THE EFFECTS OF MENTAL IMAGERY ON MORAL DILEMMAS IN A SECOND LANGUAGE

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ABSTRACT: In recent studies, reading moral dilemma scenarios in foreign languages resulted in the increase of willingness to sacrifice others to save more lives in the future, which is known as a utilitarian response. Some studies suggest that this is caused by the decline in vivid imagery during foreign language reading. This causes the immersion and empathy towards the characters to decline, making it easier to prioritize the distant outcome over the immediate emotional reaction to the idea of harm. The current study focuses on the use of mental imagery while reading second language moral dilemma scenario. Specifically, how instructing readers to use mental imagery influences the response to moral dilemma situations. Based on prior research, the imagery created while reading will increase the immersion of the story, decreasing the level of utilitarian responses. In this study, two groups were presented with a pre-post test moral dilemma scenario in their second language. One group received a mental imagery instruction before the second dilemma while the other did not. The group that received the instruction showed a marginal increase in deontological choices after the instructions. In addition, there was a significant increase in the vividness and immersion of the scenario and the characters after the imagery instructions. Based on the results, we can suggest that mental imagery could increase story immersion and perhaps increase deontological decisions despite the foreign language effect.


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lingua. Especificamente, como instruir os leitores a usar imagens mentais influencia a resposta a situações de dilema moral. Com base em pesquisas anteriores, o imaginário criado durante a leitura aumentará a imersão da história, diminuindo o nível de reponsabilização utilitária. Neste estudo, dois grupos foram apresentados com um cenário de dilema moral pré-teste em sua segunda língua. Um grupo recebeu uma instrução de imagem mental antes do segundo dilema, enquanto o outro não recebeu. O grupo que recebeu a instrução mostrou uma marginalidade in-crease nas escolhas deontológicas após as instruções. Além disso, houve um aumento significativo na vivacidade e imersão do cenário e dos personagens após as instruções das imagens. Com base nos resultados, podemos sugerir que a imagem mental poderia aumentar a imersão da história e talvez aumentar as decisões deontológicas, apesar do efeito da língua estrangeira.


LAY SUMMARY: During World War II, there was a rumor that Winston Churchill knew Nazis were planning to bomb the city of Coventry. However, he decided not to react because it would reveal they had cracked the Nazis' codes. The British army had to choose between sacrificing the city to take down the Nazis or saving Coventry and extending the war. Situations such as these are known as moral dilemmas. Recent moral dilemma studies found a phenomenon known as the foreign language effect. Dilemmas written in a second language had more readers willing to sacrifice a few to save more people. In contrast, in native languages, they were more inclined to save the few. This difference may be caused by decreased imagery vividness during foreign language reading. In this case, increasing mental imagery should influence moral dilemma decisions. The current study compares second-language moral dilemma responses between one group that was instructed to imagine while reading and another group that was not. The group that received the instruction showed increased story immersion, vividness, and disapproval towards sacrificing a few compared to the other group. The results indicate that we should consider the importance of mental imagery in foreign-language decision-making.

INTRODUCTION

The phenomenon in which a non-native (foreign) language influences decision-making is known as the foreign language effect (KEYSAR; HAYAKAWA; AN, 2012). The foreign language effect (FLE) was initially observed with gambling scenarios written in native and foreign languages (KEYSAR; HAYAKAWA; AN, 2012). Compared to native languages, situations written in foreign languages made participants more willing to take risky bets. They were also less influenced by the framing manipulation, where the wording was changed to either highlight the loss or gain (KEYSAR; HAYAKAWA; AN, 2012). Keysar and colleagues speculated that using a second language required a much slower and more deliberate thinking process, influencing their decision-making skills (KEYSAR; HAYAKAWA; AN, 2012).

Another possible cause for the FLE is based on the phenomenon that words in a second language (L2) are less emotionally charged compared to those in a first language (L1), resulting in less emotional impact (CHEN et al., 2015; SHEIKH & TITONE, 2015). Geipel et al. (2015) studied judgment toward moral actions against the participant’s cultural norms in either their native or foreign language, such as cheating and eating insects. The participants reacted to the acts more harshly in their native language. Kühne and Gianelli (2019) have suggested that this harsher reaction results from the environment where the language was obtained. Namely, L1 is connected and reinforced through perception and physical action from an early age and thus has more vivid and emotional connections, whereas L2 is often taught through textbooks, memorization, and symbol manipulation in classroom settings.

The FLE has recently been observed in moral dilemmas. Moral Dilemmas are hypothetical scenarios where a large number of people are at risk of being harmed. However, the reader is provided with the option to sacrifice a smaller number of people to save the larger group. There are two choices presented in this scenario: utilitarian and deontological. Utilitarian ideas agree that sacrifices should be made since saving more people is for the greater good. In contrast, deontological ideas suggest that purposely harming someone is inappropriate, no matter the outcome. Hayakawa and colleagues (2017) found that dilemmas in second
languages had a higher rate of utilitarian choices, while native languages had a higher rate of deontological choices (HAYAKAWA et al., 2017).

Though there are many different speculations for the cause of FLE, Hayakawa and Keysar (2018) proposed that the quality of mental imagery plays an essential role in the phenomenon. They found that in addition to the higher utilitarian rate in second-language (L2) settings, the imagery vividness of the dilemma scenario was rated lower (HAYAKAWA; KEYSAR, 2018). They concluded that foreign language elicits weaker mental imagery, which dampened their emotional reactions during L2 reading. The decrease in imagery decreases the adverse emotional reaction towards the concept of sacrificing, increasing the acceptance of the utilitarian decision.

The current study examines how using mental imagery while reading a moral dilemma scenario in a second language can influence the choice of utilitarian or deontological responses. We hypothesize that using mental imagery will increase the story’s vividness, resulting in an increase in deontological decisions for L2 moral dilemmas. In addition, the study will address whether imagery directions will change the level of L2 story immersion.

1. BACKGROUND

1.1 Moral Dilemma

As mentioned, moral dilemmas are hypothetical scenarios where a person must choose between utilitarian and deontological choices. Utilitarian choices prioritize the greater good and are associated with logical (analytical) thinking styles (LI et al., 2018). Participants who showed dominance in logical thinking styles were more likely to choose utilitarian options than those who leaned towards emotional thinking styles. Several studies found that individuals with logical thinking styles were more likely to prioritize the distant overall benefit over immediate empathetic concern (CARMONA-PERERA et al., 2013; GLEICHGERRCHT; YOUNG, 2013; PATIL; SILANI, 2014).

Deontological choices suggest that sacrificial actions are not worth the outcome and are often associated with emotional thinking styles. This relationship is often mediated by the aversion towards harming others and sensitivity to others' feelings (CHRISTOV-MOORE; CONWAY; IACOBONI, 2017; REYNOLDS; KNIGHTEN; CONWAY, 2019). Participants who are sensitive to the feelings of others are more likely to reject harm. In addition, the involvement of an emotionally arousing task has been observed to increase the number of deontological choices (SZEKELY; MIU, 2015).

Hayakawa and Keysar (2018) observed the FLE where moral dilemmas presented in L2 settings increased the rate of utilitarian choices compared to those in L1 settings. Combining this with the moral dilemma research mentioned earlier may imply that using L2 increases logical thinking or decreases emotional thinking. To address this issue further, the authors conducted two studies examining the relationship between mental imagery and L2. The first study asked participants to find the odd one out among words of everyday objects in L1 and L2 by two conditions: shapes or categories. They found a higher error rate in L2 settings for the shapes condition, concluding that this was due to a lack of ability to imagine the objects. In the other study, they had participants rate the vividness of the scene and characters of the moral dilemmas in L1 and L2 settings. Compared to the L1 settings, L2 settings rated the sacrificial character and overall vividness lower. Hayakawa and Keysar suggested that this may be due to more cognitive resources used to read in L2, leaving less for mental imagery. In contrast, as L1 processing is automatic, more resources can be allocated to creating mental imagery.

1.2 Mental Imagery

Mental imagery is often referred to as a "weaker form of visual perception" projected inside the mind during the lack of a visual stimulus (PEARSON et al., 2015). Mental imagery can elicit intense emotional responses similar to that of visual perception. The studies presented below highlight the importance of mental imagery in emotion.
Wicken et al. (2021) found that mental imagery influenced the automatic water production on the skin in response to a fearful situation, or skin conductance level (SCL), between average and low imagination ability participants groups. Participants were shown neutral and scary images and then read neutral and scary stories. However, while average imagination ability participants exhibited increased SCL to the scary pictures, low imagination participants showed a flat-line response to the scary stories (WICKEN; KEOGH; PEARSON, 2021). The authors conclude that the absence of visual imagery decreases emotional reactions.

In contrast, it is also possible to increase emotional responses using mental imagery. Amit and colleagues (2012) found a strong emotional reaction when participants were asked to imagine harming someone with great intent and force.

Another important factor is the psychological distance between the reader and the characters in various moral dilemma scenarios. In native language settings, Aguilar et al. (2013) found that increased psychological distance allowed readers to logically deduce the moral dilemma problem since intense emotions can be more easily ignored (AGUILAR; BRUSSINO; FERNÁNDEZ-DOLS, 2013). Psychological distance measures how connected one feels to a scenario. It can also be referred to how close one feels toward others. The closer the psychological distance, the more empathy one will feel toward the situation and the characters involved. The further the psychological distance, the more abstract the event feels. Viewing the studies of psychological distance and FLE, Costa et al. (2014) speculated that words in foreign languages elicit weaker emotional arousal, increasing psychological distance during L2 reading. This distance allows readers to view the moral dilemma abstractly, leading to more utilitarian decision-making.

Psychological distance is related to mental imagery as well. Visualization from a third-person perspective diminishes the vividness, while the first-person perspective enhances imagery (LIBERMAN; TROPE; STEPHAN, 2007). The clarity of imagery can also decrease if there is a greater perceived physical distance from the scenario (DAVIS et al., 2011). Davis and colleagues found that negative episodes imagined as physically approaching and growing in size resulted in negative emotional arousal and responses, while negative episodes envisioned as moving away decreased the adverse reactions.

1.3 First and Second Language Comprehension with Mental Imagery

Both first (L1) and second (L2) languages have a complex relationship with mental imagery. Imagery has been observed to increase emotional responses, reading comprehension, and retention in L1 reading through vividness. Though studies between L2 reading and mental imagery are limited, some show that imagery training can benefit L2 comprehension and immersion.

Numerous studies indicate that mental imagery and L1 reading comprehension have an intricate relationship. Yousef Atoum and Reziq (2018) found that mental imagery ability predicted reading comprehension among 7th-grade students. The authors correlated reading comprehension scores through various levels (literal, gross, critical, analytical, and overall) with the Sheveland scale, a mental imagery scale spanning seven dimensions (visual, auditory, kinesthetic, gustatory, olfactory, movement, and feelings). Their results indicated that visual mental imagery could predict 34.8% of reading comprehension. They conclude that mental imagery assists students in creating scenarios that help them understand the overall theme and meaning of the text. The authors also claim that mental imagery deepens the semantic understanding of the word. They state that imagining “affects the process of reading comprehension related to the ability to absorb texts and to understand the different relationships between events” (YOUSEF ATOUM; REZIQ, 2018). They also argue for the importance of visualization to active processes such as analyzing, forming criticisms, and conclusions.

Boerma and colleagues (2016) conducted a study that showed that when reading a story in L1 where the narrative alternates between text and pictures, children who scored higher on mental imagery skills tended to score higher on reading comprehension tasks than children with lower mental imagery scores. They suggested that children skilled at using mental imagery could build mental models to “connect pictures and words.” This connection improved their understanding and allowed them to seamlessly alternate between pictures and stories.
As other studies, such as Kocaarslan (2016), found relationships between levels of mental imagery and L1 reading comprehension, it is crucial to consider whether vividness of mental imagery can improve reading comprehension scores.

For L2 reading and mental imagery, Wang and colleagues have found that individuals learning English as a foreign language (EFL) can improve reading comprehension through "constrained imagery strategy training" (WANG et al., 2015). Constrained imagery is strictly imagining what is written or described, while non-constrained imagery allows for freedom of imagery. They tested three conditions for EFL students: control, non-constrained, and constrained training. The non-constrained training utilized a standard imagery treatment, while the constrained training used the standard imagery treatment and guidance to use constrained imagery. This guidance encouraged readers to reimagine the scenario if they did not accurately imagine the scene. The researchers found that the group with the constrained training had the highest reading comprehension performance.

Based on the L1 and L2 reading studies, mental imagery seems to be relied upon for understanding and recalling events. The more explicit and clear the mental imagery is, the higher the comprehension. Vague imagery indicated a lack of importance and deep understanding of the material. This difference may be crucial for moral dilemma reading comprehension.

Previous research illustrates the foreign language effect on moral dilemma comprehension and decision-making. Individuals who read moral dilemmas in their second language are more likely to select utilitarian responses than in their first language. Studies on mental imagery have shown that mental imagery is relied upon for understanding and recalling events -specifically, the more vivid the mental imagery, the higher the level of narrative retention and comprehension. In contrast, vague imagery resulted in a higher rate of misremembering or misunderstanding the narrative.

The present study investigates the relationship between mental imagery and moral dilemma decision-making in L2 comprehension. We assume that a second language compared to a first language elicits lower vividness of a story, which decreases story immersion. The decline in immersion widens the distance between the reader and the characters in the story.

In our study, we set up two moral dilemma task conditions. Participants in one condition were given mental imagery directions, whereas participants in the other condition were not. We hypothesize that while L2 moral dilemmas increases utilitarian responses, the imagery directions will increase the vividness of the imagery, hence increasing immersion. The immersion will result in a stronger emotional reaction toward the dilemma, resulting in higher deontological responses

2. EXPERIMENT

2.1 Method

For the non-imagery direction group, fifty-eight English second language learners (36 females and 22 males, mean age = 29.41) were recruited from two Japanese crowdsourcing websites. The recruitment conditions were restricted to native Japanese individuals between 18 to 35 and with a TOEIC score over 700 or Eiken test score higher than Grade 2. They were rewarded 400 Yen for their participation. For the imagery direction group, fifty-four participants (25 females, 29 males, mean age = 29.41) with identical criteria were recruited from a Japanese crowdsourcing website.

Data collection for the current study was approved by the International Christian University Research Ethics Committee. This approval authorized the collection of data concerning the response towards moral dilemma scenarios and questionnaires.

2.2 Materials

3EIKEN, also known as the Eiken Foundation of Japan, is a company that produces and administers English proficiency tests.
The Japanese Narrative Transportation Questionnaire (J-NTQ; OSANAI; KUSUMI, 2016) was used to measure the vividness of mental imagery and narrative immersion for philosophical dilemma scenarios. The J-NTQ is based on the Narrative Transportation Questionnaire by Green and Brock (2000). The questionnaire had 12 questions about story immersion and was rated on a 7-point Likert scale ranging from 1 (not at all) to 5 (a lot).

Two dilemmas were selected from a study conducted by Moore et al. (2008) on moral dilemma scenarios. The stories were followed by a moral dilemma question that asked the degree to which you agree the action taken in the story was justified. The moral dilemmas were presented in English.

The Oxford Quick Placement Test (Oxford University Press) was used to measure English comprehension skill level. This test contained 20 multiple choice questions and was presented in English. The demographic questionnaire asked for age, gender, occupation status, and approximate years spent learning English. The questionnaire was written in Japanese. The study was created and performed online on the psychology experiment builder Gorilla (https://www.gorilla.sc).

2.3 Procedure

In the non-imagery direction group, participants were provided with a brief description of the current experiment on the recruitment page. The participants were then provided a link, which directed them to the experiment page. After reading and signing the consent form, they continued to the experiment.

All participants first took a pretest where they were randomly assigned to read one of the moral dilemma scenarios in English and answer a yes-no moral dilemma question of if the action of pushing the elderly passengers off the lifeboat to save yourself and others was acceptable or not. Then participants were asked to fill out the NTQ based on the pretest moral dilemma scenario they read.

For the posttest, the participants were assigned to the other moral dilemma scenario. They took an identical procedure as the pretest condition, where they answered a moral dilemma question and filled out the NTQ. Participants then completed the short English proficiency test and filled out a short demographic questionnaire.

The imagery direction group was recruited with the exact requirements of the non-imagery direction group. This group also had an identical procedure, except before the posttest condition, participants were required to read and listen along with the audio mental imagery instructions based on Gambrell and Koskinen (1986)'s study.

3. RESULTS AND DISCUSSIONS

3.1 Narrative Transportation Questionnaire

As a manipulation check, the measured the Narrative Transportation Questionnaire (NTQ) to see the immersion levels of the moral dilemma scenario in both pretest and posttest conditions. Table 1 presents the mean NTQ scores for the non-imagery direction and the imagery direction groups.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pretest M</th>
<th>Pretest SD</th>
<th>Posttest M</th>
<th>Posttest SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-imagery Direction</td>
<td>42.33</td>
<td>7.28</td>
<td>42.89</td>
<td>7.61</td>
</tr>
<tr>
<td>Imagery Direction</td>
<td>42.20</td>
<td>5.56</td>
<td>44.07</td>
<td>5.54</td>
</tr>
</tbody>
</table>

Table 1. Means and Standard Deviations of Pretest and Posttest NTQ Scores in Non-imagery and Imagery Direction Groups.

A mixed-design analysis of variance (ANOVA) was conducted to assess the difference between the NTQ scores of the two testing conditions (pretest and posttest) and the two direction groups (non-imagery direction and imagery direction groups). There was a significant main effect for the pretest and posttest, $F(1,110) =$
There was also a marginally significant interaction between the condition and direction group, $F(1,110) = 2.82, p = .096$, $\eta^2 = .009$. Since significant effects were observed, post hoc comparisons were conducted using the Bonferroni correction. The results indicated that mean posttest NTQ score was significantly greater than the pretests NTQ scores in the imagery direction group. However, for the non-imagery direction group, the pretest NTQ scores did not significantly differ from the posttest NTQ scores.

To observe the self-report rate of story immersion, the vividness of mental imagery, and the vividness of the characters in the story, a Narrative Transportation Questionnaire (NTQ) was filled out after reading a moral dilemma. The NTQ scores increased in the imagery direction task group from pretest to posttest conditions. This relationship between the pretest and posttest NTQ scores was not observed in the non-imagery direction group.

We interpret these outcomes as indicating that the imagery direction worked as intended, and the overall immersion of the moral dilemma scenarios increased in the imagery direction group in the posttest conditions, which contained the imagery direction task.

The results are consistent with the prior studies in first and second language reading comprehension (YOUSEF ATOUM; REZIQ, 2018; WANG et al., 2015). We argue that directions of proper mental imagery techniques increase the vividness of imagery and narrative immersion while reading. In addition, the importance of the constrained imagination method can explain this increase in vividness through the imagery instructions task.

### 3.2 Pretest Posttest Moral Dilemma Responses

For one of the moral dilemma responses, participants were asked whether the action of pushing a few of the elderly and weaker passengers off the lifeboat to save yourself and the other passengers was acceptable. Since the non-imagery direction group did not receive a mental imagery direction, the choice rate between the pretest and the posttest should be relatively consistent. The imagery direction group had an imagery direction before the posttest. Thus, a change in the rate of choices is predicted to be observed.

In the non-imagery group, the 58 participants responded to two moral dilemma scenarios in the pretest and posttest. In the pretest, 40% ($n = 23$) responded “Yes” (this action is appropriate in this circumstance), and 60% ($n = 35$) responded “No” (this action is not appropriate in this circumstance). In the posttest, 57% ($n = 33$) responded “Yes” and 43% ($n = 25$) responded “No” (Figure 1).

![Figure 1](chart1.png)

**Figure 1.** Circle Graph for Moral Decisions in the Non-Imagery Direction Group. Percentage of the yes and no moral dilemma choices in the pretest (left) and posttest (right) for the non-imagery direction group.

In the imagery group, 54 participants responded to two moral dilemma scenarios in the pretest and posttest. In the pretest, 48% ($n = 26$) responded “Yes” and 52% ($n = 28$) responded “No”. In the posttest, 35% ($n = 19$) responded “Yes” and 65% ($n = 35$) responded “No” (Figure 2).

![Figure 2](chart2.png)

**Figure 2.** Circle Graph for Moral Decisions in the Imagery Direction Group Note. Percentage of the yes and no moral dilemma choices in the pretest (left) and posttest (right) for the imagery direction group.

Table 2 below shows the contingency table, or the frequency distribution of the pretest and posttest moral dilemma choices, for the non-imagery direction group. Table 3 shows the contingency table for the imagery direction group. These tables show the number of participants who shifted between yes and no as well as those who remained consistent (Yes-to-No or No-to-Yes).

<table>
<thead>
<tr>
<th></th>
<th>Pretest No (%)</th>
<th>Pretest Yes (%)</th>
<th>Posttest No (%)</th>
<th>Posttest Yes (%)</th>
<th>Total (%)</th>
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<tbody>
<tr>
<td>Pretest</td>
<td></td>
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<td>Posttest</td>
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Table 2
<table>
<thead>
<tr>
<th></th>
<th>Pretest</th>
<th>Posttest</th>
<th>Posttest</th>
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</thead>
<tbody>
<tr>
<td>No (%)</td>
<td>23 (40%)</td>
<td>12 (21%)</td>
<td>35 (60%)</td>
</tr>
<tr>
<td>Yes (%)</td>
<td>10 (17%)</td>
<td>13 (22%)</td>
<td>23 (40%)</td>
</tr>
<tr>
<td>Total (%)</td>
<td>33 (57%)</td>
<td>25 (43%)</td>
<td>58 (100%)</td>
</tr>
</tbody>
</table>

Table 2. Contingency Table for the Non-Imagery Direction Group. Frequency distribution of the yes and no moral dilemma choices between the pretest and posttest for the non-imagery direction group.

<table>
<thead>
<tr>
<th></th>
<th>Pretest</th>
<th>Posttest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>No (%)</td>
<td>18 (33%)</td>
<td>8 (15%)</td>
<td>26 (48%)</td>
</tr>
<tr>
<td>Yes (%)</td>
<td>17 (31%)</td>
<td>11 (20%)</td>
<td>28 (52%)</td>
</tr>
<tr>
<td>Total (%)</td>
<td>35 (65%)</td>
<td>19 (35%)</td>
<td>54 (100%)</td>
</tr>
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</table>

Table 3. Contingency Table for the Imagery Direction Group. Frequency distribution of the yes and no moral dilemma choices between the pretest and posttest for the imagery direction group.

A McNemar’s Chi-squared test was conducted to test whether the switch from Yes-to-No or No-to-Yes was different between the non-imagery and imagery direction groups. For the non-imagery direction group, there was no significant difference between Yes-to-No shift and No-to-Yes shift, $\chi^2 (1, n = 58) = 0.18, n.s$. The results imply that the potential effect of the practice was not observed. For the imagery group, there was a significant difference between Yes-to-No shift and No-to-Yes shift, $\chi^2 (1, n = 54) = 3.24, p = 0.07$. Specifically, more participants changed from Yes-to-No.

The results showed a marginal significance between the changes for those who shifted before and after the imagery task. It was found that a significant number of those responded "yes" in the pretest settings but shifted to "no" in the posttest settings. When observing the percentage of participants in the non-imagery group who shifted their responses from pretest to posttest, we could observe that the rate of change from yes to no or vice versa was close in number.

Though the significance was only marginal, this shift is consistent with our hypothesis that exposing participants to mental imagery directions increases deontological choices, as these results were only observed in the imagery direction group. Our interpretation of these outcomes is that the posttest conditions with the imagery direction either increased the feeling of unacceptability towards the sacrifice action or decreased the feeling of willingness to sacrifice.

4. CONCLUSION

The current study examines the effect of mental imagery on moral decision-making in a second language. In previous FLE research, second language settings tend to increase logical thinking styles promoting utilitarian judgments favoring the overall benefit of the scenario (Hayakawa & Keysar, 2018). In contrast, participants are more likely to choose immediate emotional reactions resulting in deontological decisions in first-language settings. This effect was explained by the possibility that L1 evoked intense and more emotional mental imagery while reading the stories. The decrease in imagery intensity is because L2 requires more cognitive effort and deliberate thinking; this decreases the resources and attention towards producing mental imagery. Based on prior research, we hypothesized that using mental imagery during L2 moral dilemmas should increase the vividness and immersion of the scenarios, resulting in an emotional decision. To test this hypothesis, we created one group that was shown imagery instructions and another group that was not. If mental imagery influenced foreign language reading and decision-making, as we assumed, the group receiving the imagery instructions should experience higher narrative immersion and increased deontological responses.
The current study found a moderate increase in deontological choices after providing the imagery instructions. In addition, an increase in story immersion and vividness was observed. On the other hand, the group not shown imagery directions did not show any changes in immersion levels or dilemma decision rates between the two stories.

The outcomes concerning mental imagery vividness are consistent with the view that the Foreign Language Effect dampens the quality of mental imagery while reading in a second language. We argue that this decline in imagery occurs due to cognitive resources consumed by lower-level language processes in L2, compared to the automatic and instinctual native language. In addition, the second language is often obtained in a less emotionally charged and active environment, such as classrooms and using textbooks, compared to first languages. It is plausible to assume that these differences change the vividness of the imagery created while reading.

Despite this, our study demonstrated that encouraging the use of mental imagery can mitigate the issues surrounding the decline of mental imagery in foreign language reading, ultimately influencing one’s decision in a moral dilemma. The application of mental imagery direction tasks may provide new insight into the Foreign Language Effect.

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Competing Interests

The authors have no conflicts of interest to declare.

Research Preregistration and Standards

We have reviewed the standards, report whether any standards were relevant for the research application, and confirm that they followed those standards in the manuscript. The current research was not preregistered.

Data Accessibility Statement

The data, codes and materials that support the findings of this study are available on request from the corresponding author, M.R.O. The data/materials are not publicly available due to restrictions pertaining to the possibility of compromising the privacy of research participants.

REFERENCES


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