Time Travels: The Spatial Representation of Time Across Cultures and Languages

Loermans, A.C.

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CHAPTER 5

Agency and Time Representation in English and Dutch Speakers

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ABSTRACT

Research reveals that the ego- and time-moving representations, two divergent ways to represent time, are not just linguistic artifacts but psychologically meaningful: they are, for example, linked to agency. This research has, however, mainly been correlational in nature and only been conducted amongst English speakers even though cross-linguistic differences are readily observed in time representation research. This study extends this prior work through three experiments. In the first experiment, we explore the causal relation amongst English speakers and show that feelings of personal agency lead to the adoption of the ego-moving representation. In the second and third experiment, we replicate the first experiment and conduct a correlational study amongst Dutch speakers. We find no proof for a similar relation between agency and time representation amongst Dutch speakers. In discussing the findings, the role language plays in shaping preferences is considered as well as the methodological issues that need to be addressed by future research.

Keywords: time representation; agency; ego-moving; time-moving; cross-linguistic differences

INTRODUCTION

Dwelling on past events and anticipating hypothetical future events are prominent activities of the human mind (Spronken et al., 2016). When talking about such events to others, people heavily rely on spatial terms to get their message across: we say a meeting was *short*, that a deadline is *approaching*, that we are *ahead* of our time, and that we are leaving bad days *behind* and looking *forward* towards a bright future. Research on understanding the representation of time has shown that this way of talking about time is reflective of the way time is cognitively represented (Boroditsky, 2001; Casasanto & Boroditsky, 2008; Casasanto et al., 2010; Lai & Boroditsky, 2013). As time cannot be experienced directly through the senses, people rely on spatial metaphors to understand and talk about time (Lakoff & Johnson, 1980). A considerable amount of research has focused on contrasting two spatial metaphors, two specific ways of representing time spatially: the ego-moving and the time-moving representation (Boroditsky & Ramscar, 2002; Duffy & Feist, 2014; Lakoff & Johnson, 1980; McGlone & Harding, 1998; McGlone & Pfiester, 2009; Richmond et al., 2012). In the ego-moving representation, people see themselves moving through a temporal landscape, approaching future events whilst leaving past events behind. In contrast, in the time-moving representation, future temporal events approach and pass a stationary self, as they change from events in the future to events in the past. Do these different ways of thinking and talking about time reveal anything about the way people feel and act towards the past and future events they so often think and talk about? The current study addresses this by investigating whether feelings of personal agency, the amount of control one perceives over life events, affects our representation of time. Specifically, we tested whether personal agency leads to the adoption of the ego-moving representation, where the person is the agentic entity moving towards future temporal events, and whether lack of personal agency leads to the adoption of the time-moving representation, where the person is stationary, being approached by future temporal events.

The idea that agency and time representation might be linked in such a way is corroborated by various studies. Indirect support for the link between agency and time representation, for example, comes from the work by McGlone and Pfiester (2009) and Ruscher (2011). Building on research linking agency to positive affect through an approach motivation (Higgins, 1997; Krieglmeyer, Deutsch, de Houwer, & de Raedt, 2010; Margolies & Crawford, 2008), they point out the inherent differences in the way that agency is assigned in ego- and time-moving expressions (McGlone & Pfiester, 2009; Ruscher, 2011). Agency is often inexplicitly communicated through certain linguistic constructions with greater agency assigned to grammatical subjects than to objects (Henley, Miller, & Beazley, 1995; McGlone & Pfiester, 2009; Ruscher, 2011;

van Dijk, 1988; see also Fausey & Boroditsky, 2010, 2011). In ego-moving expressions, the grammatical subject features the person (e.g., *We passed the deadline*) whilst in time-moving expressions the person is usually in the object role with the grammatical subject role featuring the temporal event (e.g., *The deadline passed us*). McGlone and Pfiester (2009) analyzed English corpora and found that when describing positive events, people indeed employ ego-moving expressions; when describing negative events, people employ time-moving expressions. In follow-up studies, they found similar results when eliciting narratives about either positive or negative events from participants and when asking participants to indicate the affective orientation of someone described in a vignette using either ego-moving or time-moving expressions (McGlone & Pfiester, 2009). Ruscher's (2011) findings extend this by showing a relation between time representation and affective forecasting in terms of grief: participants who read a vignette about a grieving mother after being primed with an ego-moving representation, estimated shorter grieving periods and provided agentic comments about a return to daily routines (as opposed to comments about the passive passage of negative affect), compared to participants who received a time-moving prime. The link between the ego-moving representation and an approach motivation (and by extension thus agency) is further corroborated by findings of Hauser, Carter, and Meier (2009) who showed that anger, which is an approach emotion, is linked to the ego-moving representation. In addition, Duffy and Feist (2014) found that students, compared to professional administrators, were more likely to adopt an ego-moving representation. They explained their findings as being due to the different relation these two populations have with time: where students are generally in control of structuring their time, administrators are controlled by time, in the sense that their days are more structured by external demands (Duffy & Feist, 2014).

More direct support for the hypothesized relation between agency and time representation is found in a recent study by Richmond et al. (2012). They report that happiness, higher levels of personal agency, and a future orientation were positively related to an ego-moving representation (Richmond et al., 2012). Depression, anxiety, lower levels of agency, a fatalistic and hedonistic time orientation, were, in turn, related to a time-moving representation (Richmond et al., 2012). In the experiment most relevant to the current study, Richmond et al. (2012) measured personal agency using the Behavioral Identification Form (Vallacher & Wegner, 1989). The Behavioral Identification Form provides participants with 25 behaviors or actions (e.g., "Taking a test") and asks them to choose between two descriptions that identify the actions at different levels. One description focuses on the motives and meaning of the behavior (e.g., "Showing one's knowledge") where the other description focuses on the details and methods (e.g., "Answering questions") (Vallacher & Wegner, 1985, 1989). According to Vallacher and Wegner (1989; see also Richmond et al., 2012) agentic individuals

incorporate the motives and meaning in their actions whereas those with lower levels of personal agency will focus on the details and methods. The results of the experiment showed that participants who adopted an ego-moving representation, as opposed to a time-moving representation, scored higher on the Behavior Identification Form (Richmond et al., 2012). In the first experiment reported in the current study, we build on this correlational research and extend it by manipulating agency amongst participants to test whether feelings of personal agency lead to the adoption of an ego-moving representation as opposed to a time-moving representation. In doing so, we take a first step in investigating the possible causal mechanism underlying this relation.

Another aim of the current study was to extend prior research on agency and time representation by investigating the relation between the two amongst a non-English speaking sample. Namely, all the above studies providing indirect and direct support for the relation between agency and time representation have exclusively been conducted amongst English speaking participants. Yet, a vast body of research shows that time representation is heavily influenced by linguistic and/or cultural factors (Bender et al., 2010; Boroditsky, Fuhrman, & McCormick, 2010; Dahl, 1995; Fuhrman & Boroditsky, 2010; Lai & Boroditsky, 2013; Moore, 2011; Núñez & Sweetser, 2006; Rothe-Wulf, Beller, & Bender, 2015; see Bender & Beller, 2014 for a discussion). Specifically, in relation to the ego- and time-moving representation, researchers have found that speakers of other languages, like Malagasy, Mandarin, German, and Swedish, have a strong preference for one representation over the other: Malagasy, Mandarin, and German speakers all seem to prefer the time-moving representation whilst Swedish speakers seem to prefer the ego-moving representation (Bender et al., 2010; Dahl, 1995; Lai & Boroditsky, 2013; Rothe-Wulf et al., 2015). If language indeed plays such a vital role in shaping our time representation, the question of whether previous documented relations between time representation and psychological constructs such as agency amongst speakers of English generalize to other languages becomes pertinent. The second and third experiment reported in this study address this question by investigating the relation between agency and time representation amongst non-English speaking participants. Experiment 2 replicates our first experimental study and manipulates agency between participants in a Dutch-speaking sample. Experiment 3 more closely follows Richmond et al.'s (2012) study design in taking a non-experimental approach to investigate whether the adoption of either the ego- or time-moving representation is related to increased and decreased feelings of personal agency in speakers of Dutch, respectively. Dutch speaking participants are chosen as they are well suited to examine the relation between agency and time representation on, as previous research has indicated that the ambiguous time question, a question used almost exclusively by researchers to gauge the ego- and time-moving

representations, is also ambiguous to them (Elvevåg et al., 2011). This allows us to test the relation between agency and the ego- and time-moving representations amongst a different population using the same measures as used in prior studies with English-speaking participants. All data has been made publicly available via the Open Science Framework and can be accessed at https://osf.io/u4w9t/.

EXPERIMENT 1

Experiment 1 manipulates feelings of personal agency between English-speaking participants to test the causal relation between agency and time representation. It thereby extends previous studies using a correlational approach and which, for example, used the Behavioral Identification Form as proxy measures for agency (McGlone & Pfiester, 2009; Richmond et al., 2012). We follow previous studies in using time representation questions to gauge the ego- and time-moving representations (Lai & Boroditsky, 2013; Margolies & Crawford, 2008; McGlone & Harding, 1998; Richmond et al., 2012) and hypothesize that feelings of personal agency, compared to lack of personal agency, lead to the adoption of an ego-moving representation when answering these questions.

Method

Participants and design

One-hundred sixty-four participants (74 males; 90 females) with an average age of 36.32 years (SD_{age} = 11.73), recruited via Amazon's Mechanical Turk, took part in the study. We only accepted 'Turkers' who were located in the US and with an 85% or higher approval rate to ensure high quality participants in our sample. Most participants (75.6%) identified as having European American heritage. We only included the 159 participants (97%) who indicated English as their mother tongue for the analyses. One participant was removed from the analyses because he/she provided nonsensical answers, leaving us with a sample of 158 participants. On average, participants took about 20 minutes to complete the entire study and were given monetary compensation in exchange for their participation. They were randomly assigned to either the *high personal agency* or *low personal agency* condition.

Materials and procedure

An explanation of the procedure was given before participants were asked to indicate their willingness to participate. To manipulate agency between participants we used Fisher and Johnston's (1996) autobiographical recall task. Participants in the *high*

personal agency condition were asked to recall and describe three situations in which they were in control; participants in the *low personal agency* condition were asked to recall and describe three situations in which they had not been in control.

Directly after the agency manipulation we gauged time representation using two measures. The first measure consisted of two ambiguous time questions: *Next week Wednesday's meeting has been moved forward 2 days. What day is the meeting now that it has been rescheduled?* and *Tomorrow's 12:00 p.m. (noon) meeting has been moved forward 2 hours. What time is the meeting now that it has been rescheduled?* (Lai & Boroditsky, 2013; Margolies & Crawford, 2008; McGlone & Harding, 1998; Richmond et al., 2012). If participants rely on an ego-moving time representation, see themselves as moving forward, moving a meeting forward would denote moving it to a later point in time, in the direction of the movement, thus from Wednesday to Friday or from 12:00 p.m. to 02:00 p.m. If, however, participants take a time-moving time representation, see temporal events as approaching them and sweeping past them, moving a meeting forward would denote moving to an earlier point in time, in the direction of the movement, thus from Wednesday to Monday or from 12:00 p.m. to 10:00 a.m. We randomized the order of the two ambiguous time questions. The second measure consisted of a question that asked participants to choose between an ego-moving statement (*I am approaching the meeting)* and a time-moving statement (*The meeting is approaching me*; Margolies & Crawford, 2008; Richmond et al., 2012). Participants were asked to pick the statement that best expressed how they felt. The order in which the two statements were presented was randomized across participants.

After the time representation measure, participants filled in questions unrelated to the purpose of this study. They filled in demographic information before being debriefed and thanked for their participation.

Results

We first looked at the responses participants gave to the time representation questions. In regards to the ambiguous time question, ten participants provided inconsistent answers (an ego-moving answer to one ambiguous time question and a time-moving answer to the other ambiguous time question) or incorrect answers (e.g., *Saturday*). As it was not clear which representation these ten participants used, they were excluded from further analyses. One participant specifically commented on the ambiguous nature of the time questions and was also excluded from the analyses. Of the remaining 147 participants, the majority of participants (60.5%) provided an ego-moving consistent answer (*Friday* or *02:00 p.m.*) in response to

both ambiguous time questions, whilst a minority (39.5%) provided a time-moving consistent answer (*Monday* or *10:00 a.m.*). In regards to Margolies and Crawford's (2008) question, the majority of participants (62.6%) chose the ego-moving statement (*I am approaching the meeting*); whilst a minority (37.4%) chose the time-moving statement (*The meeting is approaching*). A chi-square analysis indicated that answers to the ambiguous time questions and Margolies and Crawford's (2008) question were not significantly related, X^2 (1, N = 147) = 1.324, p = .296 (please note that for all analyses in this paper, the chi-square value reported is the exact value and the associated p value reported is two-sided).

We examined the effect of agency on the ambiguous time questions using a chi-square analysis. In line with our expectations, this chi-square analysis revealed that participants in the *high personal agency* condition, compared to participants in the *low personal agency* condition, were significantly more likely to provide an ego-moving consistent answer than a time-moving consistent answer, X^2 (1, N = 147) = 5.249, p = .028 (see Table 1).

TABLE 1. Number of Ego- and Time-Moving Responses to the Ambiguous Time Question in the High and Low Personal Agency Condition

	Ambiguous Time Question	
Condition	Ego-moving	Time-moving
High personal agency	54	24
Low personal agency	35	34

We then analyzed the responses participants gave to Margolies and Crawford's (2008) question. A chi-square analysis revealed a non-significant effect of agency on the statement chosen: participants in the *high personal agency* condition, compared to participants in the *low personal agency* condition, were not significantly more likely to choose the ego-moving statement over the time-moving statement, X^2 (1, N = 147) = .556, p = .497 (see Table 2).

Following Dienes' (2014) recommendations, we performed Bayesian analyses in order to report Bayes factors. We tested the effect of agency on the ambiguous time question and Margolies and Crawford's (2008) question using the statistical software JASP. Bayesian Contingency Tables Tests showed that in regards to the ambiguous time question, the BF_{10} was 2.69, indicating that the data we observed were 2.69 more likely under the alternative hypothesis than the null hypothesis; in regards to

Margolies and Crawford's (2008) question, the BF_{01} was 3.62, indicating that the data we observed were 3.62 more likely under the null hypothesis than the alternative hypothesis.

TABLE 2. Number of Participants Who Chose the Ego- and Time-Moving Statement in the High and Low Personal Agency Condition

	Margolies and Crawford's Question	
Condition	Ego-moving	Time-moving
High personal agency	51	27
Low personal agency	41	28

Discussion

In Experiment 1, feelings of personal agency led to the adoption of an ego-moving representation as opposed to a time-moving representation, as measured by the ambiguous time question. Even though our Bayesian analyses indicate our data only provide 'anecdotal' evidence in favor for an effect of agency on the ambiguous time question (Jeffreys, 1961; M. D. Lee & Wagenmakers, 2014), it does corroborate previous correlational findings (McGlone & Pfiester, 2009; Richmond et al., 2012). Interestingly, proof for such a relation was not found when measuring time representation with Margolies and Crawford's (2008) question. Richmond et al. (2012) did find that answers to Margolies and Crawford's (2008) question were related to agency, as measured by the Behavior Identification Form. A possible explanation for the discrepancy between the two measures and the way they relate to agency might be found when looking at Margolies and Crawford's (2008) own research. They found that their independent variable, event valence, also affected the ambiguous time question and their question differently (Margolies & Crawford, 2008). In discussing this finding, they proposed that their question might be conceptually distinct from the ambiguous time questions and instead might tap into "one's conceptualization of an event in space, regardless of time" (Margolies & Crawford, 2008, p. 1405). The fact that the two measures did not significantly correlate in our study supports this premise. Future research could determine the extent to which these two measures tap into the same construct and, in case they do tap into something slightly different, investigate the extent to which the construct gauged by Margolies and Crawford's (2008) question is related to agency.

EXPERIMENT 2

As language has been found to affect time representation (Bender et al., 2010; Dahl, 1995; Lai & Boroditsky, 2013; Rothe-Wulf et al., 2015), we wanted to see whether the relation found in Experiment 1 could also be observed amongst a linguistically different sample. Ergo, we replicated Experiment 1 amongst Dutch participants. As mentioned before, a Dutch-speaking sample was used because previous research suggests that both the ego- and time-moving representations are used by Dutch speakers and that the ambiguous time question is in fact ambiguous to them as indicated by an occurrence of both ego- and time-moving responses (Elvevåg et al., 2011). Nonetheless, two pilot studies were conducted to further explore time representation and their measurement in Dutch participants (see Appendix B for details).

Method

Participants and design

One-hundred and twenty-two university students (48 males; 74 females) with an average age of 20.57 years (SD_{age} = 4.89) participated in this study, which was conducted in the behavioral lab of a large Dutch university. The majority of participants (82.8%) identified as having Dutch heritage. Only the 99 participants (81.1%) who indicated Dutch as their (sole) mother tongue were retained for analyses. An additional two participants were excluded from the analyses, as they did not complete the autobiographical recall task used to induce either high or low personal agency. Participants, on average, took about 20 minutes complete the entire study and were awarded partial course credits or monetary compensation in exchange for their participation. They were randomly assigned to either the *high personal agency* or *low personal agency* condition.

Materials and procedure

The materials and procedure were identical to the materials and procedure of Experiment 1 with two exceptions: 1) all materials were translated to Dutch, and 2) participants completed the study in the lab as opposed to completing it online. In the appendices, the Dutch formulation of the time representations questions can be found (Appendix A) as well as the results and discussion of two pilot studies investigating the construct validity of the time representation questions amongst Dutch participants (Appendix B).

Results

We first looked at the responses participants gave to the time representation questions. In regards to the ambiguous time questions, six participants (6.2%) provided inconsistent answers (an ego-moving answer to one ambiguous time question and a time-moving answer to the other ambiguous time question) or incorrect answers (e.g., *Saturday*). As it is not clear which representation these six participants used, they were excluded from further analyses. One participant (1%) specifically commented on the ambiguous nature of the time questions and was also excluded from the analyses. A minority of participants (13.4%) provided an ego-moving consistent answer (*Friday* or *02:00 p.m.*) in response to both ambiguous time questions, whilst a majority (79.4%) provided a time-moving consistent answer (*Monday* or *10:00 a.m.*). In regards to Margolies and Crawford's (2008) question, a slight minority (43.3%) chose the ego-moving statement (*I am approaching the meeting*), whilst a slight majority chose the time-moving statement (*The meeting is approaching*). A chi-square analysis revealed that answers to the ambiguous time questions and Margolies and Crawford's (2008) question were not significantly related, X^2 (1, N = 90) = .147, p = .770.

We examined the effect of agency on the ambiguous time questions using a chi-square analysis. This chi-square analysis revealed that participants in the *high personal agency* condition, compared to participants in the *low personal agency* condition, were more likely to provide a time-moving consistent answer than an ego-moving consistent answer, although this effect was just above conventional significance level, X^2 (1, N = 90) = 3.781, p = .071 (see Table 3).

TABLE 3. Number of Ego- and Time-Moving Responses to the Ambiguous Time Questions in the High and Low Personal Agency Condition

	Ambiguous Time Questions	
Condition	Ego-moving	Time-moving
High personal agency	4	46
Low personal agency	9	31

We then analyzed the responses to Margolies and Crawford's (2008) question. A chi-square analysis revealed a non-significant effect of agency on the statement chosen: participants in the *high personal agency* condition, compared to participants in the *low personal agency* condition, were not significantly more likely to choose the ego-moving statement over the time-moving statement, X^2 (1, N = 90) = .326, p = .670 (see Table 4).

TABLE 4. Number of Participants Who Chose the Ego- and Time-Moving Statement in the High and Low Personal Agency Condition

	Margolies and Crawford's Question	
Condition	Ego-moving	Time-moving
High personal agency	23	27
Low personal agency	16	24

Again, we ran Bayesian analyses in order to report Bayes factors using the statistical software JASP. Bayesian Contingency Tables Tests showed that in regards to the ambiguous time questions, the BF_{10} was 1.14, indicating that the data we observed were 1.14 more likely under the alternative hypothesis than the null hypothesis; in regards to Margolies and Crawford's (2008) question, the BF_{01} was 10.45, indicating that the data were 10.45 more likely under the null hypothesis than the alternative hypothesis.

Discussion

Experiment 2 showed that amongst Dutch participants, feelings of personal agency do not lead to the adoption of an ego-moving representation as opposed to a time-moving representation when time representation is gauged by the ambiguous time question. Rather, the results showed a non-significant effect in the opposite direction suggesting that for Dutch participants, feelings of personal agency, may even lead to the adoption of a time-moving representation. The Bayes Factor indicates however, that we should be careful in favoring the interpretation that feelings of personal agency lead to the adoption of a time-moving representation amongst Dutch participants, considering that our data are almost as likely under the null hypothesis as the alternative hypothesis. In addition, we found no proof for a relation between agency and time representation when measuring time representation using Margolies and Crawford's (2008) question. Like in Experiment 1, we did not find that the two measures were significantly related in a Dutch sample either, again suggesting that these measures might tap into somewhat different constructs (Margolies & Crawford, 2008)

Our findings regarding the ambiguous time question stand in contrast to our own findings from Experiment 1 and previous correlational findings on the relation between agency and time representation (McGlone & Pfiester, 2009; Richmond et al., 2012). They thereby seem to suggest that the relation between agency and time representation might be linguistically or culturally idiosyncratic. When considering the possible reasons for this idiosyncrasy it is of interest to note that, when looking

at the distribution of answers in response to the time questions, our data suggest a preference for the time-moving representation amongst Dutch speaking participants. This preference is particularly pronounced when only taking into consideration the answers in response to the ambiguous time questions. Is it perhaps possible that a preference for one representation over the other, as dictated by the linguistic convention, affects the way it relates to agency? Based on the findings of the previous two experiments this question cannot be answered. Although our finding regarding the Dutch preference for the time-moving representation obviously diverges from the findings of Elvevåg et al. (2011) – who observed a more equal distribution of ego- and time-moving answers in response to the ambiguous time question when using *verplaatst* as a translation of *moving* – their study involved a small, partially clinical, sample of Dutch speaking participants. Moreover, in both our Experiment 2 design and Elvevåg et al. (2011)'s design, a manipulation of some sort preceded the ambiguous time question. This makes it more difficult to make definitive claims about the Dutch preference for either one of the time representations at this point as gauged by the ambiguous time questions. We therefore decided to follow-up with another experiment, amongst Dutch participants, wherein we simply measured agency and time representation, enabling us to simultaneously examine the occurrence of time representation amongst Dutch participants and its relation to agency.

EXPERIMENT 3

In Experiment 3, we examined the relation between agency and time representation by more closely following Richmond et al.'s (2012) research design and taking advantage of the fact that individuals differ in terms of the degree that they think they control their own lives. Using a non-experimental design does not only make our study more comparable to previous studies examining the relation between agency and time representation, it also provides a more unbiased indication of which time representation Dutch participants adopt when being asked an ambiguous time question.

Method

Participants

Two-hundred-and-thirteen university students (95 males; 118 females) with an average age of 20.30 years (SD_{age} = 3.45) participated in this study conducted in the behavioral lab of a large Dutch university. The majority of participants (77.8%) identified as having Dutch heritage only. Due to a technical error participants' mother tongue was not recorded, we therefore decided to look at heritage as a proxy for mother

tongue and only retain participants who identified as having Dutch heritage only (*N* = 164). Participants, on average, took about 21 minutes to complete the study and were awarded partial course credits or monetary compensation in exchange for their participation.

Materials and procedure

Upon arrival in the lab, participants were given an explanation about the study before being asked to sign the informed consent form. Participants completed the entire study on a computer in a private cubicle. Our measures were included as part of a larger test battery.

To gauge agency, participants completed the Levenson's Locus of Control questionnaire (Levenson, 1972, 1973; Presson, Clark, & Benassi, 2001). This questionnaire taps into individual differences regarding the amount of control one perceives over one's own life and consists of 24 items belonging to three subscales: *internal* (e.g., "I can pretty much determine what will happen in my life"), *powerful others* (e.g., "I feel like what happens in my life is mostly determined by other people"), and *chance* (e.g., "To a great extent my life is controlled by accidental happenings"). Items were rated on a 6-point Likert scale (1 = *completely disagree* and 6 = *completely agree*). Items were translated to Dutch by the authors. Subscale scores were computed by averaging over items.

To gauge time representation, we used one of the ambiguous time questions also used in Study 1 and Study 2: "Next week's Wednesday meeting was moved forward by two days. On which day is the meeting now?". Participants filled in demographic information before being debriefed and thanked for their participation.

Results

We first looked at the responses participants gave to the ambiguous time question. A minority of participants (23.8%) provided an ego-moving consistent answer (*Friday*) in response to the ambiguous time question, whilst a majority (73.8%) provided a time-moving consistent answer (*Monday*). Four participants (2.4%) provided incorrect answers (e.g., *Saturday*) and were excluded from further analyses.

Following Richmond et al. (2012), we conducted a series of *t*-tests to examine whether participants' answers to the ambiguous time question were related to agency as gauged by the Levenson's Locus of Control questionnaire. As can be observed in Table

5, participants with an ego-moving representation did not score significantly higher on the *internal* locus of control dimension, and not significantly lower on the *power others* and *chance* dimensions.

We ran the same *t*-tests using the statistical software JASP in order to report Bayes factors. As can be observed in Table 5, all BF_{01} values indicate that the data we observed were more likely under the null hypothesis than the alternative hypothesis, although it should be noted that in regards to the *internal* locus of control dimension, the BF_{01} does not reach the threshold of 3 and our data thus only provide 'anecdotal' evidence in support of the null hypothesis (Jeffreys, 1961; Lee & Wagenmakers, 2014).

TABLE 5. *t*-Test Analyses of the Ambiguous Time Question and Levenson's Locus of Control Questionnaire

	Ambiguous Time Question						
	Ego-moving		Time-moving				
Dimension	*M*	*SD*	*M*	*SD*	*t*	*p*	BF_{01}
Internal	4.53	0.54	4.43	0.48	-1.13[a]	.259	2.86
Powerful others	2.84	0.68	2.91	0.59	.574[a]	.567	4.40
Chance	2.94	0.59	3.06	0.61	1.07[a]	.286	3.05

[a]*df* = 158.

In light of the increasing emphasis placed on replication efforts (Pashler & Harris, 2012; Pashler & Wagenmakers, 2012) and to add to the validity of our findings, we conducted a replication of this experiment with a few minor modifications. The results confirm the results obtained in Experiment 2 and Experiment 3 in suggesting that amongst Dutch participants a high level of personal agency does not lead to the adoption of an ego-moving representation. Details of this experiment can be found in Appendix C.

Discussion

In Experiment 3, we found no proof that feelings of personal agency are related to the ego-moving representation amongst Dutch participants. This is in line with our findings from Experiment 2, but diverges from Richmond et al.'s (2012) findings obtained amongst English speaking participants. In addition, the distribution of responses to the ambiguous time question in Experiment 3 mirrors the distribution of responses to the ambiguous time question in Experiment 2, and clearly suggests a Dutch preference for the time-moving representation. Such a clear preference for

one representation over the other in non-English speaking participants parallels other research (Bender et al., 2010; Dahl, 1995; Lai & Boroditsky, 2013; Rothe-Wulf et al., 2015). Of particular interest in this regard is the study by Rothe-Wulf et al. (2015) which compared speakers of Swedish, German, and English, all languages closely related to Dutch. They report a Swedish preference for the ego-moving representation and a German preference for the time-moving representation, as measured by the ambiguous time questions (Rothe-Wulf et al., 2015). English speakers, like in other studies, were not found to have a clear preference for either the ego- or time-moving representation (Rothe-Wulf et al., 2015). Given that Rothe-Wulf et al. (2015) convincingly argued that the verbs used are all equally "underspecified" (p. 935), it is highly unlikely that differences between English and other languages emerge out of the different meanings of the verb being used (also see Appendix B for a discussion). Rather it reveals the agreed upon time representation adopted by the speakers of the language (Rothe-Wulf et al., 2015). Similarly, our Dutch translation of the ambiguous time questions does not render the questions unambiguous, that is, direction is not specified in the *naar voren verplaatst* formulation. This is also supported by the fact that a small proportion of participants did choose the ego-moving interpretation. The fact that opposite preferences are found in closely related languages such as Swedish and German (and Dutch) highlights that linguistic convention is a powerful driver is shaping time representation (Rothe-Wulf et al., 2015). Our findings extend this, as they suggest that linguistic convention may affect the way time representations are related to such constructs as agency, with relations between time representation and agency perhaps only being possible if linguistic convention provides the possibility of adopting either the ego-moving or time-moving representation. The data from our first pilot study (see Appendix B) also support this assertion as they indicated that spatial primes do not affect responses to the ambiguous time questions as robustly as has been previously reported for English participants.

GENERAL DISCUSSION

The present research investigated the relation between agency and time representation amongst English and Dutch speakers. Specifically, in both groups of speakers we tested whether feelings of personal agency lead to the adoption of an ego-moving representation, as opposed to a time-moving representation. Additionally, we investigated whether Dutch participants naturally adopting an ego-moving representation, as opposed to a time-moving representation, reported higher personal agency. Our results paint a heterogeneous picture: where inducing feelings of personal agency does lead to the adoption of an ego-moving representation in English participants (Experiment 1), almost the opposite pattern was observed

amongst speakers of Dutch (Experiment 2). Moreover, no proof for a correlational relation between the ego-moving representation and high personal agency could be found in speakers of Dutch (Experiment 3). Our findings contribute to the literature in two ways.

First, our study moves beyond previous correlational research on agency and time representation (McGlone & Pfiester, 2009; Richmond et al., 2012) by using an experimental design in which we manipulated agency between participants. Our findings from this experimental work provide a first insight into how agency and time representation might be causally related. Future research can build on this, for example, by investigating whether the reverse relation – so whether the adoption of an ego-moving/time-moving also increases/decreases feelings of personal agency – also holds. This is plausible considering that reciprocal relations have also been found between other psychological constructs such as anger and time representation (Hauser et al., 2009). Such a causal link between agency and time representation might be of interest to either advertisers or clinicians who may want to affect feelings of personal agency in people.

Second, by investigating the relation between agency and time representation in a Dutch population, by manipulating agency and measuring it directly, we accentuate the possible role language plays in shaping cognition, a contested notion investigated extensively (especially in research on time representation) by linguists and psychologists alike (Au, 1983; Boroditsky, 2001; Boroditsky et al., 2011; Casasanto, 2008; Fausey & Boroditsky, 2010, 2011; Fausey et al., 2010; Guiora et al., 1982; January & Kako, 2007; Lai & Boroditsky, 2013; Majid et al., 2004). More specifically, the findings of Experiment 2 and Experiment 3 seem to suggest that amongst Dutch speakers there is no relation between the ego-moving representation and personal agency, and conversely between the time-moving representation and lack of personal agency. The marginally significant finding in Experiment 2 even suggests a relation in the opposite direction. This is consequential considering that the relation between agency and time representation in English speakers has been conjectured on inherent differences between the ego- and time-moving representations that hold true for Dutch speakers as well. Namely, in the ego-moving representations the ego is the moving, agentic entity, typically taking the subject role in linguistic constructions (e.g., *We approach the deadline/Wij naderen de deadline*), which gets assigned greater agency in both Dutch and English (Henley, Miller, & Beazley, 1995; McGlone & Pfiester, 2009; Ruscher, 2011; van Dijk, 1988; see also Fausey & Boroditsky, 2010, 2011). Conversely, in the time-moving representation, the ego is the stationary non-agentic entity, typically being omitted or taking the object role in linguistic constructions (e.g., *The deadline is approaching (us)/De deadline nadert (ons)*). Evidently, cultural

and/or linguistic differences do not only directly influence the use of the ego- and time-moving representations to think and talk about time, as was shown in previous research (Bender et al., 2010; Dahl, 1995; Lai & Boroditsky, 2013; Rothe-Wulf et al., 2015), but affect the way these time representations are related to agency as well. Future research will need to determine whether this also extends to other psychological constructs implicated in time representation, such as valence, our emotional experience, and duration estimations (Boltz & Yum, 2010; Glicksohn & Ron-Avni, 1997; Hauser et al., 2009; McGlone & Pfiester, 2009; Richmond et al., 2012; Ruscher, 2011).

It should be noted that our study is not the first to implicate cultural and/or linguistic differences as (possible) explanation for our findings regarding time representation and some other variable. For example, Loermans and Milfont (2018) found that a previously reported relation between the ego-moving representation and a future temporal orientation (Richmond et al., 2012) could not be replicated amongst participants from New Zealand. Moreover, de la Fuente et al. (2014) showed that a culture's temporal orientation affects whether its constituents place the future to the front or to the back of ego. In their research, they followed up their cross-cultural comparison with an actual manipulation of temporal orientation allowing them to convincingly pinpoint differences related to temporal orientation as the cultural difference driving the time representation (de la Fuente et al., 2014). Similarly, a large body of research has implicated writing direction as the factor that determines whether time is construed as flowing from left-to-right or from right-to-left (Bergen & Lau, 2012; Casasanto & Bottini, 2014; Fuhrman & Boroditsky, 2010; Tversky et al., 1991). With the current data, we are not able to say anything conclusive about what linguistic and/or cultural differences might drive our observed differences in the way that agency and time representation are related in English and Dutch participants. Nevertheless, our data do suggest that Dutch participants might prefer a time-moving representation, whilst English participants have no strong preference for either. This makes linguistic convention/cultural preference regarding the ego-moving or time-moving representation a possible promising candidate for future research – preferably employing experimental designs to enable conclusions regarding causality – to investigate.

Regarding the observed frequencies of ego- and time-moving representations amongst Dutch participants, it should be noted that we found inconsistent results across the ambiguous time questions and Margolies and Crawford's (2008) question in Experiment 2. Whilst the ambiguous time question seemed to suggest a strong preference for the time-moving representation over the ego-moving representation, Margolies and Crawford's (2008) question seemed to suggest no such strong preference. Moreover, in both Experiment 1 and 2 the two measures did not correlate.

Although the absence of a correlation between the two measures amongst English participants goes against earlier findings by Richmond et al. (2012), it favors Margolies and Crawford's (2008) interpretation that their own question does not exactly gauge the ego- and time-moving representations like the ambiguous questions does (but rather measures something slightly different). In any case, researchers investigating linguistic convention regarding use of the ego- and time-moving representations as possible driver behinds behind other effects, would benefit from combining the commonly employed ambiguous time question with additional measures. Employing additional measures, like linguistic analyses of corpora, will provide more conclusive answers on habitual use and/or preference for one or the other representation across languages (see McGlone & Pfiester, 2009, for an example and Lai & Boroditsky, 2013, regarding preferences for the ego- and time-moving representations in Mandarin)

In conclusion, our study sheds light on the causal role agency plays in determining whether English speakers construe time using the ego-moving or time-moving representation. It also brings to the fore questions regarding the generalizability of this relation, as proof for this relation was not found amongst Dutch participants. In discussing these results, the role linguistic convention might play in favoring certain time representations over others, thereby not allowing them to be differentially linked to other constructs such as agency in ways that reveal the inherent differences between the ego- and time-moving representations, is considered. In doing so, we hope this research serves as a valuable impetus for future research examining cross-linguistic variation in time representation and broader issues regarding the interplay between language, cognition, emotions, and behavior.

APPENDIX A

Dutch Formulations of the Time Representation Questions

The time representation questions were translated to Dutch by the authors and are given below. We used *naar voren verplaatst* as a translation for *moved forward* in the ambiguous time questions (Question 1 and 2) instead of, for example, *vervroegd* or *teruggeschoven*, not only because it is the most direct translation but also because Elvevåg, Helsen, De Hert, Sweers, and Storms (2011) found that this formulation 'made' the question ambiguous in Dutch, as evidenced by both ego- and time-moving answers in response to the ambiguous time question using this formulation.

1. *De vergadering van morgen 12 uur is twee uur naar voren verplaatst. Hoe laat begint de vergadering nu?*
   (Tomorrow's 12 o'clock meeting has been moved forward by two hours. What time will the meeting start now that it has been rescheduled?)
2. *De vergadering van volgende week woensdag is twee dagen naar voren verplaatst. Op welke dag vindt de vergadering nu plaats?*
   (Next week Wednesday's meeting was moved forward by two days. What day is the meeting now that it has been rescheduled?)
3. *Welke uitdrukking beschrijft het beste hoe je je voelt?*
   a) Ik nader de vergadering.
   b) De vergadering nadert mij.
   (Which statement best expresses how you feel? a) I approach the meeting. b) The meeting is approaching me.)

APPENDIX B

Pilot Studies Assessing the Validity of the Time Question in Dutch Participants

Conducting cross-cultural or cross-linguistic research requires careful consideration of whether possible cultural differences or differences arising out of a translation might affect the validity of the measures one wants to use (He & van de Vijver, 2012; Sechrest, Fay, & Hafeez Zaidi, 1972; Van de Vijver, 2013; Vu, Finkenauer, Huizinga, Novin, & Krabbendam, 2017). Before using the time questions given in Appendix A to gauge time representation amongst Dutch speakers, we therefore investigated previous literature about the use of these measures in other linguistic samples and conducted two pilot studies which replicated previous research conducted amongst English (and Mandarin) speakers in order to assess the validity of the measures in Dutch speakers.

Time Representation Questions in Non-English Samples

To the best of our knowledge, we are the first researchers to report on answers to Margolies and Crawford's (2008) question from non-English participants. Several researchers have, however, used the ambiguous time question to explore time representation in non-English speaking populations before (Bender et al., 2010; Elvevåg et al., 2011; Lai & Boroditsky, 2013; Rothe-Wulf et al., 2015). Lai and Boroditsky (2013), for example, asked Mandarin and English monolinguals, as well as Mandarin-English bilinguals to provide answers to the two ambiguous time questions. Rothe-Wulf et al. (2015) asked German, English, and Swedish speakers and included a spatial prime previously used amongst speakers of English (Boroditsky & Ramscar, 2002). Bender et al. (2010) compared English, German, Mandarin, and Tongan speakers. Finally, Elvevåg et al. (2011) replicated McGlone and Harding's (1998) second experiment – which investigated whether answers to the ambiguous time representation could be influenced by having these ambiguous time questions preceded by questions employing either an ego-moving or time-moving representation – in a Dutch-speaking sample. Results indicate intra-individual consensus amongst speakers of Mandarin, Swedish and German, no effect of a spatial prime on the representation of time amongst speakers of German, Mandarin, and Tongan, and no similar effect of time representation as observed by McGlone and Harding's (1998) amongst speakers of Dutch (Bender et al., 2010; Elvevåg et al., 2011; Rothe-Wulf et al., 2015). These results raise the question whether the ambiguous time questions 'work' similarly across languages.

As Rothe-Wulf et al. (2015) also explain, however, the translation of the ambiguous time questions is not driving the observed cross-linguistic differences: nothing in the German or Swedish translations of *moved forward* specifies where FORWARD is located; rather it is underspecified in all languages for both the spatial and temporal domains (see also Bender et al., 2010). We argue the same thing holds for the Dutch *naar voren verplaatst*, which is supported by the fact that Elvevåg et al. (2011) found that Dutch participants do provide both ego- and time-moving consistent answers in response to the ambiguous time questions. Finding inter-individual agreement within linguistic communities "may not be exciting", but nevertheless reveals that different languages enforce different conventions when it comes to the adoption of either the ego- or time-moving representations (Rothe-Wulf et al., 2015, p. 935). Using the ambiguous time questions in different languages allows us to examine what convention in terms of time representation might be dictated by the language when answering such a question. Furthermore, the revelation that English is somewhat unique in allowing its speakers such flexibility in adopting either one of the two representations when

answering the ambiguous time questions makes the question of the generalizability of findings regarding the ego- and time-moving representations amongst speakers of English all the more pertinent.

Regarding the replication of Bender et al. (2010) and Elvevåg et al. (2011), several aspects should be pointed out. In discussing the lack of a spatial priming effect, Bender et al. (2010) point out that this is not surprising for Mandarin and German speakers considering their stable preferences for the time-moving representation. Moreover, their set-up differed slightly from that of Boroditsky and Ramscar (2002) which might have put participants "on their guard" making them less susceptible to priming effects. The replication of Elvevåg et al. (2011) provides us with promising information regarding the ambiguity of the time representation questions for Dutch speakers, but the fact that they tested these ambiguous time questions in a very small, and partially clinical, sample only makes the data less insightful regarding the validity of the questions. Therefore, to assess the validity of the (ambiguous) time questions in Dutch, we conducted two pilot studies. The first study replicated the spatial priming experiment conducted by Boroditsky and Ramscar (2002) and the second pilot study looked at L1 and L2 language effects amongst Dutch-English speakers much like Lai and Boroditsky (2013) have done for English-Mandarin bilinguals.

Pilot 1

Amongst speakers of English, the (criterion) validity of the ambiguous time question partially derives from the fact that spatial cues affect the answers (Boroditsky & Ramscar, 2002; Casasanto & Boroditsky, 2008; but see Bender et al., 2010). In our first pilot study, we therefore replicated an experiment included as part of a seminal study conducted by Boroditsky and Ramscar (2002). To clarify, Boroditsky and Ramscar's (2002) study showed that spatial experiences can cue either an ego-moving or time-moving interpretation of the ambiguous time question depending on whether one's own spatial displacement is salient or not. In Boroditsky and Ramscar's (2002) study salience of spatial displacement was operationalized in the field in most experiments by comparing people who had moved along in a lunch line or just started in the lunch line, who just had landed by airplane, were about to board an airplane, or were waiting at the airport for someone to arrive, and people who had ascended, alighted the train, or were in the middle of their journey. Across all experiments, participants whose own movement was more salient were more likely to give an ego-moving response than participants whose own movement was not salient. In their first experiment, Boroditsky and Ramscar (2002) also showed that similar effects

are found when spatial displacement is primed using a task wherein people either imagine themselves moving along a path toward a target location vs. imagining an object approaching them.

Method

Our pilot study replicated the first experiment by Boroditsky and Ramscar (2002) amongst Dutch speaking participants. The spatial prime required participants to either imagine themselves sitting on a chair and 'riding' it along a path towards the end of the path (ego-moving prime) or imagining themselves standing still, pulling a chair, attached to a rope, towards them (time-moving prime; see for details). They were provided with a drawing depicting either situation and were asked to draw and arrow reflecting the path they or the chair would follow. After the prime, participants answered one of the three time questions (ambiguous time [Wednesday] question: *N* =152; ambiguous time [12 o'clock] question: *N* = 149; Margolies and Crawford's question: *N* = 164). Dutch university students were approached around the campus of a large Dutch university. They received a pen-and-paper questionnaire containing all questions and received a candy bar in exchange for their participation.

Results

A chi-square analysis revealed a non-significant effect of spatial priming on the ambiguous time (Wednesday) question, $\chi^2(1) = 0.63$, $p = .541$. Participants who received the ego-moving spatial prime were not significantly more likely to answer with an ego-moving consistent answer (i.e., Friday) in response to an ambiguous time (Wednesday) question than participants who received a time-moving spatial prime (see Table B1 below).

TABLE B1. Number of Participants Who Provided Ego- and Time-Moving Consistent Answers after Receiving the Ego- or the Time-Moving Spatial Prime

	Ambiguous Time (Wednesday) Question	
Spatial Prime	Ego-moving	Time-moving
Ego	8	74
Time	6	64

In contrast, a chi-square analysis revealed a significant effect of the spatial priming on the ambiguous time (12 o'clock) question, $\chi^2(1) = 5.13$, $p = .020$. Participants who received the ego-moving spatial prime were more likely to answer with an ego-

moving consistent answer (i.e., 2 o'clock) in response to an ambiguous time (12 o'clock) question than participants who received a time-moving spatial prime (see Table B2 below).

TABLE B2. Number of Participants Who Provided Ego- and Time-Moving Consistent Answers after Receiving the Ego- or the Time-Moving Spatial Prime

	Ambiguous Time (12 o'clock) Question	
Spatial Prime	Ego-moving	Time-moving
Ego	17	57
Time	7	68

A significant effect of spatial priming was also observed on the Margolies and Crawford's (2008) question, χ^2 (1) = 7.43, p = .005. Participants who received the ego-moving spatial prime were more likely to select the ego-moving statement and indicate that they were approaching the meeting than participants who received a time-moving spatial prime (see Table B3 below).

TABLE B3. Number of Participants Who Chose the Ego- and Time-Moving Statement after Receiving the Ego- or the Time-Moving Spatial Prime

	Responses Margolies & Crawford's (2008) question	
Spatial Prime	I am approaching the meeting	The meeting is approaching me
Ego	60	16
Time	52	36

Discussion

The results indicate that Margolies and Crawford's (2008) question is influenced by spatial priming amongst speakers of Dutch. As for the ambiguous time questions, the results do not paint a straightforward picture: where an effect is observed on one question, it is not detected on the other question. Interestingly, when looking at the frequencies, Dutch participants seem to have a preference for a time-moving interpretation of the ambiguous time questions. This parallels results of Bender et al. (2010) for German (a language closely related to Dutch) and Mandarin speakers. As mentioned before, they also did not find an effect of spatial priming and attribute this, in part, to the strong preference exhibited by German and Mandarin speakers. The

fact that the Dutch have a preference, albeit appearing to be less strong than what is observed in German and Mandarin speakers, might explain the observed effects: if linguistic convention provides little (or no) room for alternative interpretations, possible priming effects might become smaller or even disappear.

Pilot 2

The validity for using the ambiguous time questions (in translated format) amongst non-English speakers is furthermore supported by the L1 and L2 effects reported by Lai and Boroditsky (2013). Lai and Boroditsky (2013) show that whereas monolingual Mandarin speakers almost exclusively provide time-moving consistent answers in response to the ambiguous time questions, the distribution of ego- and time-moving answers in Mandarin-English bilinguals is closer to the split observed amongst English monolinguals and depends on the language in which the ambiguous time question is posed (English or Mandarin). On top of highlighting the influence of immediate and chronic effects of both L1 and L2 on the cognitive representation of time, it also corroborates that even though linguistic convention might dictate to its speakers to adopt one representation over the other, bilinguals, at least, do have access to the other representation and the ambiguous time question can successfully be used to uncover which representation is preferred.

In an attempt to further investigate the validity of both the ambiguous time questions and also Margolies and Crawford's question, we therefore conducted a pilot study wherein, similar to Lai and Boroditsky (2013) we asked Dutch L1/English L2 speakers to provide answers to an ambiguous time question or Margolies and Crawford's question in either Dutch or English. Please note that 4-6 years of English classes are generally an obligatory part of secondary education in the Netherlands and Dutch L1/English L2 speakers also make up the samples of our main studies. An effect of language would show that Dutch L1/English L2 speakers can use either representation to think about time but preference for either the ego-moving or time-moving answer is, in part, dictated by linguistic convention.

Method

Participants were approached on and around the campus of a large Dutch university and were asked whether their first language was Dutch and whether they spoke English. If participants answered affirmative to both questions and were willing to partake in exchange for a candy bar, they were handed a booklet containing either the ambiguous time (Wednesday) question (N = 138), the ambiguous time (12 o'clock) question (N = 122) or Margolies and Crawford's question (N = 116).

Results

A significant effect of language was observed on the answers to the ambiguous time (Wednesday) question, χ^2 (1) = 39.57, p < .000. When asked in English, participants were more likely to provide an ego-moving consistent answer than when asked in Dutch (see Table B4).

TABLE B4. Number of Participants Who Provided Ego- and Time-Moving Consistent Answers when Asked in Dutch or English

	Ambiguous Time (Wednesday) Question	
Language	Ego-moving	Time-moving
Dutch	4	65
English	38	31

A significant effect of language was observed on the answers to the ambiguous time (12 o')' question, χ^2 (1) = 71.46, p < .000. When asked in English, participants were more likely to provide an ego-moving consistent answer than when asked in Dutch (see Table B5).

TABLE B5. Number of Participants Who Provided Ego- and Time-Moving Consistent Answers when Asked in Dutch or English

	Ambiguous Time (12 o'clock) Question	
Language	Ego-moving	Time-moving
Dutch	0	60
English	46	16

TABLE B6. Number of Participants Who Chose the Ego- and Time-Moving Statement when Asked in Dutch or English

	Responses Margolies & Crawford's (2008) question	
Language	I am approaching the meeting	The meeting is approaching me
Dutch	35	28
English	39	14

A significant effect of language was also observed on the conceptualization question, χ^2 (1) = 4.051, p = .034. When asked in English, participants were more likely to provide an ego-moving consistent answer than when asked in Dutch (see Table B6).

Discussion

In conclusion, there seems to be an effect of spatial priming on Margolies and Crawford's question but perhaps less so on the ambiguous time questions. The data suggest that this might be the case because linguistic convention constrains its speakers by favoring one representation more strongly, over the other, when asked the ambiguous time questions, making these questions less susceptible to priming effects. This interpretation is also supported by the second pilot. There, more conclusive evidence was provided that Dutch L1/English L2 speakers use the spatial domain to think about time using both the ego- and time-moving representations but that the Dutch and English language differ in terms of which representations it more frequently 'invokes' in its speakers, with more pronounced effects of language on the ambiguous time question than Margolies and Crawford's (2008) question.

APPENDIX C

Replication of Experiment 3

In line with the recent emphasis on replication research (Pashler & Harris, 2012; Pashler & Wagenmakers, 2012) and to add to the validity of our findings, we conducted a replication of Experiment 3 with a few minor adjustments.

Method

Participants

Ninety native Dutch speakers (39 males; 51 females) with an average age of 22.4 years (SD_{age} = 4.50) were approached on the campus of a large Dutch university. The majority of participants (98.9%) identified as having Dutch heritage. Participants were asked to complete all questions on the paper questionnaire provided to them. They were given a candy bar in exchange for their participation.

Materials and procedure

To gauge agency, participants answered 19 items of the Levenson's Locus of Control questionnaire (Levenson, 1972, 1973; Presson et al., 2001). Six items were taken from the *internal* subscale (e.g., "I can pretty much determine what will happen in my life"); 7 items were taken from the *powerful others* subscale (e.g., "I feel like what happens in

my life is mostly determined by other people"), and 6 items from the *chance* subscale (e.g., "To a great extent my life is controlled by accidental happenings"). Items were rated on a 6-point Likert scale (1 = *completely disagree* and 6 = *completely agree*). Items were translated to Dutch by the authors. Subscale scores were computed by averaging over items.

Directly after rating the items from Levenson's Locus of Control questionnaire (Levenson, 1972, 1973; Presson et al., 2001), time representation was gauged using two of the ambiguous time questions also used in Experiment 2.

Participants filled in demographic information before being debriefed and thanked for their participation.

Results

We first looked at the responses participants gave to the ambiguous time questions. A minority of participants (7.8%) provided ego-moving consistent answers to both ambiguous time questions, whilst a majority (85.6%) provided time-moving consistent answers. Six participants (7.48%) provided inconsistent answers (an ego-moving answer to one ambiguous time question and a time-moving answer to the other ambiguous time question). As it was not clear which representation these six participants used, they were excluded from further analyses.

TABLE C7. *t*-Test Analyses of the Ambiguous Time Question and Levenson's Locus of Control Questionnaire Items

	Ambiguous Time Question					
	Ego-moving		Time-moving			
Dimension	*M*	*SD*	*M*	*SD*	*t*	*p*
Internal	2.88	0.63	2.59	0.56	-1.28[a]	.203
Powerful others	3.12	0.90	2.68	0.67	-1.62[a]	.108
Chance	3.02	0.70	2.47	0.53	-2.58[a]	.012

[a]df = 82.

Following Richmond et al. (2012), we conducted a series of *t*-tests to examine whether participant's answers to the ambiguous time question were related to agency. As can be observed in Table C7, participants applying an ego-moving representation to the ambiguous time questions did not score significantly higher on the *internal*

dimension, and not significantly lower on the *power others* dimension. Participants applying an ego-moving representation to the ambiguous time questions did score significantly higher on the *chance* dimension.

Discussion

Like in Experiment 3, we found no proof that feelings of personal agency are related to the ego-moving representation amongst Dutch participants. If anything, it seems that feelings of one's life being controlled by chance are related to an ego-moving representation. This is in line with our findings from Experiment 2 as well, but again diverges from Richmond et al.'s (2012) findings obtained amongst English speaking participants. The distribution of responses to the ambiguous time question mirrors the distribution of responses observed in Experiment 2 and Experiment 3, confirming that Dutch speakers have a preference for the time-moving representation, when this representation is gauged by an ambiguous time question.