



Non-dynamism and temporal disturbances

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Abstract

Philosophical accounts denying that temporal passage is an objective feature of reality face an explanatory challenge with respect to why it appears to us as though time passes. Recently, two solutions have surfaced. *Cognitive illusionism* claims that people experience the passage of time due to their belief that time passes. *Cognitive error theory* claims that we do not experience the passage of time, but hold the belief that we do, which we have acquired through making an inference from the prior belief that time passes. These approaches suppose that belief and passage experience are explanatorily connected, and they depend on the claims that people who experience the passage of time or at least believe that they do also believe that time passes. To test these claims, we probed the beliefs of populations of individuals with depression and schizotypy, thus conditions that are strongly associated with alterations in temporal phenomenology. Depression was assessed with the Beck Depression Inventory (BDI) and schizotypy with the short Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE). While cognitive illusionism and inferentialist cognitive error theory would predict a strong association between BDI and O-LIFE scores and beliefs about time passage, our study found no such association. The experience of passage does not seem to be explanatorily connected to beliefs about the passage of time.

Keywords Temporal passage · Belief · Cognitive illusionism · Cognitive error theory

1 Introduction

Questions regarding temporal passage have attained a central place in philosophical debates, and recent studies on our temporal phenomenology in the cognitive sciences

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have further propelled those relevant debates (for recent review, see Norton, 2021). While competing views acknowledge that we habitually judge that *it appears* as though time passes, they disagree as to whether our temporal phenomenology reflects the structure of reality (for some recent discussions see Baron et al., 2015; Miller et al., 2020).

One view, *temporal dynamism*, holds that temporal passage is an objective feature of reality. Appealing in part to experiential aspects, *dynamism* claims that the overall phenomenal character of temporal experience includes experiencing time as passing and that this experience is veridical: it informs us about how time really is, not just about how it appears to us (see e.g., Smith, 1994; Craig, 2000; Schlesinger, 1994).¹ One advantage of dynamism is that it straightforwardly explains our passage phenomenology and the acquisition of the belief that time passes by the fact that time does in fact pass. We veridically experience the passage of time, and the belief that time passes is explained by this experience. According to *temporal dynamism*:

- (i) We experience the passage of time.
- (ii) We believe that we experience the passage of time.
- (iii) The belief that time passes is explained by the experience of the passage of time.

Another view, *temporal non-dynamism*, denies that temporal passage is an objective feature of reality. Since temporal non-dynamism denies that our temporal phenomenology is veridical it faces an explanatory challenge. How can it explain in a satisfactory manner (a) the phenomenology and (b) the acquisition of the belief that time passes? Recently, two solutions to this explanatory challenge have surfaced, claiming that we are either subject to an *illusion* or to a *cognitive error* (we hold a false belief about the content of our temporal phenomenology).

This illusion strategy acknowledges that the ostensible passage phenomenology is as of temporal passage but aims to show that such phenomenology must in some way be illusory, since there is no temporal passage actually (e.g., Callender, 2008; Ismael, 2012; Le Poidevin, 2007; Paul, 2010). According to one possible version of *cognitive illusionism*:

- (i) We experience the passage of time.
- (ii) Our experience is cognitively penetrated by the belief that time passes
- (iii) Our experience of the passage of time is explained by the belief that time passes.

Given that cognitive illusionism maintains that people experience the passage of time due to their belief that time passes it depends on the claim that:

- (1) People who experience the passage of time also believe that time passes.

The cognitive error strategy opposes the view that our ostensible passage phenomenology is as of the passage of time and aims to show that the relevant beliefs are disconnected from the temporal phenomenology (e.g., Braddon-Mitchell, 2013; Deng, 2013; Hoerl, 2014; Torrenco, 2017). According to one version of the view, *inferentialist cognitive error theory*:

- (i) We do *not* experience the passage of time.

¹ While there are many features to temporal phenomenology, our focus in this paper is on passage phenomenology.

- (ii) We believe that we experience the passage of time.
- (iii) The belief that we experience the passage of time is explained by the prior belief that time passes.

Instead of being based on our temporal experience, the belief that we experience the passage of time is acquired through making an inference from one belief to another. We believe that the belief that time passes is due to the temporal phenomenology and thus we infer that the supposed passage phenomenology is as of the passage of time (see Miller et al., 2020). Given that inferentialist cognitive error theory maintains that the belief that time passes explains the belief that we experience the passage of time, it depends on the claim that:

- (B) People who believe that they experience the passage of time also believe that time passes.

One route to assessing *cognitive illusionism* and *inferentialist cognitive error theory* would be to put claims (1) and (2) to empirical test. If it turned out that there are people who experience the passage of time but do not believe that time passes, then that would provide evidence against (1). Similarly, if it turned out that there are people who believe that they experience the passage of time but do not believe that time passes, then that would provide evidence against (2).

Claims (1) and (2) are what might be called *coincidence claims*: claims concerned with the way in which beliefs about passage and experiences of passage coincide. Such claims are distinct from *covariance claims* that would be concerned with the way in which beliefs about passage and experiences of passage covary across the population.

It is compatible with the coincidence claims being false that the covariance claims are true. For suppose it turned out that not everybody who experiences passage, or who believes that they do, also believes that time passes. Even if that turns out to be true (and we propose that it is, based on the study conducted here), it could still be the case that having beliefs about passage makes it *more likely* that one experiences passage. To take an analogy, it may be that not every bus driver is happy, or even that a sub-population of bus drivers is not happy, but still it could turn out that being a bus driver makes it more likely that one is happy overall.

We focus here on the coincidence claims, for the following reason. Cognitive illusionism and inferentialist cognitive error theory are broad claims about what explains the experience of passage. For the explanation to be a total and complete explanation of passage, the explanans must be found in every case of the explanandum. That is, every person who experiences passage or who believes that they experience passage must believe that time passes for the explanation to work in every case. In this way, the views seem to imply the coincidence claims.

However, there is scope for formulating weaker versions of these views in terms of covariance. One might concede that not everyone who experiences passage or who believes that they experience passage also believes that time passes, but still having such beliefs makes it more likely that one will experience passage or believe that one experiences passage. In this case, though, cognitive illusionism or inferentialist cognitive error theory would be at best *partial* explanations for the experience of passage, and so would need to be supplemented with something further, a point that we will return to shortly.

The two coincidence claims could be tested in several ways. One broader approach would be to design studies that target the general population using qualitative methods. Such a study could address various aspects of people's temporal experience by using, for example, open-ended questions and content analysis, and on that basis their beliefs about the passage of time as well. For the current study, we have chosen a more targeted approach. We probed the beliefs of populations that we have strong prior reasons to suppose experience the passage of time, or at least believe that they experience the passage of time. These are individuals with depression and schizotypy, who—according to the relevant literature in psychiatry and psychology—tend to experience temporal disturbances and a distorted perception of time.

For instance, in individuals with depression, studies using qualitative descriptions, questionnaires, visual analog scales, and subjective quantitative measures offer robust evidence of a decrease in the experienced velocity of the flow of time (e.g., Blewett 1992; Bschor et al., 2004; Mundt et al., 1998; Richter & Benzenhoefer, 1985; Wyrick & Wyrick, 1977; for recent meta-analysis see Thönes & Oberfeld, 2015). In individuals with schizophrenia, qualitative studies indicate the presence of abnormal experience of times, which not only seems to slow down or accelerate, but also seems to have “already-happened” (e.g., Fuchs, 2007; Stanghellini et al., 2016; Vogeley & Kupke, 2007). Other researchers have found impairments in temporal duration perception (Elvevåg et al., 2003), temporal event structuring (Martin et al., 2013), and increased variability in temporal perception judgments (Carroll et al., 2009). However, antipsychotic medication may confound such results (Reed & Randell, 2014; for recent meta-analysis see Thoenes & Oberfeld, 2017).

To avoid this confound it is advantageous to study individuals scoring high on *schizotypy*, which refers to certain psychometrically measurable behavioural traits and dispositions that are associated with schizophrenia in the non-clinical population (Reine & Lencz, 1995). Individuals with schizophrenia and individuals that score high on schizotypy show similar performance on the same tasks (including time perception) and are similarly disposed to unusual perceptual experiences and beliefs. As a result, researchers think that schizotypy can serve as a useful model for schizophrenia research (e.g., Claridge, 1997; Cohen et al., 2015; Lee et al., 2006).

Given the role of temporal disturbances in populations of individuals with depression and schizotypy, experiences of and beliefs about time can be expected not only to be present, but also be highly salient. In this study, we test claims (1) and (2) by assessing whether there is an association between the ideation associated with depression and schizotypy and people's beliefs about the passage of time. We examine depressive ideation using the Beck Depression Inventory (BDI) and schizotypy using the short Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE). If cognitive illusionism and inferentialist cognitive error theory are correct, then there should be a tight connection between people's beliefs about the passage of time and reports about temporal phenomenology. After all, if cognitive illusionism is correct, then the reason people have an experience of time passing is that their experience is cognitively penetrated by their belief that it passes. Further, if inferentialist cognitive error theory is correct, then the reason people report having the experience of time passing is because they believe that time passes. Given that depression and schizotypy are strongly associated with salient alterations in passage phenomenology, cognitive

illusionism and inferentialist cognitive error theory would predict that there should be a strong association between BDI and O-LIFE scores and beliefs about time passage. However, our study found no association between BDI and O-LIFE scores and passage beliefs. This provides evidence against claims (1) and (2). Our results show that many people who lack passage beliefs, experience the passage of time, and that many people who believe that they experience passage, do not hold the belief that there is temporal passage.²

2 The study

2.1 Experiment one

260 participants (115 female, 1 trans/non-binary, aged 21–74; $M = 40.20$, $SD = 11.56$) were recruited online using Amazon Mechanical Turk and responded to all the questions and answered the attention and comprehension checks correctly. Participants were randomly assigned to complete the temporal dynamism vignettes or BDI first. Ethics approval for the study was obtained from [BLINDED].

First, the two temporal dynamism vignettes were as follows:

Universe A

Imagine a universe (universe A) in which time seems to pass and it really does. In this universe, being ‘present’ is nothing like being ‘here’. Every place is ‘here’ from the perspective of those located at it. However, not every time is ‘present’ from the perspective of those located at it. Only one moment in the universe is ever present, through which moment that is changes with the passage of time.

For instance, it is Sara’s birthday in a week, Right now, Sara’s birthday is in the future. As time passes, and the present moves on, her birthday will eventually become present. After that, it will recede into the past.

Universe B

Imagine a universe (universe B) in which time seems to pass but it does not really pass. In this universe, being ‘present’ is exactly like being ‘here’. Every places is ‘here’ from the perspective of those located at it. Similarly, every time is ‘present’ from the perspective of those located at it. Moments don’t change in wheather or not they are present there, there is only a change in which moment someone takes to be present.

For instance, it is Sara’s birthday in a week. From the perspective of Sara today, her birthday is in the future. However, from the perspective of Sara at the time of her birthday in a week, her birthday is present. Both perspective are equally valid and they are fixed to points in time.

² Of course, some attenuated versions of claims (1) and (2) might be true. For example, it may be true that in some populations the experience of the passage of time or the belief that they are experiencing the passage of time is explained by the belief that time passes. But this still leaves unexplained the experience of passage and the belief that they experience passage in populations where the belief that time passes is absent. For these populations, a further explanation is needed. We will return to this matter in the discussion.

Universe A describes a dynamical universe and universe B describes a non-dynamical universe. Each vignette was presented on a separate screen and was followed by 4 statements in random order. After universe A participants saw the statements: “In universe A time seems to pass.”, “In universe A being ‘present’ is just like being ‘here’.”, “In universe A every time is present from the perspective of those located at it.”, and “In universe A moments change in whether or not they are present.” After universe B participants saw the same 4 statements but this time about universe B. They were: “In universe B time seems to pass.”, “In universe B being ‘present’ is just like being ‘here’.”, “In universe B every time is present from the perspective of those located at it.”, and “In universe B moments change in whether or not they are present.” Participants were able to respond “True” or “False” to each statement. Then, on a separate screen, participants were presented with both temporal dynamism vignettes in random order and asked: “Which universe do you think is most like the universe we live in?” Participants were able to respond: “Universe A” or “Universe B”.

Finally, participants then completed the BDI. The BDI is one of the most widely used survey instruments used to assess depression. There are 21-items in the BDI scale each of which is scored 0 to 3. These scores are then summed to produce an overall measure of depressive symptom intensity. A score between 0 and 10 is classified as normal, between 11 and 16 is classified as mild mood disturbance, between 17 and 20 is classified as borderline clinical depression, between 21 and 30 is classified as moderate depression; between 31 and 40 is classified as severe depression, and over 40 is classified as extreme depression. In what follows, we combine the number of people classified as having a mild mood disturbance and borderline clinical depression.

Table 1 summarizes the descriptive results of participant’s BDI score and classification according to whether they think that our universe is most like the dynamical universe (universe A) or the non-dynamical universe (universe B).

Consistent with previous research investigating people’s temporal beliefs, significantly more people judged that our universe is most like the dynamical universe (65.4%) rather than the non-dynamical universe (34.6%; $\chi^2(1, N = 260) = 24.615, p < 0.001$).

To test whether there was an association between BDI classification and people’s judgments regarding temporal dynamism we conducted a chi-square test of independence. The result of this test found no evidence of an association, $\chi^2(4, N = 260) =$

Table 1 Descriptive results of experiment 1

Universe	BDI classification					BDI score	
	Normal	Mild mood disturbance	Moderate depression	Severe depression	Extreme depression	<i>M</i>	<i>SD</i>
Dynamical (<i>n</i> = 170)	103 (60.6%)	34 (20.0%)	20 (11.8%)	10 (5.9%)	3 (1.8%)	10.51	11.29
Static (<i>n</i> = 90)	57 (63.3%)	12 (13.3%)	13 (14.4%)	8 (8.9%)	0 (0.0%)	10.30	11.37

4.240, $p = 0.375$. To test whether there was any difference in mean BDI score between people who judge our universe is most like a dynamical universe and those that judge our universe is most like a non-dynamical universe we conducted a between-subjects t -test. The result of this test found no evidence of a difference in the mean BDI score, $t(258) = 0.140$, $p = 0.889$.

2.2 Experiment two

250 participants (106 female, 2 trans/non-binary, aged 20–74; $M = 41.88$, $SD = 12.15$) were recruited online using Amazon Mechanical Turk and responded to all questions and answered the attention and comprehension checks correctly. Participants were randomly assigned to complete the temporal dynamism vignettes or O-LIFE first. Ethics approval for the study was obtained from [Blinded].

The temporal dynamism vignettes and associated questions are the same as those used in experiment one. The O-LIFE is one of the most widely used survey instruments used to assess schizotypy. The O-LIFE is composed of 43 “yes” or “no” questions and is scored along 4 scales that are thought to track different kinds of schizophrenic symptomatology: unusual experiences, cognitive disorganization, introvertive anhedonia, and impulsive non-conformity. The unusual experiences scale is scored between 0 and 12, measures perceptual hallucinations and magical ideation. The cognitive disorganization scale is scored between 0 and 11, measures poor attention, concentration and decision making. The introvertive anhedonia scale is scored between 0 and 10, measures the lack of enjoyment and pleasure obtained from physical and social sources. Finally, the impulsive nonconformity scale is scored between 0 and 10, measures lack of self-control.

Table 2 summarizes the descriptive results of participant’s short O-LIFE scores on each of these subscales according to whether they think that our universe is most like the dynamical universe (universe A) or the non-dynamical universe (universe B).

Consistent with previous research investigating people’s temporal beliefs and experiment one, significantly more people judged that our universe is most like the dynamical universe (67.2%) rather than the non-dynamical universe (32.8%; $\chi^2(1, N = 250) = 29.584$, $p < 0.001$).

To test whether there were any differences in mean O-LIFE subscale scores between people who judge our universe is most like a dynamical universe and those that judge

Table 2 Descriptive results of experiment 2

Universe	O-LIFE subscales M (SD)			
	Unusual experience	Cognitive disorganization	Introvertive anhedonia	Impulsive non-conformity
Dynamical ($n = 168$)	3.77 (3.30)	3.76 (3.29)	3.58 (2.23)	2.53 (2.19)
Static ($n = 82$)	4.00 (3.01)	3.66 (3.16)	3.29 (1.94)	3.01 (1.93)

our universe is most like a non-dynamical universe we conducted an ANOVA. We found no evidence of any difference in the means in any of the O-LIFE subscales, $p > 0.091$.

3 Discussion

In this paper we tested two claims:

- (1) People who experience the passage of time also believe that time passes.
- (2) People who believe that they experience the passage of time also believe that time passes.

If cognitive illusionism is true, then we would expect there to be evidence in favour of (1). We would expect that people who experience the passage of time also generally believe that time passes. If inferentialist cognitive error theory is true, then we would expect there to be evidence in favour of (2). We would expect people who believe that they experience the passage of time also generally believe that time passes. We discovered that people who experience the passage of time, in the population tested, did not generally believe that time passes. Indeed, there was a significant division of the population into those who believe that time passes and those who don't. This disconfirms both cognitive illusionism and inferentialist cognitive error theory.

As discussed earlier, claims 1 and 2 are coincidence claims. That such claims are false leaves open that the experience of passage or the belief that one experiences passage *covaries* with the belief that time passes. That is, believing that time passes makes it more likely that one experiences passage or believes that one does. This means that there is still scope for some version of cognitive illusionism or inferentialist cognitive error theory to provide *partial* explanations of experiences of passage or beliefs about the same. What our study shows is that these theories cannot provide complete explanations.

Is there a way to test covariance claims? Testing this would require comparing people who experience the passage of time with those who don't to see if beliefs about passage probabilistically interact with the experience of the passage of time or beliefs about the experience of passage. The difficulty with testing this covariance, however, is that it is not clear that anyone lacks the experiences about passage, or the beliefs about passage experiences at issue. Some population of this kind would need to be found.

Our study also replicated an existing result, namely that there is a significant difference in the population between those who believe that time passes and those who do not hold this belief (e.g., Latham et al., 2019, 2020, 2021). That this difference is stable even in a context of those who experience significant disruptions to their temporal experience, suggests that this difference is quite stable. As with previous studies, this is potential evidence that the population is split between two different concepts of time: one that is roughly A-theoretic and one that is roughly B-theoretic. This undermines any naive appeal to intuitions in philosophy to support a particular metaphysical picture of time, on the plausible assumption that our intuitions are informed and/or structured by our concepts.

The results of our study are compatible with an attenuated version of either cognitive illusionism or inferentialist cognitive error theory being true: as theses about some portion of the overall population or, as noted, as partial explanations of passage. It might be that by studying other populations who experience the passage of time, we can find a trend toward believing that time passes. That is, we might find that there is some covariance between experiences of passage or beliefs about such experiences, on the one hand, and beliefs about passage, on the other. This would be evidence for the attenuated versions of the two theses at issue.

However, even if this were true, neither cognitive illusionism nor inferentialist cognitive error would be able to play the role imagined for them in metaphysics. Both theses are offered as ways of explaining the phenomenology of passage in a manner that is compatible with the B-theory. If time does not really pass, then some explanation is needed for why we seem to experience the passage of time. The belief that time passes is made to play this explanatory role on both cognitive illusionism and inferentialist cognitive error theory. To fully play this explanatory role, the belief that time passes must be capable of explaining the experience of passage for everyone, not just some subset of the population. If there is any group left over for whom the experience of passage cannot be explained, then the way will be left open for the A-theorist to argue in favour of her view on the grounds that it is the best explanation for (at least some) phenomenologies of passage.

This is not to say that cognitive illusionism and inferentialist cognitive error theory cannot play a role in the broad explanatory story against the A-theorist. The point is just these approaches cannot be the whole story. In particular, they cannot be used to explain the experience of temporal passage for the populations that we considered. Thus, these approaches must be supplemented with some further explanatory resources to fully account for the way that time seems to pass.

In our study, we have assumed that certain populations either experience passage or believe that time passes. That is, we have assumed that individuals who rate highly on BDI and O-LIFE are very likely to either experience the passage of time or believe that time passes. This assumption might be mistaken. It might be that the populations we tested either (i) don't really experience the passage of time and/or (ii) don't believe that they do.

We admit that this is an open possibility, but it seems unlikely. This is so for two reasons. First, qualitative studies of those who score highly on the BDI and O-LIFE provide strong evidence that individuals either experience the passage of time or believe that they do. For instance, in the case of the BDI, individuals generally report a slackening or slowing of time (Blewett, 1992, p. 198, Münzel et al., 1988, p. 177, Stanghellini et al., 2016, p. 7, Vogel et al., 2018, p. 4) and some report that time seems to pass more quickly in the presence of others (Vogel et al., 2018, p. 4). The passage of time is also experienced in some cases as speeding up or stopping entirely (Stanghellini et al., 2016, p. 7, Vogel et al., 2018, p. 4). The speeding up of time is generally associated with those who score highly on O-LIFE, rather than the BDI (Bschor et al., 2004, p. 228).

Second, the association between depression and experience of the passage of time slowing has been known since the 70 s, where such experiences appeared to reliably distinguish between depressed and non-depressed populations (Wyrick & Wyrick,

1977, p. 1442). The fact that depressed populations appear to undergo alterations to the experience of time has led some to hypothesise that depression is, at core, a temporal disorder. It is at least characteristic, if not definitive of depression that one's experience of the passage of time is massively altered (Vogel et al., 2020). If this picture of depression is right, then depressed populations will be much more aware of the experience of temporal passage than most other groups. Thus, such populations are not merely a convenient proxy for testing claims concerning the experience of and beliefs about passage, they are an important test case precisely because of the nature of their phenomenal lives.³

It is worth acknowledging that there is some evidence to suggest that depressed populations don't experience the passage of time as slowing down at all (Oberfeld et al., 2014, p. 7). This evidence comes from an experimental paradigm in which individuals are asked to measure their subjective experience of the passage of time. However, it is notable that all individuals tested were able to assign a rate to their experienced passage of time. After all, while the rates might not have differed between depressed and non-depressed populations in this study, the capacity to assign a rate is evidence that the individuals tested either experienced the passage of time or believed they did strongly enough to assign one.

It is also worth acknowledging that our study provides no control over any potential medications that individuals undertaking the study might have been taking. This is potentially problematic, as some antidepressant medications might interact with the experience of the passage of time. Whether this is the case, however, is not currently known. Our study also did not control for the time of day at which individuals were asked to self-report on the BDI or O-LIFE scales. This may have affected the results, insofar as the time of day is generally controlled for in other studies that probe the relationship between depression and the experience of time. Future work could thus seek to control for these variables.

Finally, even if no-one is experiencing the passage of time in the populations that we studied, in a way, this would still be bad news for cognitive illusionism and inferentialist cognitive error theory. Both approaches are predicated on the idea that we generally experience the passage of time or believe that we do. Thus, both approaches would be based on a mistaken presupposition if it turned out that there are portions of the population who don't have such experiences, or who don't believe that they do. This would speak in favour of an alternative approach to the phenomenology of temporal passage, perhaps one on which it is simply incorrect that everyone experiences the flow of time. We should emphasise, however, that there is currently no evidence to support a view along these lines.

³ While we argue that our findings pose a problem for cognitive error theory, they are less obviously a problem for a *misdescriptionist* approach, which holds that while people describe time as passing, they do not really believe that time is passing. Such a misdescriptionist approach is not a focus in this paper, but we note that the question whether or not the misdescriptionist claim is true is an empirical one, and, as far as we know, the claim has not been studied for these particular populations.

4 Conclusion

In summary, our results show that there is no evidence that everyone who experiences the passage of time or who believes that they do also believes that time passes. This provides us with reason to reject both cognitive illusionism and inferentialist cognitive error theory as complete explanations of passage phenomenology and associated beliefs, since they propose models of how belief and passage experience interact which are not reflected in the populations that we studied. Future work could focus on conducting a more general qualitative analysis of individuals with respect to their experience of time, and then testing for beliefs about temporal passage. This more ambitious study could potentially confirm the results of the present study by showing that beliefs about passage are unrelated to experiences of passage, insofar as they are not significantly correlated. Such a study might also contradict the present study by showing that there is some link between beliefs about passage and the experience of passage after all. Future work could also focus on extending the present study, by studying populations who have received a clinical diagnosis of depression or schizophrenia. If our results persist, then that would potentially strengthen the result that the experience of passage is explanatorily unconnected to beliefs about the passage of time.

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Declarations

Conflict of interest The authors have no conflicts of interest to declare.

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