

RESEARCH REPORT

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

Miyuki Rachel OSHIMA  

Graduate School, Psychology and Education Program - International  
Christian University (ICU)  
Mitaka, Tokyo, Japan

Morishima YASUNORI  

Department of Psychology and Linguistics - International Christian  
University (ICU)  
Mitaka, Tokyo, Japan



OPEN ACCESS

The whole content of *Cadernos de  
Linguística* is distributed under Creative  
Commons Licence CC - BY 4.0.

EDITORS

- Amanda Post (UFJ)

REVIEWERS

- Lilian Hübner (PUC-RS)  
- Danielle Wisintainer (UFSC)

ABOUT THE AUTHORS

- Miyuki Rachel Oshima  
Conceptualization; Methodology;  
Software; Formal Analysis; Investigation;  
Writing - Original Draft; Visualization.

- Morishima Yasunori  
Writing - Review & Editing; Supervision;  
Funding Acquisition.

Received: 07/07/2023

Accepted: 12/18/2023

Published: 12/30/2023

HOW TO CITE

OSHIMA, M.R.; YASUNORI, M. (2023). The  
Effects of Mental Imagery on Moral  
Dilemmas in a Second Language. *Cadernos  
de Linguística*, v. 4, n. 3, e689.

ABSTRACT

Recent studies on the so-called “foreign language effect” using moral dilemmas such as the famous trolley problem have shown that individuals are more inclined to save more lives at the cost of a few when given the problem in a foreign language than in their first language. Studies suggest that the decline in vivid imagery during foreign language reading causes the empathy towards the characters to decline, making it easier to prioritize the outcome of saving more lives over the emotional reaction to the idea of harm. The current study focuses on the use of mental imagery while reading second language moral dilemma scenarios. 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 story immersion, decreasing utilitarian responses. In this study, two groups were presented with a pre-post test moral dilemma scenario in their second language. One group received 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 argue that



mental imagery could increase story immersion and perhaps increase deontological decisions despite the foreign language effect.

#### RESUMO

Estudos recentes sobre o chamado "efeito de idioma estrangeiro" usando dilemas morais, como o famoso problema do carrinho, mostraram que as pessoas estão mais inclinadas a salvar mais vidas ao custo de algumas, quando o problema é apresentado em um idioma estrangeiro do que em seu idioma nativo. Estudos sugerem que a diminuição de imagens vívidas durante a leitura em idioma estrangeiro faz com que a empatia com os personagens diminua, facilitando a priorização do resultado de salvar mais vidas em detrimento da reação emocional à ideia de dano. O estudo atual se concentra no uso de imagens mentais durante a leitura do cenário de dilema moral em segunda língua. 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 na história, diminuindo o nível de responsabilização utilitária. Neste estudo, dois grupos foram apresentados com um cenário de dilema moral pré-pós 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 um aumento marginal 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' code. 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.

#### KEYWORDS

Foreign Language Effect; Moral Dilemma; Mental Imagery; Second Language Processing; Cognitive Resource Allocation.

#### PALAVRAS-CHAVE

Efeito do Idioma Estrangeiro; Dilema Moral; Imagens Mentais; Processamento de Segunda Língua; Alocação de Recursos Cognitivos.

## INTRODUCTION

Compared to native languages, situations described in a foreign language made participants more willing to take riskier bets in gambling scenarios (Keysar; Hayakawa; An, 2012). They were also less influenced by the framing manipulation, where the wording was changed to emphasize the loss or gain (Keysar; Hayakawa; An, 2012). The phenomenon in which a non-native language influences decision-making is known as the foreign language effect (FLE) (Keysar; Hayakawa; An, 2012). The FLE has recently been observed in moral dilemmas as well (Hayakawa *et al.*, 2017). Though there are several accounts for the cause of FLE, Hayakawa and Keysar (2018) proposed that the quality of mental imagery plays an essential role in the phenomenon. The current study investigates whether mental imagery can influence an individual's moral decision when reading a moral dilemma scenario in a second language.

## 1. BACKGROUND

### 1.1. MORAL DILEMMA

Moral dilemmas are hypothetical scenarios where a person must choose from two choices: utilitarian and deontological. Utilitarian choices prioritize the greater good and are associated with logical (analytical) thinking styles (Li *et al.*, 2018). Participants with dominance in logical thinking styles were more likely to choose utilitarian options as they were more likely to prioritize the overall benefit over immediate empathetic concern (Carmona-Perera *et al.*, 2013; Gleichgerrcht; Young, 2013; Patil; Silani, 2014).

Deontological choices, in contrast, suggest that sacrificial actions are not worth the outcome and are often associated with emotional thinking styles, aversion towards harming others, and sensitivity to others' feelings (Christov-Moore; Conway; Iacoboni, 2017; Reynolds; Knighten; Conway, 2019). 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. 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. When participants were shown neutral and scary images and then read neutral and scary stories, both average and low imagination ability participants exhibited increased SCL to the scary pictures. However, while average imagination participants showed increased SCL, 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 between mental imagery and emotions is the perceived 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. The closer the psychological distance, the more empathy one will feel toward 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 (Lieberman; 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.

For L2 and mental imagery, though studies are limited, Kühne and Gianelli (2019) suggest that 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. This relationship is similar to the theory presented by Hayakawa and Keysar (2018) that forming mental imagery is related to abilities to retrieve episodic memories. The retrieval of memory is also dependent on the language they used to encode. The authors conclude that as most episodic memories are encoded in L1, they will be less accessible in L2, resulting in difficulty producing mental imagery in L2.

### 1.3. FIRST AND SECOND LANGUAGE COMPREHENSION WITH MENTAL IMAGERY

Other studies suggest that imagery training could benefit reading comprehension and immersion. 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 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% reading comprehension. They conclude that mental imagery assists students in creating scenarios that help them understand the overall theme and meaning of the text (Yousef Atoum; Reziq, 2018). Boerma and colleagues (2016) 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."

For L2 reading and mental imagery, Wang and colleagues have found that individuals learning English as a second language 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 researchers found that the group with the constrained training had the highest reading comprehension performance. The results suggest that the guidance of constrained imagery encouraged readers to prioritize imagining the scene accurately, resulting in better comprehension.

Based on these 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.

The studies on the role of mental imagery have led us to investigate 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 due to cognitive load or episodic memory encoding. Furthermore, we assume that 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. Based on previous research, it can be hypothesized that as cognitive load and the lack of L2 episodic memory limit the creation of mental imagery during reading, the condition without imagery directions will have a higher utilitarian response rate. For the imagery direction condition, we hypothesize that mental imagery directions 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.

## 2. PILOT STUDIES

In the present research, the mental imagery manipulation plays a crucial role. We wanted to confirm the mental imagery directions that we employed would yield the expected effect on mental imagery ratings by L2 English participants. Thus, two within-participant pilot studies were conducted to compare the influence of mental imagery directions on mental imagery ratings within nineteen L1 English participants (Pilot Study 1) and twenty L2 English-L1 Japanese (Pilot Study 2) participants by using two short English stories. For the L2 condition, five participants were removed from the study due to skipping the instructions section of the study.

### 2.1. METHOD

Both pilot studies had a pretest posttest structure using two stories with similar difficulty confirmed by Coh-Metrix (Flesch Reading Ease score of 89.94 and 90.55): *Lamb for slaughter* and *Two were left*. The pretest instructed participants to "Please read the story and answer the questions that follow." After they read the story, they answered a short comprehension test and filled out the Narrative Transportation Questionnaire (NTQ). In the posttest, participant were told to "Please imagine the story very carefully as you read and answer the questions that follow." Afterward they were presented with the story, a comprehension test, and the NTQ similarly to the control condition. The stories were randomized to prevent any order bias.

## 2.2. RESULTS

For Pilot Study 1, there was no significant difference between the pretest ( $M = 46.026$ ,  $SD = 7.934$ ) and posttest conditions ( $M = 46.722$ ,  $SD = 8.323$ ),  $t(1, 18) = -0.495$ , *n.s.*. For Pilot Study 2, there was a significant difference between the pretest ( $M = 42.600$ ,  $SD = 3.542$ ) and posttest condition ( $M = 45.733$ ,  $SD = 5.298$ ),  $t(1,14) = -2.775$ ,  $p = .015$ .

Pilot Study 1 shows that in L1 story conditions, there is no difference in NTQ ratings between including or not including mental imagery instructions. This can be supported by the idea that in L1 conditions the mental imagery levels are already high, thus including a mental imagery instruction is not enough to increase levels of NTQ. On the other hand, Pilot Study 2 shows there is a possibility that mental imagery direction increases the rating of NTQ in L2 settings as there is a significantly higher score on the posttest condition with the imagery instructions compared to the conditions without instructions. In addition, the mean posttest scores in the Pilot Study 2 look closer in value to the mean scores in Pilot Study 1. This may indicate that for L2 stories, mental imagery instructions elevate NTQ ratings closer to L1 NTQ ratings.

We interpreted these outcomes to indicate that the instructions that we constructed would encourage L2 participants to engage in mental imagery as intended.

## 3. MAIN EXPERIMENT

In our experiment, we set up two moral dilemma task conditions. Participants in the condition were given mental imagery direction, whereas participants in the other condition were not. We hypothesize that mental imagery will increase the story's vividness, resulting in an increase in deontological decision for L2 moral dilemmas. In addition, the study will address whether imagery direction will change the level of L2 story immersion.

### 3.1. METHOD

In total, sixty-two participants were collected for the non-imagery direction group but four were taken out for failing to meet the English Comprehension Test requirement scores. 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<sup>1</sup> test score higher than Grade 2. They were rewarded 400 Yen for their participation.

CEFR	Overall TOEIC Score (NAMSAENG, 2021)	EIKEN Grades (EIKEN)	Oxford Quick Placement Test
A1	120-220	4 ~ 5	1-17
A2	225-545	3 ~ Pre-2	18-29
B1	550-780	3 ~ 2	30-39
B2	785-940	Pre-2 ~ Pre-1	40-47
C1	945-990	Pre-1 ~ 1	48-54
C2	-	-	55-60

**Table 1.** Score comparisons for CERF (Common European Framework of Reference for Languages), TOEIC, and EIKEN.

For the imagery direction group, sixty participants were collected for the imagery direction group but six were taken out for failing to meet the English Comprehension Test requirement scores. Fifty-four participants (25 females, 29 males, mean age = 29.41) with identical criteria were recruited from a Japanese crowdsourcing website.

### 3.2. MATERIALS

Two English dilemmas were selected from a study conducted by Moore et al. (2008) on moral dilemma scenarios. The two stories with similar situational settings were selected. The situational setting was controlled because setting differences can influence dilemma choices, such as if the situation is flipping a switch (impersonal) vs. pushing someone (personal) and whether the situation is also threatening your life (life threatened) or not (not threatened). Two stories were selected so that the story order could be randomized.

The stories were processed by Coh-Metrix to gauge the difficulty level and readability. Two stories with similar lengths and similar difficulty levels were chosen. The Flesch Reading Ease for story one was 76.173, and for story two was 77.766, which is considered “fairly easy” or for CEFR (Common European Framework of Reference for Languages) approximately between A1 and A2 (Lindhout; Teunissen; Lindhout, 2012) or B1 according to Linguapress. The stories were followed by

<sup>1</sup> EIKEN, also known as the Eiken Foundation of Japan, is a company that produces and administers English proficiency tests.

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 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).

The Oxford Quick Placement Test (Oxford University Press) was used to measure English comprehension skill level. This test contained 60 multiple-choice questions and was presented in English through an online format. 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>).

### 3.3. 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, directing them to the experiment page. After reading and signing the consent form, they continued the experiment.

All participants first took a pretest where they were instructed with a simple audio and direction text in Japanese (L1) to read the English moral dilemma scenarios and answer the English yes-no moral dilemma question. The audio instructions were only provided during the instruction phase of the study. The moral dilemmas were asked to be read without any audio assistance. The participants were randomly assigned to story one or story two as their pretest story. Then, participants were asked to fill out the NTQ-J based on the pretest moral dilemma scenario they had read.

For the posttest, the participants were assigned to the other moral dilemma scenario. If they read story two for the pretest, they read story one for the posttest. They took an identical procedure as the pretest condition, where they were instructed with an L1 audio and text to answer the moral dilemma question in English and filled out the NTQ-J. 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 an additional L1 audio mental imagery instructions based on Gambrell and Koskinen's (1986) study, they were instructed to "carefully imagine the moral dilemma scenario while reading to the best of your ability." Once again, the audio instructions were only provided during the instruction phase of the study. The moral dilemmas were asked to be read without any audio assistance.

## 4. RESULTS

### 4.1. ENGLISH PROFICIENCY TEST RESULTS

An Oxford Quick Placement Test was administered. This test had a cut-off score of 30, equivalent to level B1 for CEFR (Akbarnezhad; Sadighi; Bagheri, 2020) (See Table 1). For the non-imagery direction group, the lowest score was 15, and the highest was 57. Four participants in total whose scores failed to meet the cut-off requirement of 30 were removed from the study. The mean test score after the cut-off was 40.862 ( $SD = 9.137$ ). For the imagery direction group, the lowest score was 18, and the highest was 60. Six participants in total whose scores failed to meet the cut-off requirement of 30, the mean test score after the cut-off was 38.778 ( $SD = 8.703$ ). The participants were, on average, considered to be on the intermediate proficiency level (i.e., B1 and B2).

### 4.2. NARRATIVE TRANSPORTATION QUESTIONNAIRE

As a manipulation check, the Narrative Transportation Questionnaire (NTQ) was used to measure the immersion levels of the moral dilemma scenario in both pretest and posttest conditions. Table 2 presents the mean NTQ scores for the non-imagery direction and the imagery direction groups.

Groups	Pretest		Posttest	
	M	SD	M	Sd
Non-imagery Direction	42.33	7.28	42.89	7.61
Imagery Direction	42.20	5.56	44.07	5.54

**Table 2.** 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,  $F(1,110) = 9.903$ ,  $p = .05$ ,  $\eta^2 = .009$ . There was also a marginally significant interaction between the condition and direction group,  $F(1,110) = 2.82$ ,  $p = .096$ ,  $\eta^2 = .002$ . Since significant effects were observed, post hoc comparisons were conducted using the Bonferroni correction. The results indicated that the mean posttest NTQ score was significantly greater than the pretest 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.

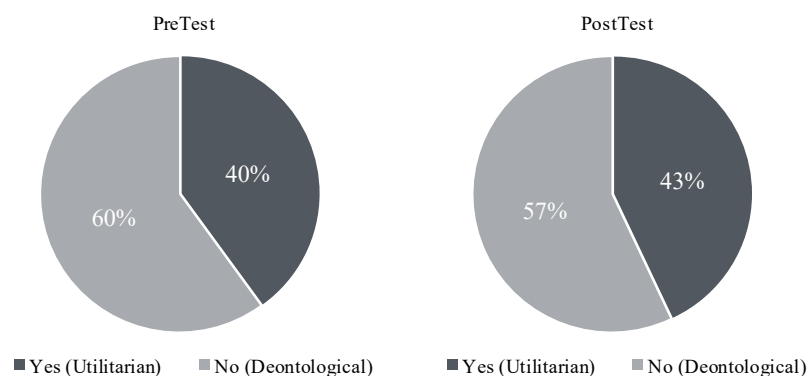
We interpret these outcomes as indicating that the imagery direction worked as intended, and the overall immersion of the moral dilemma scenarios increased in the imagery direction group in the posttest conditions, which contained the imagery direction task.

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.

#### 4.3. PRETEST POSTTEST MORAL DILEMMA RESPONSES

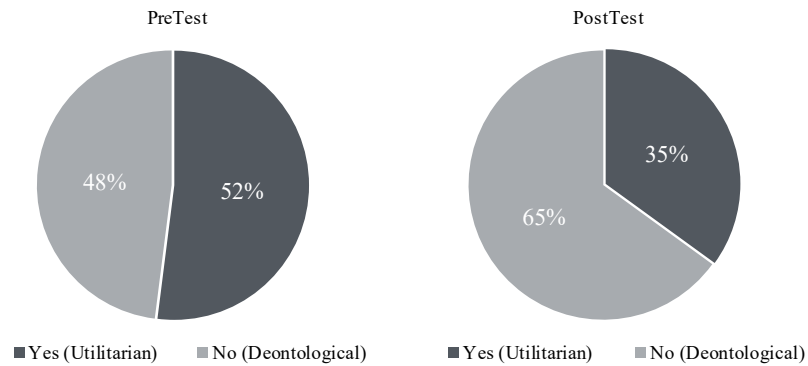
For one of the moral dilemma responses, participants were asked whether the action of pushing a few of the elderly and weaker passengers off the lifeboat to save yourself and the other passengers was acceptable. Since the non-imagery direction group did not receive a mental imagery direction, the choice 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.** 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 the 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.** 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 3 below shows the contingency table, or the frequency distribution of the pretest and posttest moral dilemma choices, for the non-imagery direction group. Table 4 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).

Pretest	Posttest		
	No (%)	Yes (%)	Total (%)
No (%)	23 (40%)	12 (21%)	35 (60%)
Yes (%)	10 (17%)	13 (22%)	23 (40%)
Total (%)	33 (57%)	25 (43%)	58 (100%)

**Table 3.** 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.

Pretest	Posttest		
	No (%)	Yes (%)	Total (%)
No (%)	18 (33%)	8 (15%)	26 (48%)
Yes (%)	17 (31%)	11 (20%)	28 (52%)
Total (%)	35 (65%)	19 (35%)	54 (100%)

**Table 4.** 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 the Yes-to-No shift and the 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 the Yes-to-No shift and the 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 willingness to sacrifice.

## 5. DISCUSSIONS AND CONCLUSIONS

The current study examines the effect of mental imagery on moral decision-making in a second language. Previous FLE research has shown that second language settings tend to increase logical thinking styles, promoting utilitarian judgments that favor the overall benefit of the scenario (Hayakawa; Keysar, 2018). This trend sharply contrasts with the findings of corresponding studies in L1, which have shown that 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. Unlike the L1 settings, the L2 trend toward utilitarian decision implies that such mental imagery does not seem to be evoked because L2 requires more cognitive effort and deliberate thinking; this decreases the resources and attention towards producing mental imagery.

This conjecture has led us to hypothesize 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 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 reduction 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.

Though the study was not conducted with L1 English participants, the assumption of imagery reduction due to cognitive resource limitation suggests that the results of the pilot study seem to offer some indirect evidence. The pilot study results indicate that the imagery instructions yielded a higher score on vividness in the L2 condition and obtained closer scores to the L1 participants. Thus, we contend that the instructions in the experiment led the L2 participants to engage in more deliberate imagery of the story.

Overall, 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.

## ACKNOWLEDGMENTS

I would like to express my thanks and gratitude to my advisor, Professor Yasunori Morishima, for the endless guidance I received throughout the research and writing process. I am grateful for the encouraging comments and support from the ICU Psychology Department students and staff. I thank the CadLin reviewers for their feedback and suggestions during the writing process. Finally, I would like to thank JSPS for the funding I received, which made the project possible.

## ADDITIONAL INFORMATION

### CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

### STATEMENT OF DATA AVAILABILITY

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.

### ETHICS AND CONSENT

The 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.

### FUNDING SOURCES

This work was supported by JSPS Grant-in-Aid for Scientific Research to the second author (Grant Number: JP17K00210).

### REVIEW AND AUTHORS' REPLAY

Avaliação: <https://doi.org/10.25189/2675-4916.2023.V4.N3.ID689.R>

Resposta dos Autores: <https://doi.org/10.25189/2675-4916.2023.V4.N3.ID689.A>



## REFERENCES

- AGUILAR, Pilar; BRUSSINO, Silvina; FERNÁNDEZ-DOLS, José-Miguel. Psychological distance increases uncompromising consequentialism. *Journal of Experimental Social Psychology*, v. 49, n. 3, p. 449-452, May 2013. DOI <https://doi.org/10.1016/j.jesp.2013.01.002>.
- AKBARNEZHAD, Shima; SADIGHI, Firooz; BAGHERI, Mohammad Sadegh. A syntactic-based approach to the perception and production of English verbs 'argument structures by Iranian EFL learners. *Cogent Arts & Humanities*, v. 7, no. 1, p. 1770956, 1 Jan. 2020. DOI <https://doi.org/10.1080/23311983.2020.1770956>.
- AMIT, Elinor; GREENE, Joshua D. You See, the Ends Don't Justify the Means. *Psychological Science*, v. 23, n. 8, p. 861-868, 28 June 2012. DOI <https://doi.org/10.1177/0956797611434965>.
- YOUSEF ATOUM, Adnan; M. REZIQ, Abdullah. Can mental imagery predicts reading comprehension? *Current Research Journal of Social Sciences and Humanities*, v. 1, n. 1, p. 13-20, 25 June 2018. DOI <https://doi.org/10.12944/crjssh.1.1.02>.
- AUTOMATED Evaluation Of Text And Discourse With Cohmetrix. [S. l.]: Cambridge University Press, 2014. ISBN 9780521137294.
- BOERMA, Inouk E.; MOL, Suzanne E.; JOLLES, Jelle. Reading Pictures for Story Comprehension Requires Mental Imagery Skills. *Frontiers in Psychology*, v. 7, 24 Oct. 2016. DOI <https://doi.org/10.3389/fpsyg.2016.01630>.
- CARMONA-PERERA, Martina *et al.* Heart rate correlates of utilitarian moral decision-making in alcoholism. *Drug and Alcohol Dependence*, v. 133, n. 2, p. 413-419, Dec. 2013. DOI <https://doi.org/10.1016/j.drugalcdep.2013.06.023>.
- CHRISTOV-MOORE, Leonardo; CONWAY, Paul; IACOBONI, Marco. Deontological Dilemma Response Tendencies and Sensorimotor Representations of Harm to Others. *Frontiers in Integrative Neuroscience*, v. 11, 12 Dec. 2017. DOI <https://doi.org/10.3389/fnint.2017.00034>.
- COMPARISON table | Research | EIKEN | Eiken Foundation of Japan. Available from: <https://www.eiken.or.jp/eiken/en/research/comparison-table.html>. Accessed: 1 Nov. 2023.
- COSTA, Albert *et al.* Your Morals Depend on Language. *PLoS ONE*, v. 9, n. 4, p. e94842, 23 Apr. 2014. DOI <https://doi.org/10.1371/journal.pone.0094842>.
- DAVIS, Joshua Ian; GROSS, James J.; OCHSNER, Kevin N. Psychological distance and emotional experience: What you see is what you get. *Emotion*, v. 11, n. 2, p. 438-444, Apr. 2011. DOI <https://doi.org/10.1037/a0021783>.
- FLESCH-KINCAID readability and EFL. Available from: <https://linguapress.com/teachers/flesch-kincaid.htm>. Accessed: 1 Nov. 2023.
- GAMBRELL, Linda; KOSKINEN, Patricia. Mental Imagery and the Reading Comprehension of Below Average Readers: Situational Variables and Sex Differences. In: ANNUAL MEETING OF THE AMERICAN EDUCATIONAL RESEARCH ASSOCIATION, 1982, New York. *Annual Meeting of the American Educational Research Association*. Washington D.C.: ERIC Clearinghouse, 1982. p. 1-19. DOI <https://eric.ed.gov/?id=ED217386>.
- GLEICHGERRCHT, Ezequiel; YOUNG, Liane. Low Levels of Empathic Concern Predict Utilitarian Moral Judgment. *PLoS ONE*, v. 8, n. 4, p. e60418, 4 Apr. 2013. DOI <https://doi.org/10.1371/journal.pone.0060418>.
- GREEN, Melanie C.; BROCK, Timothy C. The role of transportation in the persuasiveness of public narratives. *Journal of Personality and Social Psychology*, v. 79, n. 5, p. 701-721, Nov. 2000. DOI <https://doi.org/10.1037/0022-3514.79.5.701>.
- HAYAKAWA, Sayuri; KEYSAR, Boaz. Using a foreign language reduces mental imagery. *Cognition*, v. 173, p. 8-15, Apr. 2018. DOI <https://doi.org/10.1016/j.cognition.2017.12.010>.

HAYAKAWA, Sayuri *et al.* Thinking More or Feeling Less? Explaining the Foreign-Language Effect on Moral Judgment. *Psychological Science*, v. 28, n. 10, p. 1387-1397, 14 Aug. 2017. DOI <https://doi.org/10.1177/0956797617720944>.

KEYSAR, Boaz; HAYAKAWA, Sayuri L.; AN, Sun Gyu. The Foreign-Language Effect. *Psychological Science*, v. 23, n. 6, p. 661-668, 18 Apr. 2012. DOI <https://doi.org/10.1177/0956797611432178>.

KÜHNE, Katharina; GIANELLI, Claudia. Is Embodied Cognition Bilingual? Current Evidence and Perspectives of the Embodied Cognition Approach to Bilingual Language Processing. *Frontiers in Psychology*, v. 10, 6 Feb. 2019. DOI <https://doi.org/10.3389/fpsyg.2019.00108>.

LI, Zhongquan *et al.* Analytical thinking style leads to more utilitarian moral judgments: An exploration with a process-dissociation approach. *Personality and Individual Differences*, v. 131, p. 180-184, Sept. 2018. DOI <https://doi.org/10.1016/j.j.paid.2018.04.046>.

LIBERMAN, Nira; TROPE, Yaacov; STEPHAN, Elena. Psychological distance. In A. W. Kruglanski & E. T. Higgins (Eds.), *Social psychology: Handbook of basic principles* 2nd ed. [S. l.]: The Guilford Press, 2007. p. 353-381.

LINDHOUT, Paul; TEUNISSEN, Truus; LINDHOUT, Mark. Quick effective CEFR level evaluation of complete documents: Integrated readability appraisal of text and graphics with the L-scale algorithm. *International Journal of Language Studies*, v. 6, no. 3, p. 37-56, June 2012.

MOORE, Adam B.; CLARK, Brian A.; KANE, Michael J. Who Shalt Not Kill? Individual Differences in Working Memory Capacity, Executive Control, and Moral Judgment. *Association for Psychological Science*, v. 19, n. 6, p. 549-557, 2008. DOI <https://doi.org/10.1111/j.1467-9280.2008.02122.x>.

OSANAI, Hidekazu; KUSUMI, Takashi. Reliability and validity of the Narrative Transportation Scale in Japanese. *The Japanese Journal of Personality*. (In Japanese with English abstract.), Japan, v. 25, n. 1, p. 50-61, 2016. DOI <https://doi.org/10.2132/personality.25.50>.

PATIL, Indrajeet; SILANI, Giorgia. Reduced empathic concern leads to utilitarian moral judgments in trait alexithymia. *Frontiers in Psychology*, v. 5, n. 501, p. 1-12, 2014. DOI <https://doi.org/10.3389/fpsyg.2014.00501>.

PEARSON, Joel; NASELARIS, Thomas; HOLMES, Emily A.; KOSSLYN, Stephen M. Mental Imagery: Functional Mechanisms and Clinical Applications. *Trends in Cognitive Sciences*, v. 19, n. 10, p. 590-602, 2015. DOI <https://doi.org/10.1016/j.tics.2015.08.003>.

REYNOLDS, Caleb J.; KNIGHTEN, Cassidy R.; CONWAY, Paul. Mirror, mirror, on the wall, who is deontological? Completing moral dilemmas in front of mirrors increases deontological but not utilitarian response tendencies. *Cognition*, v. 192, n. 103993, 2019. DOI <https://doi.org/10.1016/j.cognition.2019.06.005>.

SZEKELY, Raluca D.; MIU, Andrei C. Incidental emotions in moral dilemmas: The influence of emotion regulation. *Cognition and Emotion*, v. 39, n. 1, p. 64-75, 2014. DOI <https://doi.org/10.1080/02699931.2014.895300>.

WANG, Lihui; LAWSON, Michael; CURTIS, David D. The effect of image quality training on reading comprehension of EFL students using the keyword method. *Language Teaching Research*, v. 19, n. 4, p. 435-454, 2015. DOI <https://doi.org/10.1177/1362168814541718>.

WICKEN, Marcus; KEOGH, Rebecca; PEARSON, Joel. The critical role of mental imagery in human emotion: insights from fear-based imagery and aphantasia. *Proceedings: Biological Sciences*, v. 288, n. 1946, 2021. DOI <https://doi.org/10.1098/rspb.2021.0267>.