Title
Walking munu and jumping bibi: Sound symbolism in (non)words produced by Turkish speakers

Journal
Proceedings of the Annual Meeting of the Cognitive Science Society, 44(44)

Authors
Topel, Selin
Kanero, Junko
Saji, Noburo
et al.

Publication Date
2022

Peer reviewed

Walking *munu* and jumping *bibi*: Sound symbolism in (non)words produced by Turkish speakers

Selin Topel (s.topel@fsw.leidenuniv.nl)
Institute of Psychology, Clinical Psychology Unit, Leiden University
Pieter de la Court Building, 2300 RB Leiden, Netherlands

Junko Kanero (jkanero@sabanciuniv.edu)
Faculty of Arts and Social Sciences, Sabancı University
Orhanlı – Tuzla, 34956, Istanbul, Turkey

Noburo Saji (saji@waseda.jp)
Faculty of Human Sciences, Waseda University
2-579-15, Mikajima, Tokorozawa city, Saitama, 359-1192, Japan

Tilbe Göksun (tgoksun@ku.edu.tr)
Department of Psychology, Koç University
Rumelifeneri Yolu, 34450, Sariyer – Istanbul, Turkey

Abstract

Contrary to the classic idea of arbitrariness in mappings between words and meanings, many languages have words that mimic the sounds of their referents (onomatopoeia) and other subtler sound symbolic associations. However, our knowledge concerning the characteristics of sound-meaning links is still limited. Previous research mostly focused on languages with a large (e.g., Japanese) or limited (e.g., English) inventory of sound symbolic words. We conducted a word-production study with native speakers of Turkish, a language with a moderate amount of sound symbolic words, and examined links between sound properties (e.g., voiced vs. voiceless) and semantic dimensions (e.g., *size*, *speed*) in describing motions. Some of the sound-meaning links identified were the links found in Japanese and English samples in previous studies (Saji et al., 2019), whereas many seem to be specific to Turkish. This study provides initial evidence for language-specific sound symbolism in Turkish and links that are consistent across languages.

Keywords: sound symbolism; iconicity; Turkish; locomotion; sound-meaning association

Introduction

In traditional linguistics, the relationship between sound and meaning has been considered arbitrary (e.g., de Saussure, 1983). In line with this arbitrariness assumption, there exist countless examples where different sounds correspond to the same meaning across different languages (e.g., the referent is the same for *dog*, *köpek*, *inu*, *hund*, *perro*). Challenging this complete arbitrariness view, however, a large body of research provides additional evidence for consistent and systematic sound-to-meaning mappings (Blasi et al., 2016; Köhler, 1947; Ramachandran & Hubbard, 2001; Imai et al., 2008; also see Dingemanse et al., 2015; Perniss et al., 2010). *Sound symbolism* refers to non-arbitrary mappings between sound and meaning and is found in many languages. Japanese is known to have a large inventory of grammaticalized sound symbolic words (Hamano, 1998). For example, describing the manner of locomotion, *yotayota* refers to a clumsy walk while *hyoihyoi* may indicate effortless hopping (Kanero et al., 2014). English, on the other hand, does not have many conventional sound symbolic words; but even in English, there are some onomatopoeic words such as *splash*, *buzz*, *knock*, and *boom* that mimic real sounds. Previous research has mostly focused on languages with a large number of conventional sound symbolic words (e.g., Japanese) and languages with a very limited number of sound symbolic words (e.g., English). Here, we argue that all languages can be placed within a continuum based on how sound symbolism is reflected in their lexicons, and "in-between" languages should also be examined. As the first of its kind, the current study examined how sound symbolism was reflected in the Turkish language.

Turkish has a considerable number of sound symbolic expressions (Akyıldız-Ay, 2017; Demircan 1996; 1997; Ido, 1999; Jendraschek, 2001; Zülfikar, 1995). These expressions share some similarities with Japanese mimetics such as a reduplicative structure (e.g., *harıl harıl,* which is used to indicate working hard or non-stop) and consonant-vowel-consonant-vowel (CVCV) form (e.g., *piti piti* is used when describing walking away slowly with small steps). The range of both conventional and unconventional sound symbolic words in the Turkish language and their similarities to sound symbolic words in Japanese makes Turkish a unique and ideal example for the study of sound-meaning associations. Critically, although anecdotal evidence suggests that Turkish is considerably rich in sound symbolic words, no experimental research has explored how sound symbolism is reflected in the vocabulary used by Turkish speakers.

Research investigating sound symbolic associations beyond conventional sound symbolism and imitative words across languages typically uses forced-choice designs (e.g., Ćwiek et al., 2022; Sidhu et al., 2021) or ratings on different

In J. Culbertson, A. Perfors, H. Rabagliati & V. Ramenzoni (Eds.), *Proceedings of the 44th Annual Conference of the Cognitive Science Society.*

semantic categories for a given list of (non)words (e.g., Kambara & Umemura, 2021; Knoeferle et al., 2017). Less is known about how people intuitively produce words with systematic sound-meaning correspondences when describing non-acoustic stimuli (Saji et al., 2019; Shinohara et al., 2016). A previous study by Saji et al. (2019) investigated sound symbolic associations in English and Japanese speakers and identified shared as well as language-specific properties. Participants were shown videos displaying an individual walking in different manners and asked to 1) rate the motion on five semantic dimensions (i.e., size, speed, weight, energeticity, and jerkiness), and 2) produce a word that they think describes the motion in the specified CVCV format. Using a data-driven approach, they found that across both samples, voicing of the consonants had an association with semantic dimensions. They also reported language-specific sound symbolic links. In particular, voiced consonants were associated with larger and heavier motions in the Japanese-speaking sample, and with slower motions in the English-speaking sample. In addition, the nasal manner of articulation of consonants was associated with slowness and lower vowel was linked to fastness in the Japanese group. Palatal and velar consonants were linked to lighter and jerky motions in the English group. These findings were informative for gaining insight into the cross-linguistic and language-specific sound-meaning mappings. However, the extent to which similar sound symbolic associations would be observed in other languages that differ in their inventory of sound symbolic words remains to be investigated.

Turkish, despite containing many sound symbolic words and expressions, has not been studied extensively to uncover the characteristics of sound-meaning associations in different domains. Turkish is rich in sound symbolic words imitating motions (Akyıldız-Ay, 2017; Ido, 1999; Jendraschek, 2001). For example, *patlamak* (to explode) imitates the sound of an explosion, or *zıp* (to jump) corresponds to the up and down movement of an object. The sound *-rt* is related to rapid and sudden motion and is used in words like *fırt* referring to liquid suddenly moving out of its container (Akyıldız-Ay, 2017). However, it is not clear whether these sound-symbolic correspondences are specific to Turkish or whether they reflect a sound inventory of Turkish.

In the current study, we present the data from a motion-related word-production study in a sample of native Turkish speakers. Given the results of previous research reporting both shared and exclusive sound symbolic patterns for English and Japanese (Saji et al., 2019), we further explored the similarities with previously reported sound symbolic associations in a large set of words produced by Turkish speakers.

Methods

Participants

Sixty native Turkish-speaking undergraduate students were recruited for the study. We excluded one participant who did not provide answers in the CVCV format. Our final sample consisted of 59 participants (M_{age} = 22.48, *SD* = 1.21). Participation in the study was voluntary and the participants did not receive any monetary compensation except for course credits. No personal information was collected other than the date of birth, sex, languages the participant speaks besides Turkish and their proficiency in those languages. This study was approved by the Ethics Committee of the local Institutional Review Board of the same university where the data were gathered.

Materials

The stimuli consisted of 70 video clips (Saji et al., 2019). Each video was 4-15 seconds long and showed a person moving from the left side to the right side of the screen in different manners (e.g., running, stomping). The actions in the videos were expected to differ in perceived size, speed, weight, energeticity, and jerkiness.

Procedure

We collected the data using the online questionnaire software *Qualtrics* (Qualtrics, Provo, UT). Participants were provided with a survey link and instructed to start the experiment in a quiet environment with no distraction. After providing consent to participate in the study, they completed the two tasks: rating task and word production task. All participants completed the tasks in the same order.

Rating Task Participants watched each of the 70 videos showing different manners of locomotion and rated them in terms of five dimensions: “size”, “speed”, “weight”, “energeticity”, and “jerkiness” (Saji et al., 2019). They were instructed to follow their intuition without thinking too much when indicating their ratings. The videos were presented to the participants in randomized order. All dimensions were rated on an 11-point scale ranging from -5 to +5 with 0 indicating that the dimension was not associated with the motion.

Production Task Participants were then asked to watch the same 70 videos presented in the rating task again and come up with (non)words that, according to them, matched each action presented in the videos. They were instructed to produce a novel word by using the template of CVCV (e.g., *fofo*, *yalo*), and type the word in a text box. We included the same words that Saji et al. (2019) used as an example (e.g., *tepu*, *bobo*, *şoki*) in the instructions to clarify the task. There was no time constraint for the participants to complete the experiment, and they were asked to complete each task at their own pace.

Data Coding

A total of 4024 CVCV-formed words were included in the analyses. The words that were clearly based on conventional, already existing words were excluded from the analyses (e.g., *robo, zıpı* [similar to the verb stem *zıpla-* that means to jump or hop in Turkish], *hızı* [similar to *hızlı*—fast or quick in Turkish], *yava* [similar to *yavaş*—slow in Turkish]). The first syllable of each novel word (C1V1) was coded phonologically to be used in further analyses. The coding scheme for the consonants included place of articulation, manner of articulation, voicing; and height, backness and roundness for the vowels (Bailey & Hahn, 2005; Saji et al., 2019).

Statistical Analyses

We analyzed the semantic ratings for each dimension and the words generated by the participants using multilevel regression models (*lmer* function in the *lme4* package in *R*; Bates et al., 2015; R Core Team, 2019). In addition, *anova* function in the *lmerTest* package was used to calculate and report the *p*-values (Kuznetsova et al., 2017). *Post-hoc* analyses were conducted using the *emmeans* package (Lenth et al., 2018).

Results

Table 1 shows the frequencies of the phonological features in a data set of novel motion-words produced by native Turkish speakers. The numbers in parentheses represent the percentages of observed phonetic values within the phonetic feature categories. The order of frequencies in place and manner of articulation was identical with those in English and Japanese from Saji et al (2019); *alveolar* and *labial* (place of articulation), *stop* and *fricatives* (manner of articulation) appear more frequently than the other phonetic features. This suggests that participants produced sounds in a non-random fashion, recruiting the inventory of sounds typical of Turkish.

Table 1: Frequency table of phonological features

Consonant			
Feature	Category	Frequency	Example
Place of articulation	Alveolar	1753 (43%)	***t**ata*
	Labial	1120 (28%)	***p**iti*
	Velar	460 (11%)	***k**ati*
	Glottal	368 (9%)	***h**ahi*
	Palatal	368 (9%)	*yula*
Manner of articulation	Stop	1733 (43%)	***d**ire*
	Fricatives	1162 (29%)	***s**iya*
	Nasal	365 (9%)	***m**unu*
	Lateral	246 (6%)	***l**alı*
	Glide	229 (6%)	*yuta*
	Flap	187 (5%)	***r**ipi*
	Affricates	147 (4%)	***ç**içi*
Voicing	Voiced	2013 (49%)	***m**imi*
	Voiceless	2056 (51%)	***f**iti*
Vowel			
Feature	Category	Frequency	
Height	High	1585 (39%)	*kıpı*
	Mid	1272 (31%)	*m**o**ro*
	Low	1212 (30%)	*t**a**ra*
Backness	Back	2653 (65%)	*s**a**ma*
	Front	1416 (35%)	*m**e**lo*
Roundness	Round	1297(32%)	*z**u**zu*
	not Round	2772(68%)	*p**i**ti*

We specified separate models for each dimension where the variance in participant ratings were explained by different phonological characteristics of the words produced. We included fixed effects for all categories. Both the subject and video effects were specified as random intercepts in the models. All significant effects are reported in Table 2.

Results of the multilevel regression analysis for the *size* dimension show that the manner of articulation of consonants explained the variance in the perceived size significantly ($F(6, 3899) = 3.37$, $p = .003$). *Post-hoc* pairwise comparisons of the manners of articulation showed that using *nasal* consonants was associated with motions perceived as smaller particularly when compared with the use of *affricate, fricative,* and *stop* consonants.

Manner of articulation of consonants also explained the variance in the *speed* dimension significantly ($F(6, 3902) =$

Table 2: Type-III ANOVA table for model fixed effects

	numDF	denDF	F
Size			
Voicing	1	3904.8	1.351
Place	4	3900.2	1.283
Manner	6	3898.0	3.354**
Height	2	3906.2	0.526
Backness	1	3909.3	0.378
Roundness	1	3906.7	0.910
Speed			
Voicing	1	3908.7	2.097
Place	4	3904.5	2.021
Manner	6	3900.7	3.734**
Height	2	3908.7	1.066
Backness	1	3914.1	0.126
Roundness	1	3911.3	2.056
Weight			
Voicing	1	3934.5	6.082*
Place	4	3926.8	2.090
Manner	6	3921.9	1.888
Height	2	3931.9	2.683*
Backness	1	3940.8	0.214
Roundness	1	3937.7	3.910*
Energeticity			
Voicing	1	3919.7	0
Place	4	3914.4	3.520**
Manner	6	3909.3	2.193*
Height	2	3918.4	1.213
Backness	1	3926.1	0.032
Roundness	1	3922.8	1.110

Note: $p < 0.001$ '***' $p < 0.01$ '**' $p < 0.05$ '*'

3.78, p = .001). *Post-hoc* analyses further showed that this effect was due to *nasal* consonants being associated with quickness of the motion particularly relative to *fricative* (β = -0.58, *SE* = 0.13, p < .001) and *stop* consonants (β = -0.47, *SE* = 0.12, p = .002).

Results of the analyses for the *weight* dimension revealed a different pattern such that both the voicing of the consonants (F(1, 3936) = 6.74, p = .009) and the backness of the vowels (F(1, 3947) = 4.79, p = .029) explained the variance in perceived weight significantly. *Voiced* consonants were associated with heavier-perceived motions compared with *voiceless* consonants (β = -0.24, *SE* = 0.09, p =.009). *High* vowels were associated with lighter motions relative to the *low* vowels (β = -0.335, *SE* = 0.13, p = .04). Unrounded vowels were associated with lighter motions than rounded vowels (β = -0.23, *SE* = 0.12, p = .04).

Multilevel regression analyses with *energeticity* as the outcome variable showed that both the place (F(4, 3916) = 3.57, p = .007) and manner of articulation (F(6, 3911) = 2.21, p = .039) of consonants explained the variance in the energeticity ratings significantly. Further analyses revealed that the use of the *glottal* consonant was linked to higher perceived energeticity especially when compared with using *alveolar* (β = 0.45, *SE* = 0.14, p = .012) and *labial* consonants (β = 0.43, *SE* = 0.14, p = .024). Additionally, *nasal* consonants were associated with higher perceived energeticity, particularly relative to *fricatives* (β = 0.44, *SE* = 0.14, p = .030).

No phonological category explained the variance in the *jerkiness* dimension significantly in the novel motion words produced by native Turkish speakers (ps > .05).

Discussion

In this study we investigated sound symbolism in motion-related (non)words produced by native Turkish speakers. We focused on the links between phonological features of the words that correspond to different motions and ratings on different semantic dimensions (i.e., *size, speed, weight, energeticity, jerkiness*; Saji et al., 2019).

We found that the *nasality* of the produced word was important for three of these semantic dimensions. Specifically, native Turkish speakers produced words that started with nasal consonants such as /m/ or /n/ corresponding to motions they rated as smaller in size, faster, and slightly more energetic. In addition, we observed the following links: *voiced* consonants – heavier motions, *front* vowels – lighter motions, and the *glottal* consonant (i.e., /h/) – more energetic motions. These results partially corroborate previously reported sound symbolic associations in the motion domain. For example, native Turkish speakers came up with words that started with *voiced* consonants for motions they perceived to be heavier as in Japanese (Hamano, 1998; Imai et al., 2008; Saji et al., 2019). Another frequently reported sound symbolic link in the literature concerns the mappings between *voiced* consonants and larger objects or movements (Newman, 1933; Saji et al., 2019; Thompson & Estes, 2011). However, we did not observe a similar *voicing–size* association in the current study. Although *voiced* consonants were not associated with larger-perceived motions significantly, *voiced* consonants showed an overall trend of association with larger motion ratings. In addition, although *nasality* was associated with the *speed* dimension as in Japanese, the mapping between *nasal* consonants and faster movements is opposite of the previous findings in a Japanese-speaking sample (Saji et al., 2019).

Our finding that both *high* vowels and *unrounded* vowels were associated with lighter motions has not been reported previously, though some studies have reported vowel backness are associated with heavy objects; *back* and *open* vowels have been found to symbolize the perceived heaviness of the objects relative to *front* and *close* vowels (Walker & Parameswaran, 2019). Compared to the more frequently cited association between vowel height and object size (e.g., *mil/mal* effect where the word with a high vowel is associated with smallness; Sapir, 1929), the one between vowel *height– weight* has not been studied widely. The similar situation is seen in the case of vowel roundness. D'Onofrio (2014) noted that rounded vowels are sound-symbolically connected to larger size, as the shape of the lips form a larger opening in rounded vowels. It is possible that there are some correspondences between semantic dimensions (e.g., *small-light, large-heavy*; Walker & Parameswaran, 2019), although we did not observe a relationship between vowel backness and size of the motion in the current study.

Lastly, Turkish speakers produced words starting with the *glottal* (/h/) and *nasal* consonants for the motions they rated as more energetic. This *glottal-energetic* association has not been previously reported in other languages and might be more specific to Turkish. It is thus important for future studies to investigate this link further in Turkish alone and in comparison to other languages.

One of the limitations of the study is the sample characteristics. All participants were university students with a good knowledge of English, and their English skills could have affected the ways they came up with words in our task. However, none of the participants spoke Japanese. The similarities in sound symbolic links to those in the Japanese-speaking sample and dissimilarities to the English-speaking sample suggests that these native Turkish speakers were not influenced by their knowledge of English to a large degree. Another potential limitation is that we asked participants to write the words instead of recording their speech. One might argue that transcribing and coding words based on recordings is better suited for capturing the phonetic properties of the words. That was indeed why Saji et al. (2019) asked their English-speaking participants to additionally pronounce the words. However, it should be noted, like Japanese, Turkish has a very high grapheme-to-phoneme correspondence allowing us to make inferences based on written words.

To our knowledge, this is the first study to investigate motion-related sound symbolic associations in a sample of native Turkish speakers. Our method allowed Turkish speakers to produce words that intuitively correspond to motions with different attributes. Overall, the findings demonstrate the Turkish-specific sound-to-meaning mappings in the motion domain and to what extent sound symbolic associations are shared with previously studied languages.

References

Akyıldız Ay, D. (2017). Sound symbolism and an attempt on a different classification of sound-meaning relationship. *Journal of Turkish Language and Literature, 57*(57), 17-27. https://doi.org/10.26561/iutded.369143

Bailey T., & Hahn U. (2005). Phoneme similarity and confusability. J*ournal of Memory and Language, 52,* 339–362. https://doi.org/10.1016/j.jml.2004.12.003

Blasi, D. E., Wichmann, S., Hammarstroem, H., Stadler, P. F., & Christiansen, M. H. (2016). Sound–meaning association biases evidenced across thousands of languages. *Proceedings of the National Academy of Sciences - PNAS, 113*(39), 10818–10823. https://doi.org/10.1073/pnas.1605782113

Ćwiek, A., Fuchs, S., Draxler, C., Asu, E. L., Dediu, D., Hiovain, K., Kawahara, S., Koutalidis, S., Krifka, M., Lippus, P., Lupyan, G., Oh, G. E., Paul, J., Petrone, C., Ridouane, R., Reiter, S., Schümchen, N., Szalontai, Á., Ünal-Logacev, Ö., … Winter, B. (2022). The bouba/kiki effect is robust across cultures and writing systems. *Philosophical Transactions of the Royal Society B: Biological Sciences, 377*(1841), 20200390. https://doi.org/10.1098/rstb.2020.0390

Demircan, Ö. (1996). Türkçede Yansımaların Özüne Doğru. *Dilbilim Araştırmaları Dergisi , 7* , 175-191

Demircan, Ö. (1997, August 7-9). Türkçede nedenli göstergeler: Yansımalarda anlamlama. [Conference Proceeding]. VIII. Uluslararasi¸ Türk Dilbilimi Konferansi.

Dingemanse, M., Blasi, D. E., Lupyan, G., Christiansen, M. H., & Monaghan, P. (2015). Arbitrariness, Iconicity, and Systematicity in Language. *Trends in Cognitive Sciences, 19*(10), 603–615. https://doi.org/10.1016/j.tics.2015.07.013

D'Onofrio, A. (2014). Phonetic detail and dimensionality in sound-shape correspondences: Refining the Bouba-Kiki paradigm. *Language and Speech, 57*(3), 367-393.

Ido, S. G. (1999). Turkish mimetic word formation. *Asian African Studies, 8*, 67-73.

Imai, M., Kita, S., Nagumo, M., & Okada, H. (2008). Sound symbolism facilitates early verb learning. *Cognition, 109*(1), 54–65. https://doi.org/10.1016/j.cognition.2008.07.015

Jendraschek, G. (2001). *Semantische Eigenschaften von Ideophonen im Türkischen*. München: Lincom Europa

Kambara, T., & Umemura, T. (2021). The relationships between initial consonants in Japanese sound symbolic words and familiarity, multi-sensory imageability, emotional valence, and arousal. *Journal of psycholinguistic research, 50*(4), 831–842. https://doi.org/10.1007/s10936-020-09749-w

Kanero, J., Imai, M., Okuda, J., Okada, H., & Matsuda, T. (2014). How sound symbolism is processed in the brain: A study on Japanese mimetic words. *PLoS ONE, 9*(5), e97905. https://doi.org/10.1371/journal.pone.0097905

Knoeferle, K., Li, J., Maggioni, E., & Spence, C. (2017). What drives sound symbolism? Different acoustic cues underlie sound-size and sound-shape mappings. *Scientific Reports, 7*(1), 5562. https://doi.org/10.1038/s41598-017-05965-y

Köhler, W. (1947). *Gestalt psychology* (2nd ed.). New York, USA: Liveright

Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2017). lmerTest Package: Tests in Linear Mixed Effects Models. *Journal of Statistical Software, 82*(13). https://doi.org/10.18637/jss.v082.i13

Lenth, R., Singmann, H., Love, J., Buerkner, P., & Herve, M. (2018). Package "Emmeans". R Package Version 4.0-3.

Hamano, S. (1998). *The sound symbolic system of Japanese.* Stanford, CA: CSLI Publications; Tokyo: Kuroshio.

Newman, S. S. (1933). Further experiments in phonetic symbolism. *The American Journal of Psychology, 45*, 53–75. https://doi.org/10.2307/1414186

Perniss, P., Thompson, R. L., & Vigliocco, G. (2010). Iconicity as a general property of language: evidence from spoken and signed languages. *Frontiers in Psychology, 1*, 227–227. https://doi.org/10.3389/fpsyg.2010.00227

R Core Team (2018). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.URL https://www.R-project.org/.

Ramachandran, V. S., & Hubbard, E. M. (2001). Synesthesia: A window into perception, thought and language. *Journal of Consciousness Studies, 8*, 3-34.

Saji, N., Akita, K., Kantartzis, K., Kita, S., & Imai, M. (2019). Cross-linguistically shared and language-specific sound symbolism in novel words elicited by locomotion videos in Japanese and English. *PloS ONE, 14*(7), e0218707. https://doi.org/10.1371/journal.pone.0218707

Sapir, E. (1929). A study in phonetic symbolism. *Journal of Experimental Psychology, 12*(3), 225–239. https://doi.org/10.1037/h0070931

de Saussure, F. (1983). *Course in general linguistics.* Bally, C., & Sechehaye, A. (Eds.) with collaboration of Riedlinger, A., Harris, R. (Trans.). London:Duckworth.

Shinohara, K., Yamauchi, N., Kawahara, S., & Tanaka, H. (2016). Takete and Maluma in action: A cross-modal relationship between gestures and sounds. *PLoS ONE, 11*(9), e0163525. https://doi.org/10.1371/journal.pone.0163525

Sidhu, D. M., Westbury, C., Hollis, G., & Pexman, P. M. (2021). Sound symbolism shapes the English language: The maluma/takete effect in English nouns. *Psychonomic Bulletin & Review, 28*(4), 1390–1398. https://doi.org/10.3758/s13423-021-01883-3

Thompson, P. D., & Estes, Z. (2011). Sound symbolic naming of novel objects is a graded function. *Quarterly Journal of Experimental Psychology (2006), 64*(12), 2392–2404. https://doi.org/10.1080/17470218.2011.605898

Walker, P., & Parameswaran, C. R. (2019). Cross-sensory correspondences in language: Vowel sounds can symbolize the felt heaviness of objects. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 45*(2), 246–252. https://doi.org/10.1037/xlm0000583

Zülfikar, H. (1995), *Türkçede ses yansımalı kelimeler. (İnceleme-sözlük).* Ankara: Atatürk Kültür, Dil ve Tarih Yüksek Kurumu (Türk Dil Kurumu Yayınları, 628).