names were rated as competent ($M = 4.20$, $SE = .14$) as the ones wandering outward ($M = 4.16$, $SE = .14$).

The results from the second set of experiments replicated those observed in the first set, corroborating the differential impact of the in-out effect on the core dimensions of social perception. While the articulatory direction affected social warmth judgments, it had no impact on competence judgments. In other words, inward usernames were judged as socially warmer, but not as more competent.

Meta-analysis. To further examine the full magnitude of the in-out effect in warmth and competence ratings we conducted a joint ANOVA ($N = 894$), where experiment and trait were entered as between factors (Rosenthal, 1978).

The 2 (Consonantal wandering: inward, outward; within) X 5 (Experiment; between) X 2 (Trait: warmth, competence; between) ANOVA yielded a main effect of consonantal wandering direction, $F(1,888) = 25.89$, $p < .001$, $\eta_p^2 = 0.03$ and an interaction effect between the consonantal wandering direction and the trait being rated $F(1,888) = 5.12$, $p < .001$, $\eta_p^2 = 0.02$. Importantly no main effect was found for the experiment, the trait being rated, nor any other interaction effects emerged.

Across the five experiments, inward words ($M = 4.32$, $SE = .06$) were preferred over outward-wandering words ($M = 4.20$, $SE = 0.06$), $t(893) = 5.03$, $p < .001$, $d_z = 0.17$, 95% CI [0.10, 0.23]. The interaction effect revealed that competence ratings for inward and outward-wandering were not significantly different ($M_{difference} = .02$, $SE = .04$, $p = .612$), while the inward-wandering usernames were consistently rated as warmer than the outward-wandering ones ($M_{difference} = .24$, $SE = .04$, $p < .001$).

These results confirm that the in-out effect is observed in warmth related but not in competence related judgments and support the claim that the effect is grounded in an approach-avoidance mechanism (triggered only when the participants rate usernames in a congruent affective dimension).

General Discussion

Research on impression formation conducted within an information-processing framework has already established the paramount importance of interpersonal warmth. Complementing the representational perspective, there is recent evidence consistent with the socially situated cognition perspective (e.g., Semin & Smith, 2013), showing the role of physical experiences in shaping social information processing namely the social attribution of central traits such as warmth and competence. In five experiments we demonstrated the impact of subtle inward or outward oral movements involved in the articulation of mock usernames on warmth and competence judgments in the person perception domain. The results indicated that the impact of consonantal articulation direction is consistently observed in warmth related but not in competence related judgments. These results also contribute to understanding the specific mechanisms underlying the in-out effect, supporting the hypothesis that the effect is due to an oral approach-avoidance mechanism inherited from a survival instinct related to our mouths' biomechanical functions.

The present results are also in line with previous findings (Freddi et al., 2014) Wentura, et al., 2000) showing that approach-avoidance movements affect the evaluation on the warmth dimension (but not the competence dimension). Moreover, the current findings converge with Rosenberg's and colleagues (1968) early work showing that the good-bad judgments in the social dimension can be more extreme compared to the intellectual dimension. Liking another individual is an affective response requiring minimal inferential activity (Zajonc, 1980) and therefore, while trustworthiness, likeability or attractiveness evaluations can be made instantly, after minimal exposure times, competence inferences seem not to rely in fast or intuitive, System 1 judgments (Willis & Todorov, 2006). Indeed, there is evidence that children's judgments seem to rely in a single general (good-bad) dimension, showing greater sensitivity to cues associated to sociability (e.g., Cluver, Heyman, & Carver, 2013; Stipek & Daniels, 1990).

Overall, our findings support recent frameworks that define cognitive functioning as grounded in bodily and sensorimotor processes and present a theoretical contribution to the debate about the mechanism underlying the in-out effect. In a world where social interaction is increasingly mediated by technology, and where first impressions are often limited to usernames or e-mail addresses, it seems relevant to show that a simple oral approach-avoidance mechanism can foster preference and elicit positive affect towards others.

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The "ins" and "outs" of product and services marketing: The influence of consonant wanderings in consumer decision-making*

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Abstract

The established preference for words featuring consonants ordered inward in the oral cavity – the in-out effect, may become determinant to assist marketeers naming new products and services. To investigate the conditions under which this effect may affect consumer preference we conducted four experiments (N=818) examining the influence of consonant wanderings in the evaluation of different professionals and food products. While inward articulation direction selectively biased warmth judgments about workers who are perceived as relatively neutral on both warmth and competence, for professionals traditionally associated with either a warmth or a competence dimension inward-wandering usernames systematically presented a competitive advantage. In the same way, hypothetical food products with inward-wandering names were judged as more hedonic and more utilitarian. The present evidence supports the application of the in-out effect to market products and services and highlights the relevance of exploiting this and other oral kinematics phenomena as an asset for managerial practice.

Keywords: in-out effect, oral kinematics, embodiment, consumer decision-making

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Market success is contingent to the brand's name (Kohli & LaBahn, 1997). Thus, one of the greatest challenges presented to marketers launching new products and services is how to name them. To address such concern, researchers have consistently examined the characteristics that make brand names effective, that is, which names entice consumers to buy the product (e.g., Grewal, Krishnan, Baker, & Borin, 1998), believe that it is more effective (e.g., Klink, 2001), value it higher (e.g., Argo, Popa, & Smith 2010; Coulter & Coulter, 2010) or even remember it better (e.g., Lowrey, Shrum, & Dubitsky, 2003). While some research has focused on exploring how the name conveys meaningful associations and other information about the products' characteristics (e.g., Aaker & Keller, 1990; Keller, Heckler, & Houston, 1998; Klink, 2001), other lines of research have focused in the basic psychological mechanisms that facilitate brand recognition, pronunciation, or memory (e.g., Lee & Baack, 2014; Robertson, 1989). Recently, in this quest to find effective brand names, a new chapter that explores surprising oral-muscular effects was open – the Oral Kinematics.

The most recent and interesting discovery in the oral kinematics domain is known as the in-out effect (e.g., Topolinski, Maschmann, Pecher, & Winkielman, 2014), demonstrating that the oral articulatory activity necessary to pronounce a name affects how much the name is liked. An already robust set of evidence suggests that words whose articulation involve inward wandering kinematics, similar to ingestion movements (e.g., IBUK), are preferred to words where the muscular contractions wander outward, that is, similar to expectoration movements (e.g., KIDUB). Such affect has been proven to be independent on whether those words refer to names or usernames of ordinary persons (e.g., Garrido, Godinho, & Semin, 2018; Silva & Topolinski, 2018), fictitious characters (e.g., Topolinski et al., 2014), foods (e.g., Topolinski & Boecker, 2016a) or actual brands (Godinho & Garrido, 2017).

Since, the potential of the in-out effect to assist marketing professionals in developing and selecting brand names has just begun to be rehearsed (Topolinski, 2017), the current set of four, largely powered, experiments was designed to provide insights on whether the preference for inward wandering names may present a competitive advantage in the services marketing domain, triggering consumer preference for specific professionals, as well as in the Fast-Moving Consumer Goods market (FMCG), examining its potential to name products.

Relevant (Marketing-Wise) Boundary Conditions

The in-out effect was initially established as an oral approach-avoidance mechanism through which orally induced sensorimotor experiences could bias preference evaluations

(Topolinski et al., 2014). Despite its moderate effect sizes, the effect seems extremely robust, and was already replicated across several languages and language families (e.g., Godinho & Garrido, 2016; Godinho, Garrido, & Horchak, 2019), triggered with minimal manipulations (Topolinski & Boecker, 2016b) or reduced presentation durations (Gerten & Topolinski, 2018). The effect has proven to be resistant both to motor interference (Lindau & Topolinski, 2018) and competing visual information (Godinho & Garrido, 2017). Despite the evidence supporting the effects' stability, successful modulations have been also reported and, importantly, present relevant implications for marketing and managerial practice.

The first boundary condition relates to the seminal explanation of the mechanism underlying the effect - the resemblance of the oral movements involved in word articulation and ingestion/expectoration oral movements. Indeed, there seems to exist a match between inward and outward movements and the oral movements associated respectively with ingestive (e.g., lemonade, mouthwash) or expectorative (e.g., chemicals, bubble gum; Topolinski, et al., 2017) products. Thus, when judging inward or outward names for consumer products, the products' function appeared to be determinant. In a subsequent clarification of this functional explanation for the in–out effect, Godinho, Garrido Zürn and Topolinski (2019) found that participants preferred inward words more than outward for edible products (water, beer, fuzzy drink), but not for non-edible products (shampoo, detergent, bleach). Since the preference for inward-wandering names only seems to emerge when naming edible products, it may be useless to select inward names for non-edible products.

While examining the in-out effect in the context of competing visual information, Topolinski and Boecker (2016a) found that, when used to name images of foods that were high on palatability cues (e.g., appealing food dishes), inward-wandering words did not grant a higher appraisal of the stimuli. This finding suggests that articulation direction may be ineffective fostering consumer preference when presented simultaneously with vivid and suggestive visual information. However, subsequent research by Godinho and Garrido (2017) demonstrated that the in-out effect persists with common marketing brand imagery such as the logo or packaging. Since only extremely stimulating visual information seems to carry diagnostic information powerful enough to disrupt the articulation direction effect, this second boundary condition does not present a threat to the potential application of the in-out effect to marketing practice.

Very recently, Körner, Bakhtiari and Topolinski (2018), suggested the role of motor fluency in shaping the in-out effect and demonstrated that training outward articulation sequences could block or even invert the established preference for inward wandering ones (see Bakhtiari, Körner, & Topolinski, 2016 and also Godinho & Garrido, 2019 for an overview of the state of the art). Independently of the debate surrounding the origin of the effect, these findings demonstrate that the in-out effect is permeable to fluency manipulations. From a managerial perspective this means that oral kinematics manipulations may be used as an initial advantage to foster positive feelings towards brands, but that other techniques may be combined (e.g., repeated exposure - Zajonc, 1968) to strengthen or contradict such effects.

Finally, in the person perception domain, this preference for inward-consonantal strings has been recently shown to only affect judgments pertaining a warmth (but not a competence) dimension (Garrido, Godinho, & Semin, 2019). Such evidence plays alongside with previous reports on the marketing domain where the effect was rehearsed as a competitive advantage for online sellers' usernames, demonstrating that inward consonantal wanderings increase perceived trustworthiness (Silva &Topolinski, 2018).

The present research aims to provide support for the application of the in-out effect to marketing, exploring whether such a simple sensorimotor experience may bias judgments of mock usernames of services providers and of names of FMCG. Evidence was collected across four experiments where participants were asked to rate usernames of professionals that are relatively neutral in both warmth and competence (Experiments 1 and 2), professionals that are traditionally associated with either warmth or competence traits (Experiment 3) as well as names of hypothetical food products (Experiment 4).

Experiments 1 and 2

The first experiments shared the same materials and procedures, to examine the in-out influence in the evaluation of mock usernames belonging to professionals with no particular association to a warmth or a competence dimension. Experiment 1 featured a between-participants design, where the trait ratings were run separately to establish the effect without potentially confounding the dependent variables. In Experiment 2 participants completed both, warmth and competence ratings. In line with previous evidence (Garrido et al., 2019), we expected that inward usernames would increase warmth but not competence ratings.

Method

Power Analysis and Sampling Plan. Sample sizes were determined before data collection with G*Power (Faul, Erdfelder, Lang, & Buchner, 2007). In Experiment 1, presenting a between-participants design, the power analysis was based on the average effect size of Cohen's d_z = 0.40 obtained in Garrido et al., (2019; Experiment 1c – warmth evaluations, between-participants design). For Experiment 2 the same analysis was based in Cohen's d_z = 0.23 obtained in Experiments 2a of the same article (within-participants design). The sample sizes required to replicate the in-out effect with a statistical power of 0.90 were N = 54 and 164, respectively. Since data collection was set to stop at the end of the day in which the sample reached these numbers, more data was collected.

Participants. Eleven participants in Experiment 1 and one in Experiment 2 were discarded for being non-Portuguese native speakers or bilinguals. None of the valid participants reported any valid suspicion of the manipulation. The final samples included 83 Portuguese-speaking participants (*M*age = 30, *SD* = 15.3; 48 female; N_{warmth} = 39; $N_{competence}$ = 44) in Experiment 1 and 199 (*M*age = 28, *SD* = 11.6; 154 female) in Experiment 2.

Stimuli. Forty-six inward and outward-words were randomly selected from a larger stimulus pool, validated for the Portuguese phonation (Godinho & Garrido, 2016). These pre-tested words were merged with @gmail.com resulting in usernames such as bateco@gmail.com (inward) or catebo@gmail.com (outward). A pre-test (*N* = 85) validated our selection of the target professional group (customer service assistant for a mobile telecommunications company) - in the warmth versus competence dimension, $t(84)=1.71$, p = .089.

Procedure. All data was collected according to the host institution ethical guidelines. Participants were invited to join the survey by emails sent to their personal accounts or through private messages in social media platforms. After entering the Qualtrics platform, reading and agreeing with the informed consent, participants were informed that the study was designed to understand the way people perceive usernames of professionals. They were also informed there were no right or wrong answers and that they should silently read the usernames before rating them. While participants in Experiment 1 were asked to complete the ratings regarding their perceived 'warmth' or 'competence' (1 *Not warm at all* to 10 *Very warm*; 1 *Not competent at all* to 10 *Very competent*; between-participants design) in Experiment 2 participants were asked to do both ratings (within-participants design).

Each participant was presented a random sample of 28 usernames (14 inward and 14 outward), one at the time. As in all our previous experiments, there was no time limit to complete the ratings and the stimuli were visible until the answer was provided. After the ratings, participants were asked socio-demographic questions such as gender, age and native language, and two control questions aiming to detect possible manipulation awareness (Godinho & Garrido, 2016). All measures and manipulations are reported.

Results

Experiment 1. A repeated-measures analysis of variance (ANOVA) was conducted to determine the effect of the consonantal direction articulation of the usernames on participants' perception of their warmth and competence.

The consonantal articulation direction of the usernames exerted a significant impact on participants' judgments, $F(1,81) = 5.90$, $p = .017$, $\eta_p^2 = .07$, 95% CI [0.00, 0.19]. Usernames wandering inward ($M = 4.24$, $SE = .18$) were rated higher than those wandering in the opposite direction ($M = 4.09$, $SE = .17$). There was also a marginal effect of the trait being evaluated, $F(1,81) = 3.84$, $p = .054$, $\eta_p^2 = .05$, 95% CI [0.00, 0.16], showing higher ratings for competence ($M = 4.50$, $SE = .24$) than for warmth ($M = 3.82$, $SE = .25$). Importantly, the interaction between articulation direction and the trait being rated was significant, $F(1,81) = 15.86$, $p < .001$, $\eta_p^2 = .16$, 95% CI [0.04, 0.30]. As the pairwise comparisons revealed, articulation direction of the usernames did not inform competence judgments, but was relevant for warmth judgments, being inward usernames rated as warmer ($M = 4.02$, $SE = .28$) than those wandering in the opposite direction ($M = 3.63$, $SE = .28$), $t(38) = 4.70$, $p < .001$, $d_z = 0.75$, 95% CI [0.39, 1.11].

Experiment 2. Again, a repeated-measures analysis of variance (ANOVA) revealed similar results. Consonantal articulation direction of the usernames presented a main effect $F(1,198) = 4.93$, $p = .028$, $\eta_p^2 = .02$, 95% CI [0.00, 0.08], with higher ratings for inward-wandering ($M = 4.41$, $SE = .11$) than for outward-wandering usernames ($M = 4.31$, $SE = .11$). The trait being rated also presented a significant main effect, $F(1,198) = 8.00$, $p = .005$, $\eta_p^2 = .04$, 95% CI [0.00, 0.10], indicating that competence ratings were higher ($M = 4.43$, $SE = .11$) than warmth ones ($M = 4.30$, $SE = .11$). The interaction between articulation direction and the trait being rated was also statistically significant, $F(1,198) = 3.95$, $p = .048$, $\eta_p^2 = .02$, 95% CI [0.00, 0.07]. This interaction revealed that articulation direction did not affect participants' perception of competence, but only their perception of warmth, $t(198) = 2.89$, $p = .004$, $d_z =$

0.21, 95% CI [0.06, 0.35]. Usernames with inward wanderings (*M* = 4.38, *SE* = .12) were rated higher in the warmth dimension than those wandering outward (*M* = 4.20, *SE* = .12).

Overall these results unveil the impact that the in-out effect may have in increasing preference for particular services providers. Moreover, previous findings (Garrido et al., 2019), suggesting that while judgments of warmth are affected by consonantal wandering direction, competence judgments remain unaffected, were replicated.

Experiment 3

Experiments 1 and 2 examined the in-out effect in the services marketing domain, by asking participants to rate the warmth and competence of usernames of professionals that are relatively neutral in these dimensions. Results were extremely robust, supporting previous evidence obtained in the person perception domain. Nevertheless, social reality is far more complex than neutral characters or professionals.

In Experiment 3, the impact of consonantal wandering direction was tested for professional groups traditionally associated with either the warmth or the competence dimensions (Fiske & Dupree, 2014). The procedure was identical to the one used in the previous experiments, but participants were asked to judge four distinct professionals' (nurse and childcare worker, lawyer and accountant). In line with previous evidence and the results from Experiments 1 and 2, we expected that inward usernames would increase likability and warmth but not competence ratings.

Method

Power Analysis and Sampling Plan. As in the previous experiments, sample size was defined prior to data collection. We used the size of Cohen's dz = 0.31 obtained in Garrido et al., (2019) also featuring randomized ratings. The required sample size to replicate the effect with a statistical power of 0.90 was N = 91. Since Experiment 3 included between-participants ratings (liking, warmth and competence), we set that number per condition (N_{Total}=273). Again, because data collection was established to stop at the end of the day that the sample reached this number, the sample became slightly larger.

Participants. Two participants were excluded, one for not being English native speaker and the other for failing to report his/her native language. None of the remaining participants reported any valid suspicion of the manipulation. The final sample included 282

English-speaking participants (*M*age = 35, *SD* = 12.2; 196 female; $N_{preference}$ = 86; N_{warmth} = 97; $N_{competence}$ = 99).

Stimuli. Sixty inward and outward-words were randomly selected from a stimulus pool pre-tested for English phonation (Topolinski et al., 2014). Like in the former two experiments, inward and outward wandering words were merged with @gmail.com, resulting in usernames such as opinaki@gmail.com (inward) and okidapi@gmail.com (outward).

The inward and outward-wandering usernames and each of the four professional groups selected were presented together. The selection of the professional groups was supported by the classical matrix where occupational groups are classified alongside warmth and competence dimensions (Fiske & Dupree, 2014). A subsequent pilot (N = 29) validated our selection of the target professional groups - in the warmth versus competence dimension (1 - *Warmth related profession* to 10 - *Competence related profession*). Accordingly, nurse and childcare worker were elected as professions traditionally associated with the warmth (M = 4.98), whilst accountant and lawyer with the competence dimension (M = 8.93), $t(28) = -9.12$, $p < .001$.

Procedure. Participants were recruited trough Prolific platform to join a survey examining how people evaluate online usernames for different professional groups. Data was collected according to the host institution ethical guidelines. After entering Qualtrics, participants read and agreed with the informed consent stating that all data treatment would be anonymous and used for scientific purposes only.

Participants were asked to silently read and rate a total of 48 usernames, 12 for each professional group (6 inward and 6 outward). Participants were randomly distributed across the three conditions, that is, each participant rated either the usernames perceived likeability (1 - *Do not like it at all* to 10 - *Like it very much*), warmth (1 - *Not warm at all* to 10 - *Very warm*) or competence (1 - *Not competent at all* to 10 - *Very competent*). The order of the ratings was randomized. At the end participants were asked to complete the same socio-demographic questions and control questions to detect possible awareness of word manipulation as in previous experiments. We report all measures and manipulations.

Results

A repeated-measures analysis of variance (ANOVA) revealed a main effect of consonantal articulation direction on participants' evaluations of the usernames, $F(1,279) = 90.28$, $p < .001$, $\eta_p^2 = .25$, 95% CI [0.16, 0.32]. Participants provided higher ratings for

inward (M = 4.65, SE = .10) than outward-wandering usernames (M = 4.29, SE = .10). No main effect of the type of profession being rated was observed, $F(1,279) = 1.23$, $p = .269$, that is, participants' ratings did not differ for professions traditionally associated with a warmth (nurse, childcare worker) versus a competence dimension (accountant, lawyer). A marginal main effect of the type of rating, $F(1,279) = 2.69$, $p = .070$, $\eta_p^2 = .01$, 95% CI [0.00, 0.04] indicated that competence ratings where on average higher (M = 4.77, SE = .17) than likeability (M = 4.42, SE = .18) and warmth ratings (M = 4.22, SE = .17).

Interaction effects were found between articulation direction and the trait being rated, $F(1,279) = 5.84$, $p = .003$, $\eta_p^2 = .02$, 95% CI [0.00, 0.06], and between articulation direction and the professional group under scrutiny, $F(1,279) = 3.47$, $p = .063$, $\eta_p^2 = .01$, 95% CI [0.00, 0.05]. The first interaction revealed that the in-out effect was larger in likeability ratings ($M_{difference} = .540$, $p < .001$) than in warmth ($M_{difference} = .265$, $p < .001$) or competence ratings ($M_{difference} = .261$, $p < .001$). The second interaction, despite marginal, suggested that the difference between the ratings given to inward-wandering versus outward usernames was larger when participants were judging competence-related occupations (accountant and lawyer, $M_{difference} = .407$, $p < .001$) as opposed to warmth-related occupations (nurse and child care worker, $M_{difference} = .303$, $p < .001$).

These results reveal that the in-out effect may play an even more relevant role in the services marketing domain than the previous examination of more neutral occupations would lead us to predict. The apparently irrelevance of the in-out effect for competence judgments observed in previous research and conveniently replicated across Experiments 1 and 2, seems to be only valid for professional groups with no particular association with a warmth or competence dimension. When the professional group under scrutiny is somehow associated with any of the core dimensions of social perception, this modulation fails to emerge. In real life scenarios, where consumers must choose between professionals from diverse backgrounds, the articulatory direction is expected to cross-cut general likeability, social warmth and competence judgments.

Experiment 4

Experiments 1, 2 and 3 examined the in-out effect in the services marketing domain, testing whether the systematic modulation of consonantal wanderings is a reliable method to increase preference for different professionals through their online usernames. Due to the size-wise powerful samples and the consistency observed in the results it was possible to

corroborate the relevance of the effect for the services context. Experiment 4 was specifically designed to test the effect with FMCG.

Consumer attitudes resulting from a shopping experience may be assessed on both hedonic and utilitarian dimensions (Babin, Darden, & Griffin, 1994). Thus, just like the warmth and competence dimensions are at the core of person perception, hedonic and utilitarian dimensions are relevant to characterize consumer attitudes towards products (Botti & McGill, 2011). While one pertains to a more emotional side of consumption, the other is better defined as the rational aspect of consumer judgment focusing on objective characteristics such as usefulness.

Based on the previous results, that is, the relevance of consonant articulation direction for warmth but not competence judgments of neutral characters or professional groups, we expected that consonantal articulation would only be pertinent for the evaluation of hypothetical brand names for unspecified food products in an affective product type dimension. In other words, the affective in-out manipulation would only be relevant for hedonic (vs. utilitarian) judgments. Indeed, previous research has demonstrated that there is a congruency between the type of ad (affective or rational) and the type of product (hedonic vs. utilitarian) advertised (e.g., Drolet, Williams, & Lau-Gesk, 2007), being affective ads only diagnostic for hedonic products (Schwarz & Clore 1983).

Method

Power Analysis and Sampling Plan. Prior to data collection, we used the Cohen's dz = 0.32 obtained in a food naming experimental setting by Topolinski and Boecker (2016a; Experiment 1) to estimate the sample size required to replicate the in-out effect with a statistical power of 0.90 (N = 86). Because the ratings (liking, hedonic and utilitarian) were between-participants, we established that number per condition (N_{Total} = 258). Despite using the same data-collection stopping rule defined in the previous experiments, data exclusions lead to a slightly smaller final sample.

Participants. Four participants were excluded for not being English native speakers. No more exclusions were made because no one reported a valid suspicion of the manipulation. The final sample included 254 English speaking participants (*M*age = 34, *SD* = 10.9; 170 female, 1 undisclosed gender; $N_{preference}$ = 87; N_{warmth} = 78; $N_{competence}$ = 89).

Stimuli. Sixty inward and outward-words randomly selected from the stimulus pool pre-tested for English phonation included in Topolinski et al. (2014) were used as potential names for food products to be launched in the market.

Procedure. After being recruited in Prolific to join a survey examining how people evaluate names for food products, participants were directed to the Qualtrics platform and asked to read and agree with the informed consent stating that all data treatment would be anonymous and for scientific purposes only. Data was, collected according to the host institution ethical guidelines.

As in Experiments 1 and 2, participants were requested to rate a "neutral" stimulus, that is, a name for a food product that is not associated with a particular hedonic or utilitarian dimension. The instructions were adapted for the product scenario and to the judgment required:

Likeability Judgment – "Silently read each name and rate it as fast and spontaneously as possible regarding how much you like it as a name for a new FOOD PRODUCT. Please give your answer in a scale from 1 - *Do not like it at all* to 10 - *Like it very much*";

Hedonism Judgment– "Silently read each name for a new FOOD PRODUCT and rate it as fast and spontaneously as possible regarding the hedonistic nature that it conveys about the product. By hedonistic judgment we mean, how much you believe the name conveys the image of a food product that is pleasant, fun, enjoyable or appealing to the senses. Please give you answer in a scale from 1 - *Not hedonistic at all* to 10 - *Very hedonistic*";

Utilitarian Judgment– "Silently read each name for a new FOOD PRODUCT and rate it as fast and spontaneously as possible regarding the utilitarian nature that it conveys about the product. By utilitarian judgment we mean, how much you believe the name conveys the image of a food product that is useful, practical and performing a specific operation. Please give you answer in a scale from 1 - *Not utilitarian at all* to 10 - *Very utilitarian*".

Each participant randomly rated 30 names and was after asked to complete the same socio-demographic and control questions to detect possible manipulation awareness. We report all measures and manipulations.

Results

A repeated-measures analysis of variance (ANOVA) revealed a main effect of consonantal articulation direction on participants' evaluations of the product's names,

$F(1,251) = 167.04$, $p < .001$, $\eta_p^2 = .40$, 95% CI [0.31, 0.48]. Participants provided higher ratings for inward names ($M = 4.32$, $SE = .11$) than outward-wandering names ($M = 3.68$, $SE = .11$). No main effect of the type of judgment being made or interaction effects were observed.

In a product domain, more specifically, when addressing potential names for food products, the in-out effect presents itself very robustly across all the rating types requested. Thus, contrary to our predictions, the in-out effect is also observed in judgments regarding a rational, utilitarian dimension. Products' names wandering inward in the oral cavity were consistently perceived as more likeable, hedonistic and utilitarian.

Meta-analysis. To better establish the magnitude of the in-out effect in more affective (warmth / hedonistic) or more rational (competence/utilitarian) judgments across services and products we conducted a joint ANOVA ($N = 648$), where Services versus Products and Affective versus Rational judgments were entered as between factors (Rosenthal, 1978). In this analysis: (a) data was gathered from Experiments 1, 2 and 4, that included judgments about "neutral" products or services; (b) since data in Experiment 2 was collected within-participants, each participant provided ratings for both warmth and competence; the data included in the meta-analysis refers to the actual number of affective and rational ratings ($N = 648$), which is larger than the number of participants across these three experiments ($N = 449$); and, (c) preference ratings from Experiment 4 were excluded.

The 2 (Consonantal wandering: inward vs. outward; within) X 2 (Stimulus Type: service vs. product; between) X 2 (Judgment Type: affective vs. rational; between) ANOVA yielded a main effect of consonantal wandering direction, $F(1,644) = 92.23$, $p < .001$, $\eta_p^2 = .13$, 95% CI [0.08, 0.17] and a main effect of the type of stimulus being rated, $F(1,644) = 3.92$, $p = .048$, $\eta_p^2 = .01$, 95% CI [0.00, 0.02]. While the inward wandering names / usernames ($M = 4.36$, $SE = .08$) were consistently preferred over outward ($M = 4.01$, $SE = .07$), the usernames for services also presented higher ratings ($M = 4.33$, $SE = .11$) than the names for products ($M = 4.04$, $SE = .13$).

Importantly, there was an interaction effect between the consonantal wandering direction and the type stimulus under judgment (services vs. products), $F(1,644) = 44.07$, $p < .001$, $\eta_p^2 = 0.06$, 95% CI [0.03, 0.10], indicating that the in-out effect is consistently larger when participants are selecting a name for a hypothetical food product ($M_{difference} = .588$, $p < .001$) than a username for a professional ($M_{difference} = .107$, $p = .004$).

The considerably stronger effect of consonant articulation in hedonic and utilitarian ratings of food products, reinforces the hypothesis that the in-out effect might have an eating-related explanation. Indeed, this strong association might have been the reason why the in-out effect was surprisingly observed in the utilitarian judgments made about the hypothetical food products. We will explore this reasoning further in the discussion.

Discussion

In four experiments we show that consonantal articulation direction may be used to influence perceptions of service providers and products. Inward-wandering usernames and product-names, that in their articulation resemble the oral ingestion of aliments, trigger positive evaluations more intensively than those featuring outward-wandering sequences, similar to expectoration movements. Moreover, while Experiments 1 and 2 replicated an already known modulation - the absence of this established preference for inward-wandering consonantal sequences in competence ratings, Experiments 3 and 4 demonstrated that the in-out effect might cue judgment beyond affective dimensions.

The results observed in Experiment 3 suggest that the boundary condition previously found for judgments about neutral stimuli seems to happen only in the absence of relevant information about the target-person. Previous research in the person perception domain suggest that when judging a neutral target in the absence of relevant information, consonant wandering may act as an important cue that informs warmth ratings (Garrido, et al, 2019). This is arguably the case because while competence inferences seem not to rely in intuitive System 1 judgments (Willis & Todorov, 2006), attractiveness, likeability or trustworthiness evaluations are often made instantly, after minimal exposure times. Meaning that affective judgments about other individuals require minimal inferential activity (Zajonc, 1980). However, when more information is known about the target, namely about the warmth or the competence typically associated to a given professional group, this affective cue seems to inform all the judgments (preference, warmth but also competence).

In Experiment 4, inward-wandering names combined with neutral food products, biased judgments about both affective (hedonism) and rational (utilitarianism) dimensions. Assuming that the inward-preference results from an oral-approach avoidance mechanism inherited from a survival instinct (Topolinski et al., 2014), it may be the case that, in the context of food products, the oral manipulation becomes highly diagnostic (Experiment 4, Godinho et al., 2018).

The most relevant takeaway message from the current work is the potential of the application of the in–out effect to branding. Overall our experiments present a pragmatic approach to oral kinematics, uncovering the relevance of consonantal wandering for actual marketing practice. As far as the in-out effect, as well as other reported motor-to-affect links (e.g., articulatory-feedback, Rummer, Schweppe, Schlegelmilch, & Grice, 2014), may seem from being actual market-assets when presented experimentally with meaningless and odd-sounding words, the robustness of overall oral kinematics findings cannot be ignored. Moreover, since these articulatory manipulations operate independently of the traditional semantic paths, they present high potential for triggering preference outside of consumers' awareness. Our findings consistently suggest that, since cognitive functioning is grounded in bodily and sensorimotor processes, simple and apparently innocent articulatory manipulations might become the secret ingredient to reach market success.

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SECTION C | GENERAL DISCUSSION

1. SUMMARY

The main goal of the present work was to rehearse the application of the in-out preference when naming products and service providers and to establish the conditions under which such preference would be advantageous to increase market success. Additionally, we intended to provide evidence about the universality of this articulatory effect by replicating it in new languages and writing systems. Finally, it was also our goal to assist theoretical endeavors in the examination of the underlying mechanism causing the preference for words with inward consonantal-articulations, namely by further testing the fluency hypothesis. The successive experiments conducted to reach these goals were divided into eight different articles, whose main results will be summarized in the following paragraphs to ground an informed discussion about their limitations and main contributions.

In the first chapter, we established the universality of the in-out effect (Godinho & Garrido, 2016; Godinho, Garrido, & Horchak, 2019) by presenting four replications in three different languages (Portuguese, Ukrainian and Turkish). Replications were held in languages with different roots and families (in the Italic and Slavic branches of the Indo-European language-family and in the Turkic language-family) and with two distinct writing systems (Latin and Cyrillic alphabets). Since these replications supported the universality of the effect and provide ground for future replications in less explored languages and contexts, this chapter constitutes a robust conceptual and methodological contribution. Nevertheless, and beyond the value of these replications, the articles are also relevant for marketing. Applied research using oral kinematics may become critical for implementing strategies to overcome the challenges presented by the global multi-cultural markets, increasing brand growth and overall business performance.

The second chapter included two systematic analyses (Godinho & Garrido, 2019a; Godinho & Garrido, 2019b) to the alternative explanation advanced for the in-out effect, namely the fluency hypothesis. Our results revealed that, while powerful enough to compete with and disrupt the in-out effect, fluency did not fully explain why inward wandering words are consistently preferred over outward ones. The present findings contribute, therefore, to challenge a mere fluency explanation (Bakhtiari, Körner, & Topolinski, 2016; Körner, Bakhtiari, & Topolinski, 2019), opening the door for new research directly examining alternative accounts for such a surprising phenomenon. Indeed, while questioning the operation of a single fluency mechanism, the experiments presented suggest that fluency may

have a powerful effect capable of masking the in-out preference. Therefore, this second chapter presents conceptual but also applied contributions. The acknowledgment of the competitive role of fluency emphasizes that the in-out effect can only be effectively applied to branding and advertising if worked out together with other established effects such as those resulting from fluency mechanisms (e.g., mere exposure effect; Zajonc, 1968).

Finally, in the third chapter, we rehearsed applications to the marketing context and implemented direct tests to three boundary conditions that could affect the successful application of the in-out effect to the consumer behavior domain. First, we examined the relevance of edibility for the emergence of the in-out effect and clarified the role of valence for the same purpose (Godinho, Garrido, Zürn, & Topolinski, 2019). Second, we evaluated the potentially disruptive role of competitive visual information, with increasingly complex materials in the emergence of the in-out effect (Godinho & Garrido, 2017). Finally, we combined this new line of research with well-established literature in the popular domain of person perception (Garrido, Godinho, & Semin, 2019; Godinho & Garrido, 2019c). Our results converge in suggesting that despite the inefficacy of the in-out effect to market non-edible products, it can be successfully applied to both products or service providers to trigger consumer preference. Moreover, traditional brand imagery such as different logos or packaging types did not disrupt the in-out effect. Taken together, these findings confirm previous studies concluding that these subtle articulatory manipulations may have a substantial role when naming both new products or services, while providing new insights on how to accomplish such benefits with the in-out effect.

2. LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

There are undoubtedly some limitations that we need to address when summarizing our key findings and assessing their overall contribution.

From a theoretical standpoint we acknowledge that our contribution is quite modest to solve the debate regarding the mechanism underlying the in-out effect. By providing evidence that fails to support a fluency hypothesis (Bakhtiari et al., 2016), we are not offering an answer, nor even pointing the way for a potential solution. Thus, despite the evidence hereby provided, the question on what or which mechanisms might drive the in-out effect remains unanswered.

Future research endeavors testing the oral-approach avoidance motivation explanation (Topolinski, Maschmann, Pecher, & Winkielman, 2014), are still very much needed. Ideally the examination of compatibility effects between approach–avoidance and in-out stimuli could provide interesting inputs about the relation between the two mechanisms. Classical manipulations such as arm movements (e.g., Chen & Bargh 1999) could be used to either increase the accessibility of approach-avoidance motivations or simply to measure participants' responses to inward-outward wandering stimuli. With the same purpose, an oral approach-avoidance explanation for the in-out effect would predict an absence of the inward preference in populations whose approach motivation towards food is compromised, such as patients with eating disorders (e.g., Neimeijer, de Jong, & Roefs, 2015).

Another limitation concerns our methodological options and affects directly the main goal our work - the applicability of the in-out preference effect as a valid asset for marketing management. While demonstrating that the effect is quite robust, resistant to competing visual cues or valence of the denoted objects and applicable to market products and services, our empirical evidence was excessively dependent upon artificial experimental stimulus materials and procedures. Moreover, the dependent variables did not provide a proxy good enough to predict buying behavior. Contrary to previous research (e.g., Topolinski, Zürn & Schneider, 2015), we did not measure important variables for consumer research such as purchase intentions or willingness-to-pay. The narrow set of dependent variables used was restricted, in most of the experiments, to preference ratings, clearly beneath the usual variety and richness of the scales used by marketing researchers to predict consumer behavior. Moreover, in consumer contexts, people are exposed to huge amounts of information presented simultaneously, as for example, product packages lined up in a shelve, and not to

information presented sequentially. Therefore, we believe that despite the efforts made in the third chapter, the applicability of the effect to products and services marketing may only be categorically established after being tested in real life settings.

Moreover, despite the advantages of controlled lab experiments, this research domain is lacking field studies that mimic real buying and consumption behavior. The options are abundant and may simply include new dependent variables or more complex procedures where product tastings are required. Either way, such research will always need to be complemented with correlational studies, examining real brands, both with inward and outward wandering names, and their competitive performance.

Finally, another potentially interesting research avenue could include the comparative analysis of other articulatory effects reported in the literature. The combined use of the in-out effect and the articulatory-feedback hypothesis for instance (Rummer, Schweppe, Schlegelmilch, & Grice, 2014) may present increased benefits for brand name design and help to fully understand the extension of this motormouth effects.

3. CONCLUSION

Taken together, our findings successfully show that apparently innocent articulatory-features of names, that in their articulation imply particular mouth movements, elicit positive feelings toward products (and service providers). Oral kinematics is hereby recognized as a fascinating research field, by no means fully explored, that entails great opportunities for branding and advertising. Indeed, since this simple in-out manipulation seems capable of eliciting positive attitudes in potential customers (without any prior exposure), it will likely be effective in assisting creative teams in the design of brand names and marketing managers in planning marketing strategies (see Lowrey, Shrum, & Dubitsky, 2003, for other effects of linguistic properties on brand name memorability). Overall, even if presenting a small effect, the in-out effect may add that secret ingredient that, when ethically used like any other marketing technique, becomes determinant for brand awareness, engagement, and success.

Ultimately this work also establishes the significant role of bodily simulation in consumer-behavior and supports the need to revisit the definition of Sensory Marketing. The relevance in considering a broader conceptual approach, capable of integrating (and inspire) motor related research and marketing practices becomes evident. Departing from Krishnas' (2011) Sensory Marketing definition, we suggest Grounded Marketing as the marketing that engages consumers' senses, their *motor system*, and their social and physical environments, in shaping perception, attitudes, decision-making, and ultimately consumer behavior.

Articulatory effects such as the in-out effect do not necessarily represent "flaws" in our cognitive systems. On the contrary, they are powerful demonstrations of the mechanisms that allow us to (re)act on-time, directly in the environment and guarantee survival. Given the evidence showing that like cognition in general, consumer cognition is also for action (e.g., Elder & Krishna 2012), embodied (e.g., Streicher & Estes 2015), and extended to the physical (e.g., Clark, 1999) and social world (e.g., Ineichen, Florack, & Genschow 2009), these surprising hidden routes to preference are certainly worthy of further research.

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