Studia Psychologica, Vol. 68, No. 4, 2026, 317-330
https://doi.org/10.31577/sp.2026.04.951

The Influence of Task Type on Emotional Word Processing Speed

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This study examined the influence of task type on the relationship between valence and word processing speed. According to existing theories, negative stimuli are generally processed more slowly due to their ability to grab attention. However, this is not always the case. The response-relevance hypothesis suggests that negative stimuli may be processed faster in tasks where valence is a relevant parameter (e.g., when participants are asked to name the valence of a word). The experiment involved lexical decisions and valence judgments using high- and low-arousal negative words, high- and low-arousal positive words, and neutral words. In valence judgments, negative words showed arousal-dependent effects: high-arousal words were processed faster than neutral words, whereas low-arousal negative words were processed more slowly than neutral words. In lexical decisions, there was a linear relationship between valence and RTs. Together, these findings suggest that valence effects on word processing are task-dependent and critically modulated by arousal.

Key words: valence judgments, lexical decisions, word processing, emotional word, valence

Emotional information is processed differently depending on its valence and level of arousal (Compton, 2003; Kauschke et al., 2019). Valence refers to the pleasantness or unpleasantness of an emotion, while arousal represents the degree of emotional excitement (Colombetti & Kuppens, 2024). When considering valence and arousal of the stimuli themselves, stimulus valence can be defined as the "*intrinsic attractiveness or aversiveness of events, objects, and situations*" (Frijda, 1986, p. 207), whereas stimulus arousal reflects the extent to which a stimulus is associated with arousal. Positive stimuli are typically defined as those with intrinsic attractiveness, whereas negative stimuli are defined as those with intrinsic aversiveness. Neutral stimuli are described as those that do not elicit emotional responses. Differences in the processing of emotional information at the behavioral level can result in faster or slower processing speed. The literature describes both positivity bias (Matlin & Stang, 1978) and negativity bias (Kanouse & Hanson, 1972).

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Online supplement is available at https://journals.savba.sk/index.php/studiapsychologica/article/view/5704/2675

Received September 8, 2025

A positivity bias typically manifests itself in the faster and more efficient processing of positive over negative stimuli (Kauschke et al., 2019). For example, positive words have been found to be processed faster than negative and neutral words in both lexical decisions (Crossfield & Damian, 2021; Hinojosa et al., 2010; Kanske & Kotz, 2007; Kuchinke et al., 2005) and valence judgments (Fan et al., 2023; González-Villar et al., 2014; Kever et al., 2017; Liu et al., 2016; Robinson et al., 2004; Stenberg et al., 1998; Unkelbach et al., 2010). An explanation for positivity bias is provided by the broaden-and-build theory (Fredrickson, 1998), which proposes that positive emotions broaden the scope of attention. Since Ben-Haim et al. (2014) demonstrated that even emotional words can induce corresponding emotional states, it has been suggested that positive words can induce positive states, thereby facilitating their processing (Liu et al., 2018; Arioli et al., 2021). Also, Unkelbach et al. (2019) explained this effect by suggesting that positive words are more frequent and densely clustered (Unkelbach et al., 2008). First, stimuli that occur more frequently are processed faster, which leads to faster processing of positive stimuli. Second, because of their greater similarity, positive stimuli are more densely clustered in memory, thereby increasing subjective exposure frequency to them (Unkelbach et al., 2010).

By contrast, negativity bias is characterized by preferential processing of negative stimuli (Kauschke et al., 2019). Usually, it is reflected in slower processing of negative stimuli due to their attention-grabbing power (Bayer et al., 2012; Kuperman et al., 2014; Liu et al., 2016). Pratto and John (1991) demonstrated this effect using the emotional Stroop task. They argued that attention may automatically be drawn to unpleasant stimuli because they are more important for the perceiver's well-being than pleasant stimuli. However, in some studies, negative stimuli were processed faster than positive stimuli (Dijksterhuis & Aarts, 2003; Nasrallah et al., 2009). These results are often explained from an evolutionary perspective: rapid processing of negative stimuli is thought to serve an adaptive survival function (Baumeister et al., 2001).

Estes and Verges (2008) suggested that the processing speed of negative stimuli can be task-dependent. Their response-relevance hypothesis proposes that negative stimuli should be processed faster in tasks in which stimulus valence is response-relevant (e.g., valence judgments). They also acknowledged the attention-grabbing power of negative stimuli but argued that when attention does not need to be disengaged from stimulus valence, captured attention can lead to faster valence judgments. They conducted an experiment involving lexical decisions and valence judgments using positive and negative words. The results confirmed their hypothesis: negative words were processed faster than positive words during valence judgments, whereas positive words were processed faster than negative words during lexical decisions.

However, comparisons between positive and negative stimuli and the absence of neutral stimuli as a baseline make it unclear whether the valence effects reflect facilitation (faster processing) of one category or inhibition (slower processing) of the other. Therefore, the hypotheses should be formulated in terms of the relationship between emotional and neutral stimuli. For example, based on evidence from previous studies, Gao et al. (2022; Figure 1, p. 2145) identified a linear (Kousta et al., 2009; Vinson et al., 2014; Yap & Seow, 2014) and ∩-shaped (inverted U-shaped; Kuperman et al., 2014) relations between valence and lexical decision time. A linear relation represents faster processing of positive stimuli than neutral stimuli and the slowest processing of negative stimuli, where-

as a ∩-shaped relation is characterized by faster processing of emotional stimuli, both positive and negative stimuli, relative to neutral stimuli. These patterns were derived from findings in the literature, primarily based on visual lexical decisions. In their own experiment, Gao et al. (2022) demonstrated that these relationships depend on modality. Although these patterns were demonstrated in lexical decisions, they can be used as a general framework for describing how valence effects may manifest across different tasks. Within the framework of the response-relevance hypothesis, we suggest that different tasks may produce different patterns of valence effects. A linear relation should be observed for lexical decisions, and a ∩-shaped relation should be expected for valence judgments.

Regarding arousal, most studies address the relationship between valence and arousal. The most widespread model, which assumes a symmetrical U-shaped relationship between valence and arousal, posits that arousal increases with increasing extremity of valence (both negative and positive), while remaining low for neutral stimuli (Kuppens et al., 2013). Because higher arousal is associated with more extreme valence, it may increase the clarity of valence of emotional information, making valence easier to identify. Consequently, valence judgments may be facilitated for high-arousal words compared to low-arousal words. This was shown for negative words by Purkis et al. (2009), but arousal had no influence on positive words. In lexical decisions, the interaction between valence and arousal is more often observed than a direct influence of arousal. Several studies have demonstrated slower processing of high-arousal positive and low-arousal negative words compared to low-arousal positive and high-arousal negative words (Citron et al., 2013, 2014; Yao et al., 2016). In contrast, other studies have demonstrated facilitative effects of arousal with faster processing of high-arousal negative stimuli compared to low-arousal negative stimuli (Bayer et al., 2012) or faster processing of high-arousal words in general (Estes & Adelman, 2008). At the same time, Kuperman et al. (2014) showed the opposite pattern with faster processing of low-arousal (calming) words. Taken together, these findings indicated that the role of arousal may depend on its interaction with valence. Moreover, some authors have suggested that a significant interaction may reflect not a true interaction between valence and arousal, but rather an artifact of model specification when valence is treated as a continuous variable (Estes & Adelman, 2008).

This study examined the influence of task type on the relationship between valence and word processing speed. First, we hypothesized that reaction times (RTs) would show a linear pattern in lexical decisions: positive words would be processed faster than neutral ones, and neutral words faster than negative ones. Second, we hypothesized that RTs would show a ∩-shaped (inverted U-shaped) relationship in valence judgments: positive and negative words would be processed faster than neutral words. Thirdly, RTs would be faster for high-arousal than for low-arousal words in valence judgments, whereas in lexical decisions, there would be an interaction between valence and arousal RTs. The present study extends the response-relevance hypothesis proposed by Estes and Verges (2008) by testing it using neutral words as an explicit baseline and by considering the level of arousal of emotional stimuli. This approach allows for a more precise examination of valence effects across tasks.

Method

Participants. Seventy native Russian speakers participated in the experiment. They were

aged from 18 to 26 (*M* = 19.31, *SD* = 1.65), 60 of whom were women. The participants were psychology students at HSE University (Moscow). They signed informed consent forms before the experiment and received 250 rubles (approximately 3 USD) as compensation.

Lexical decisions. A fixation cross appeared before each trial for 400 ms. After a 100-ms pause, a word or pseudoword was presented at the center of the black screen, printed in white, in Arial font, with a letter height of 0.05. The participants responded whether the item was a word or a pseudoword using the "right arrow" and "left arrow" keys. The item remained on the screen until the response, and the next trial was presented after a response was recorded.

Valence judgments. The technical characteristics of word presentation were the same as those in lexical decisions. The participants responded whether the word was positive, negative, or neutral using the "right arrow," "left arrow," and "space" keys.

Procedure. PsychoPy v2023.2.3 (Peirce, 2019) was used to present the stimuli and record responses (error rate and RT). Before the experiment, the participants received instructions and signed an informed consent form. In the first part of the experiment, the participants performed either lexical decisions or valence judgments using the first set of words (20 neutral, 20 negative, and 20 positive). In the last part of the experiment, the participants performed the remaining task (valence judgments or lexical decisions) using the second set of words. The word sets were counterbalanced across participants, such that both word sets were presented in each task across the sample. The task order was also counterbalanced across participants. The participants performed practice sessions before lexical decisions and valence judgments. In addition to the tasks reported here, the study included memory tasks, which are described in Supplementary materials.

Stimuli. The experiment included 40 neutral words, 40 negative words (20 each with high and low arousal), 40 positive words (20 each with high and low arousal), and 60 pseudowords. The words were selected from the database of emotional ratings for Russian nouns (Lyusin & Sysoeva, 2026). Negative words were selected from items with valence ratings below 3.4 on the 7-point scale, neutral words from the range 3.5–4.6, and positive words from items with ratings above 4.6. Neutral words were selected from items with arousal ratings below 2.5 on the 7-point scale, low-arousal words from items with arousal ratings below 4.5, and high-arousal words from items with arousal above 4.9. Pseudowords were created by modifying real words through letter or syllable replacement or rearrangement, ensuring that they resembled real words but did not evoke any associations. The descriptive statistics for valence, arousal, age of acquisition, concreteness, frequency, syllable length, and letter length of the words and pseudowords are presented in Table 1. Word categories were balanced by frequency ($F(4, 115) = 1.14$, $p = .34$, $\eta_p^2 = .04$), length in syllables (including pseudowords; $F(5, 234) = 1.11$, $p = .35$, $\eta_p^2 = .02$), and length in letters (including pseudowords; $F(5, 234) = 1.47$, $p = .20$, $\eta_p^2 = .03$). Valence ratings differed across categories ($F(4, 115) = 759.00$, $p < .001$, $\eta_p^2 = .96$): neutral words had higher valence than negative words (p_{Tukey}s < .001) and lower valence than positive words (p_{Tukey}s < .001). Arousal ratings also differed ($F(4, 115) = 592.82$, $p < .001$, $\eta_p^2 = .95$): neutral words had lower arousal than emotional words (p_{Tukey}s < .001), and low-arousal words had lower ratings than high-arousal words (p_{Tukey}s < .001). Negative and positive words were matched on arousal ($p_{Tukey} > .05$) and emotional intensity ($p_{Tukey} > .05$)[1]. Each word category was random-

[1] Emotional intensity was operationalized as the absolute distance from the neutral midpoint of the 7-point valence scale (|valence − 4|).

Table 1 *Means (and SDs) ratings for valence, arousal, age of acquisition (AoA), concreteness, frequency, syllable length, and letter length of used words and pseudowords*

Words	Valence	Arousal	AoA	Concreteness	Frequency	Syllables	Letters
Neutral	4.10 (0.18)	2.17 (0.21)	6.84 (2.02)	2.91 (1.06)	25.30 (12.04)	2.30 (0.47)	5.98 (0.92)
High-arousal negative	1.76 (0.29)	5.61 (0.14)	8.41 (2.06)	3.45 (0.71)	27.92 (13.82)	2.60 (0.88)	6.50 (1.61)
Low-arousal negative	2.67 (0.37)	3.62 (0.40)	6.30 (1.60)	2.38 (1.10)	22.34 (21.08)	2.20 (0.89)	6.00 (1.56)
High-arousal positive	6.00 (0.22)	5.44 (0.37)	6.81 (2.02)	3.85 (0.80)	31.64 (19.97)	2.55 (0.69)	6.40 (1.23)
Low-arousal positive	5.29 (0.41)	3.99 (0.42)	6.71 (2.38)	3.02 (1.22)	31.12 (20.80)	2.50 (0.61)	6.50 (1.10)
Negative	2.21 (0.56)	4.62 (1.05)	7.41 (2.12)	2.91 (1.06)	25.13 (17.82)	2.40 (0.90)	6.25 (1.58)
Positive	5.64 (0.48)	4.71 (0.83)	6.76 (2.17)	3.44 (1.10)	31.38 (20.12)	2.53 (0.64)	6.45 (1.15)
High-arousal	3.88 (2.16)	5.53 (0.29)	7.61 (2.17)	3.65 (0.77)	29.78 (17.06)	2.58 (0.78)	6.45 (1.41)
Low-arousal	3.98 (1.38)	3.81 (0.44)	6.51 (2.02)	2.70 (1.19)	26.73 (21.14)	2.35 (0.77)	6.25 (1.35)
Pseudowords	-	-	-	-	-	2.35 (0.74)	6.00 (0.75)

Note. Valence and arousal ratings were taken from a database using a 7-point Likert scale (Lyusin & Sysoeva, 2026). Norms for AoA were obtained from the database "Subjective Age of Acquisition Norms for 30,849 Russian Words" (Grigoriev et al., 2026). Abstractness–concreteness ratings were taken from a database using a 5-point Likert scale (1 = highly concrete, 5 = highly abstract; Solovyev et al., 2022). Frequency is instances per million words, based on Lyashevskaya and Sharov (2009).

ly divided into two sets: one half was used in lexical decisions, and the other half in valence judgments. The word order was counterbalanced across participants.

Results

The data were processed in RStudio 2024.12.1+563 (Posit team, 2026) using R 4.5.2 (R Core Team, 2025). Trials with incorrect responses (1.02% in lexical decisions, 15.52% in valence judgments) were excluded from the analysis. Errors in valence judgments were considered to be responses that did not correspond to the normative (and experimental) valence categories of the stimulus. Trials with RTs shorter than 300 ms or longer than 2500 ms in lexical decisions (1.03%) and longer than 3000 ms in valence judgments (3.20%) were also excluded. Five words with missing age of acquisition and concreteness norms were excluded from the analyses. As participants performed memory tasks between the two experimental tasks, performance on the second task may have been affected by prior exposure to the stimuli and, therefore, may not be directly comparable to performance obtained before the memory tasks. To evaluate the potential influence of the memory tasks, we compared lexical decisions and valence judgments performed before and after the memory tasks. Because

the pattern of results differed, only data from tasks administered before the memory tasks were included in the main analysis. The final datasets comprised 1,731 observations in valence judgments and 1,983 observations in lexical decisions, including data from 70 participants and 115 words. Mean RTs for neutral, all negative, high-arousal negative, low-arousal negative, all positive, high-arousal positive, and low-arousal positive words were calculated (Table 2).

To test our hypotheses, two separate linear mixed-effects models were fitted for lexical decisions and valence judgments. The lexical decisions model included *valence* and *arousal* (continuous predictors, grand-mean centered) as fixed effects, age of acquisition, concreteness, word length (in letters), and frequency as continuous covariates (grand-mean centered), and *participants* and *words* were included as random intercepts. The valence judgments model included *valence*, its *quadratic term*, and *arousal* (continuous predictors, grand-mean centered) as fixed effects; the same set of covariates, *participants,* and *words* were included as random intercepts. The quadratic term of valence was included to assess the U-shaped relationship. Log-transformed RTs were used as the dependent variable in both tasks. The significance of fixed effects was assessed using *t*-tests with degrees of freedom approximated using the Satterthwaite method. The analysis was conducted using the lmerTest R package (Kuznetsova et al., 2017). To examine the interaction between valence and arousal, a simple slopes analysis was conducted using emmeans R package (Lenth & Piaskowski, 2025). The effect of valence was estimated at arousal values corresponding to neutral, low-arousal, and high-arousal word categories, and the effect of arousal was estimated at valence values corresponding to negative, neutral, and positive word categories. The selected values corresponded to the thresholds used for classifying stimuli into valence and arousal categories.

For lexical decisions, there was significant influence of valence (b = -0.03, t(99.00) = -2.87, p < .01) and a significant interaction between valence and arousal (b = 0.02, t(100.00) = 3.15, p < .01). Multicollinearity diagnostics

Table 2 *Descriptive statistics (mean and SD) for lexical decisions and valence judgments*

Words	Lexical decisions	Valence judgments
	Mean RT in ms (*SD*)	Mean RT in ms (*SD*)
Neutral	695 (261)	1092 (444)
Negative	695 (257)	1032 (425)
Negative high	680 (227)	1081 (453)
Negative low	710 (285)	1218 (510)
Positive	664 (239)	1010 (404)
Positive high	687 (289)	948 (382)
Positive low	641 (172)	1091 (420)
Pseudowords	744 (152)	-

Note. Negative high – negative words with high arousal; Negative low – negative words with low arousal; Positive high – positive words with high arousal; Positive low – positive words with low arousal.

indicated no problematic collinearity among predictors (all *VIF*s < 5). The marginal R^2 was .018, and the conditional R^2 was .362. The effect of valence was significant for neutral (b = -0.06, SE = 0.02, t = -3.17, p = .002) and low-arousal words (b = -0.03, SE = 0.01, t = -2.88, p < .01), indicating faster responses for more positive words under these conditions. The effect of arousal was dependent on valence, with faster response for negative words (b = -0.04, SE = 0.01, t = -2.95, p < .01) and slower response for positive words (b = 0.03, SE = 0.01, t = 2.30, p = .02). Mean log-transformed RTs (and SE) by valence for neutral, high-, and low-arousal words in lexical decisions are presented in Figure 1.

For valence judgments, there was a significant effect of valence (b = -0.04, t(87.62) = -3.43, p < .001) and a significant interaction between valence and arousal (b = 0.02, t(81.57) = 2.71, p < .01). Multicollinearity diagnostics indicated no problematic collinearity among predictors (all *VIF*s < 3). The marginal R^2 was .048, and the conditional R^2 was .342. The effect of valence was significant for neutral (b = -0.08, SE = 0.03, t = -3.17, p < .01) and low-arousal words (b = -0.05, SE = 0.01, t = -3.42, p < .001), indicating faster responses for more positive words under these conditions. The effect of arousal was dependent on valence and was significant only for negative words with faster responses (b = -0.08, SE = 0.03, t = -2.88, p = .01).

In addition, there was a significant interaction between arousal and the quadratic term of valence (b = -0.02, t(81.93) = -3.61, p < .001), indicating that the U-shaped relationship between valence and RTs depends on arousal. To examine this relation, we conducted separate analyses for high- and low-arousal words. The results showed a significant quadratic effect of valence for high-arousal words (b = -0.02, t(58.63) = -2.72, p < .01), whereas for low-arousal words a significant linear effect of valence was observed (b = -0.05, t(57.09) = -3.76, p < .001). Multicollinearity diagnostics indicated no problematic collinearity among predictors in both models (all *VIF*s < 3). For the model with high-arousal words, the marginal R^2 was .045 and the conditional R^2 was .333; for the model with low-arousal words, the marginal R^2 was .021 and the conditional R^2 was .324.

For high-arousal words, negative words were processed slower with increasing va-

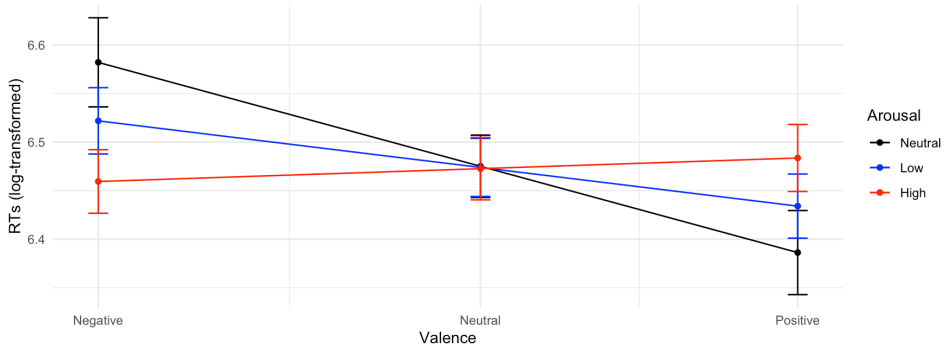
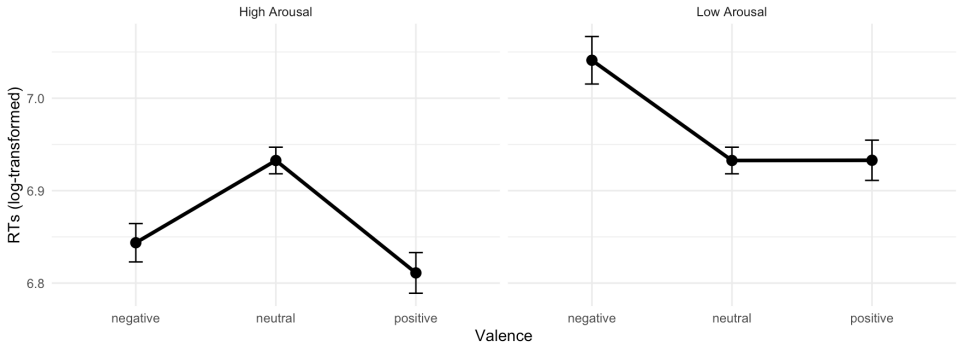


Figure 1 Mean log-transformed RTs (and SE) by valence for neutral, high-, and low-arousal words in lexical decisions.



Note. Neutral words were used as a common reference condition and were not divided by arousal.

Figure 2 Mean log-transformed RTs (and SE) by valence for high and low-arousal words in valence judgments.

lence (b = 0.08, SE = 0.03, t = 2.86, p < .01), and positive words were processed faster with increasing valence (b = -0.08, SE = 0.03, t = -2.40, p = .02). For low-arousal words the effect of valence was significant only for neutral words (b = -0.05, SE = 0.01, t = -3.40, p = .001), indicating faster responses with increasing valence. Also, the effect of valence was marginally significant for negative words (b = -0.10, SE = 0.05, t = -1.83, p = .07), indicating slower responses with decreasing valence. Together, these results indicate that the relationship between valence and RTs depends on arousal. Mean log-transformed RTs (and SE) by valence for high and low-arousal words in valence judgments are presented in Figure 2.

To test whether the valence effect differed between lexical decisions and valence judgments, we fitted an additional unified mixed-effects model that included *task* and its interactions with *valence*, *the quadratic term of valence*, and *arousal*. No significant interactions between task and either valence or its quadratic term were observed (ps > .07). Similarly, the Task × Valence × Arousal interaction was not significant (p = .58). However, the Task × Arousal × Valence^2 was significant (b = 0.02, t(3551) = 4.01, p < .001), indicating that arousal affected the non-linear valence effect differently across tasks. Full results of all models are presented in the Online Supplement.

Discussion

This study examined the influence of task type on the relationship between word valence and processing speed. We used lexical decisions and valence judgments with neutral words, high- and low-arousal negative words, and high- and low-arousal positive words.

First, we hypothesized that RTs would show a linear pattern in lexical decisions: positive words would be processed faster than neutral words, and neutral words would be processed faster than negative words. The main effect of valence was significant and negative, indicating faster processing of more positive words, thus confirming this hypothesis. Our results

are consistent with most previous studies reporting valence effects in lexical decisions, including faster processing of positive words compared to negative (e.g., Barriga-Paulino et al., 2022; Crossfield & Damian, 2021; Haro et al., 2023) and neutral words (e.g., Citron et al., 2013; Hofmann et al., 2009; Yap & Seow, 2014), as well as slower processing of negative words compared to neutral words (e.g., Bayer & Schacht, 2014; Martin & Altarriba, 2017; Yao et al., 2016). However, our findings do not align with studies reporting faster processing of negative words compared to neutral words (e.g., Kanske & Kotz, 2007; Kousta et al., 2009; Palazova et al., 2011). A recent meta-analysis (Ferré et al., 2025) showed that positive words are processed faster than both negative and neutral words, whereas negative words are typically processed at a speed similar to neutral words, except in some cases. Also, some authors suggest that valence can influence word processing primarily when it is processed explicitly (Rinck & Becker, 2009). Similarly, Parkin (1982) argued that lexical decisions are based on word form (i.e., spelling or phonology) rather than their meaning, and that word valence may not be accessed early enough to influence processing speed, resulting in the absence of an acceleration for positive words or a slowing for negative words.

The obtained valence effect varied depending on arousal level: there was no significant main effect of arousal, but a significant interaction between valence and arousal was observed, confirming our hypothesis. Processing facilitation associated with higher positive ratings was observed for neutral and low-arousal words but disappeared for high-arousal words. For positive words, higher arousal was associated with slower responses, whereas for negative words, higher arousal facilitated processing. These results are consistent with previous findings for negative (Bayer et al., 2012; Citron et al., 2013; Hofmann et al., 2009; Yao et al., 2016) and positive words (Citron et al., 2013; Yao et al., 2016). No effect of arousal was observed for neutral words, which may be explained by the relatively narrow range of arousal values for this category. Overall, the pattern suggests a linear relationship between valence and RTs for neutral and low-arousal words, whereas for high-arousal words, the interaction between valence and arousal becomes dominant, resulting in the absence of a linear valence effect. At the same time, Estes and Adelman (2008) suggested that the significant interaction between valence and arousal may be an artifact of the model, arising from the use of valence as a continuous predictor. However, the recent study by Haro et al. (2024) demonstrated an interaction between valence and arousal for both continuous and categorical valences.

Also, we hypothesized that RTs would show a ∩-shaped (inverted U-shaped) relationship in valence judgments: positive and negative words would be processed faster than neutral words. In addition, we suggested that high-arousal words would be processed faster than low-arousal words in valence judgments.

First, we did not obtain a ∩-shaped relationship for all words; instead, this pattern was observed for high-arousal words, indicating that it depends on arousal level. Both positive and negative words were processed faster as the extremity of their valence increased. Second, for low-arousal words, RTs decreased with increasing valence for negative and neutral words, whereas this effect was absent for positive words, indicating an asymmetric relationship. When arousal is not considered, the observed pattern may give the impression of a valence effect, with faster responses to more positive words. However, the additional analyses suggest that processing in valence judgments is more sensitive to the influence of arousal than to valence per se. One possible explanation is that this effect reflects dif-

ferences in the valence clarity across arousal levels. As Kuppens et al. (2013) argued, valence and arousal have a U-shaped relation, with the intensity of negative and positive valence increasing with higher arousal levels.

For high-arousal words, the presence of valence in emotional words is more clearly defined than the absence of valence in neutral words, which lack emotional content, because they provide a strong signal of valence, allowing for rapid categorization, while neutral words may require confirmation of the absence of emotional tone. The valence of emotional words may stand out ("pop out") compared to neutral words, facilitating valence naming and speeding up processing of emotional stimuli. For low-arousal words, the slower processing of negative words may be due to their less extreme valence ratings. Their valence ratings are intermediate between high-arousal and neutral words, making their valence less pronounced and closer to neutrality, which increases ambiguity, makes valence judgments more difficult, and requires longer processing time. The processing speed of low-arousal positive words did not differ from that of neutral words. One possible explanation is that, from an evolutionary perspective, it is more dangerous to misclassify a negative stimulus as neutral than a positive one (Baumeister et al., 2001). As a result, negative words may require more processing time to determine their valence, while positive words do not require the same level of processing.

The response-relevance hypothesis predicts that the processing of negative words should be facilitated when valence is a relevant dimension of the task (Estes & Verges, 2008). Estes and Verges demonstrated that negative words were processed faster than positive words during valence judgments, whereas in lexical decisions, positive words were processed faster than negative words. In our study, neutral words were used as a baseline instead of positive words, as interactions between valence and task type may be more nuanced. Overall, the hypothesis was partly supported: high-arousal words were processed faster than neutral words in valence judgments, while in lexical decisions, RTs decreased with increasing positive valence.

At the same time, an alternative explanation should be considered. As noted by Unkelbach et al. (2020), processing speed may mostly depend on correlates of valence, especially higher frequency and greater similarity. However, these correlates may include additional factors. For example, words with higher valence and arousal ratings are more likely to be abstract than concrete, and the AoA of negative words is higher than that of neutral or positive words. Thus, these linguistic characteristics can influence word processing speed not only directly, but also indirectly through their association with valence.

Our initial assumption was that different tasks may produce different patterns of valence effects. However, the direct comparisons of tasks demonstrated a more nuanced pattern. Valence did not significantly differ between tasks. Instead, arousal modulated the relationships between valence and RTs for different tasks. These findings show that RTs' patterns in valence judgments and lexical decisions differ not in how valence per se influences the processing of emotional words, but in how arousal changes valence effects.

Overall, the present findings indicate that the effect of valence on word processing is not uniform but depends on arousal. Across tasks, valence effects were significant at low levels of arousal, indicating a linear relationship between valence and RTs. In contrast, at high levels of arousal, valence effects disappeared or changed their form. These findings may help explain inconsistencies in the literature. The results challenge strong versions of

valence-based accounts and point to a more prominent role of arousal and its interaction with task context. They further suggest that effects traditionally attributed to valence may, at least in part, reflect the influence of lexical and semantic correlates associated with emotional words rather than valence per se.

Acknowledgements

This article is an output of a research project (HSE-BR-2025-046) implemented as part of the Basic Research Program at HSE University. The author is grateful for assistance in article preparation to D. Lyusin.

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