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

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 Topolisnki 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, $F(1,543) = 5.068$, $p = .025$, $\eta_p^2 = .009$ 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, 2015), 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.

[insert Table 1 here]

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, 2018): 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.

References

Bakhtiari, G., Körner, A., & Topolinski, S. (2016). The role of fluency in preferences for inward over outward words. *Acta Psychologica*, *171*, 110-117. doi:10.1016/j.actpsy.2016.10.006

Bates, D., Maechler, M., Bolker, B., & Walker, S. (2014). lme4: Linear mixed-effects models using Eigen and S4. *R package version*, *1*(7), 1-23.

Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*(1), 155-159. doi: 10.1037/0033-2909.112.1.155

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*(2), 175-191. doi: 10.3758/BF03193146

Godinho, S., & Garrido, M. V. (2016). Oral approach-avoidance: A replication and extension for European–Portuguese phonation. *European Journal of Social Psychology*, *46*, 260–264. doi:10.1002/ejsp.2172

Godinho, S., & Garrido, M. V. (2017). Branding with the in–out effect: The impact of consonantal articulation on brand evaluation. *Psychology & Marketing*, *34*(9), 904-911. doi:10.1002/mar.21031

Kronrod, A., Lowrey, T., & Ackerman, J. (2014). The effect of phonetic embodiment on attitudes towards brand names. *ACR North American Advances*, *42*, 139-140.

Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2017). lmerTest package: tests in linear mixed effects models. *Journal of Statistical Software*, *82*(13).

Lindau, B., & Topolinski, S. (2018a). The articulatory in-out effect resists oral motor-interference. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *44*(2), 209–220. doi:10.1037/xlm0000443

Lindau, B., & Topolinski, S. (2018b). The influence of articulation dynamics on recognition memory. Cognition, 179, 37-55.

Pashler, H., & Harris, C. R. (2012). Is the replicability crisis overblown? Three arguments examined. *Perspectives on Psychological Science*, *7*(6), 531-536. doi:10.1177/1745691612463401

Rossi, P., Pantoja, F., & Borges, A. (2015). What a delicious name! Using oral movements to influence food perception and consumption. In Kristin Diehl and Carolyn Yoon (Eds.) NA - *Advances in Consumer Research, 43* (pp. 805-805). Duluth, MN: Association for Consumer Research.

Rossi, P., Pantoja, F., Borges, A., & Werle, C. (2016). What a delicious name! The relationship between embodiment and food consumption. In Maximilian Stieler (Ed.) *Creating Marketing Magic and Innovative Future Marketing Trends* (pp. 447-448). Cham: Springer International Publishing AG. doi:10.1007/978-3-319-45596-9_83.

Rossi P., Pantoja F., Borges A., Werle C., (2017), What a delicious name! Articulatory movement effects on food perception and consumption, *Journal of the Association for Consumer Research*, *2*(4), 392-440. doi: 10.1086/693112

Rozin, P. (1996). Towards a psychology of food and eating: From motivation to module to model to marker, morality, meaning, and metaphor. *Current Directions in Psychological Science*, *5*, 18–24. doi:10.1111/1467-8721.ep10772690

Rummer, R., Schweppe, J., Schlegelmilch, R., & Grice, M. (2014). Mood is linked to vowel type: The role of articulatory movements. *Emotion*, *14*(2), 246-250. doi: 10.1037/a0035752

Silva, R. R., & Topolinski, S. (2018). My username is IN! The influence of inward vs. outward wandering usernames on judgments of online seller trustworthiness. *Psychology & Marketing*, *35*, 307–319. doi:10.1002/mar.21088

Topolinski, S. (2017). Articulation patterns in names: A hidden route to consumer preference. *Journal of the Association for Consumer Research, 2(4)*, 382–391. doi:10.1086/692820

Topolinski, S., & Bakhtiari, G. (2016). Sequential approach-avoidance movements: The case of inward and outward articulation. *Social Psychology, 47(2)*, 98-117. doi: 10.1027/1864-9335/a000263.

Topolinski, S., & Boecker, L. (2016a). Minimal conditions of motor inductions of approach-avoidance states: The case of oral movements. *Journal of Experimental Psychology: General, 145(12)*, 1589.

Topolinski, S., & Boecker, L. (2016b). Mouth-watering words: Articulatory inductions of eating-like mouth movements increase perceived food palatability. *Appetite, 99*, 112-120. doi:10.1016/j.appet.2016.01.018

Topolinski, S., Boecker, L., Erle, T. M., Bakhtiari, G., & Pecher, D. (2017). Matching between oral inward-outward movements of object names and oral movements associated with denoted objects. *Cognition and Emotion, 31(1)*, 3-18. doi:10.1080/02699931.2015.1073692

Topolinski, S., Maschmann, I. T., Pecher, D., & Winkielman, P. (2014). Oral approach–avoidance: Affective consequences of muscular articulation dynamics. *Journal of Personality and Social Psychology*, *106*, 885-896. doi:10.1037/a0036477

Topolinski, S., Zürn, M., & Schneider, I. K. (2015). What's in and what's out in branding? A novel articulation effect for brand names. *Frontiers in Psychology*, *6*, 585. doi:10.3389/fpsyg.2015.00585/full