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Human Imprints of Real Time: from Semantics to Metaphysics

K. M. Jaszczolt¹ 

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Abstract

Investigation into the reality of time can be pursued within the ontological domain or it can also span human thought and natural language. I propose to approach time by correlating three domains of inquiry: metaphysical time (M), the human concept of time (E), and temporal reference in natural language (L), entertaining the possibility of what I call a ‘horizontal reduction’ ($L > E > M$) and ‘vertical reduction’. I present a view of temporality_{L/E} as epistemic modality, drawing on evidence from the L domain and its correlates in the E and M domains. On this view, the human concept of time is a complex, ‘molecular’ concept and can be broken down into primitive concepts that are modal in nature, featuring as degrees of epistemic commitment to representations of states of affairs. I present evidence from tensed and tenseless languages (endorsing the $L > E$ path) and point out its compatibility with the view of real time as metaphysical modality (endorsing the $E > M$ path).

Keywords Metaphysical time · Real time · Human concept of time · Time in language · Temporal reference · Reductionism · Modal reduction · Default Semantics · Tenseless languages

Abbreviations

time_M Real time/metaphysical time
time_E Human concept of time
time_L Time in language

1 The Questions

‘Yes, I love life. Why?’

‘But you’ve made up your mind to shoot yourself.’

✉ K. M. Jaszczolt
kmj21@cam.ac.uk

¹ Theoretical and Applied Linguistics, MMLL, University of Cambridge, Sidgwick Avenue, Cambridge CB3 9DA, UK

‘What about it? Why put the two together? Life’s one thing, and that’s another. Life exists, but death doesn’t exist at all.’

‘Do you believe in a future everlasting life?’

No, not in a future everlasting but in an everlasting life here. There are moments, you reach moments, and time comes to a sudden stop, and it will become eternal.’

‘You hope to reach such a moment?’

‘Yes.’

‘That’s hardly possible in our time,’ Stavrogin said, also without the slightest irony, slowly and as though pensively. ‘In the Revelation the angel swears that there will be no more time.’

‘I know. That’s very true. Clear and precise. When all mankind achieves happiness, there will be no more time, for there won’t be any need for it. A very true thought.’

‘Where will it be hidden?’

It will not be hidden anywhere. Time is not an object, but an idea. It will be extinguished in the mind.’

‘Old philosophic clichés, the same from the beginning of time,’ Stavrogin muttered with an expression of mingled pity and contempt.

‘The same! The same from the beginning of time and never any others!’ Kirillov cried with glittering eyes, as though that idea contained a triumphant proof of all he stood for.

Fyodor Dostoyevsky, *The Devils*, 1971, London: Penguin Books, pp. 242-243

Can we conceive of reality without time? The dialogue from Fyodor Dostoyevsky’s *The Devils* gives an interesting insight: time as an idea that can be ‘extinguished in the mind’. Questions about the nature of time and its role in human life are ubiquitous in fiction and show that although we live in time, we still do not comprehend the human concept of time and what it is in reality that this concept reflects or addresses. Philosophical research does not fare much better: ongoing debates concerning the (un)reality of time demonstrate that we still strive for an answer to such a fundamental question as whether reality is *tensed* – that is, whether the present, the past and the future (or at least some of these) exist, or rather they are just the way humans conceptualize the absolute and relative ordering of events. In other words, the metaphysics of time is still open to debate, and so is the nature of the concept of time and the relation, if any, between the two.

Some philosophers of time believe that metaphysical time (or, what philosophers standardly call the ontology of time) ought to be pursued only through an inquiry into the physical world; others assume the relevance of an inquiry into the human mind and the linguistic expression of the human concept of time. In what follows I propose to adopt the assumption of commensurability of the three domains with respect to time: metaphysical, epistemological, and linguistic. I present a sketch of a proposal on which the three domains inform one another to answer their respective, domain-specific questions concerning temporality. The outcome is what I call a ‘double reduction’ account that testifies to the compatibility of time discourse in all three domains.

I distinguish three meanings of tense: metaphysical tense, in the sense in which philosophers use it when they ask whether reality is ‘tensed’ (tense_M); epistemological tense, in the sense that our thoughts distinguish between the past, the present and the future

(tense_E); and linguistic tense, meaning systematic grammatical marking, normally on the verb, of temporal reference in a natural language (tense_L). Analogously, I distinguish between metaphysical time (time_M), where the pertinent questions are whether time itself is real and what its nature is; the human concept of time (time_E); and linguistic time, that is time as it is conveyed through natural language devices (time_L). We have to remember here that tense_L is not a reliable guide to tense_E : not all languages are tensed and in languages that are tensed, there are tense-time mismatches as well as constructions without tense marking where temporality is conveyed by other, lexical or pragmatic, means. For the same reason, time_L need not correlate with tense_L . I also occasionally employ the indices M, E and L in other labels, for example ‘passage of time_E ’, ‘future $_L$ ’, or ‘modality $_M$ ’.

I begin with the focus on time_E and discuss it along two dimensions: one, that I call ‘horizontal’, is the relation between the M, E and L domains. Here I look at the expression of time in natural language (time_L) in order to gain some insight from linguistic semantics and pragmatics into the concept that is being expressed. The variety of means that languages utilise for temporal reference seems to demonstrate that different aspects of this concept are foregrounded. This is because, as I argued elsewhere in my proposal of temporality as supervenient on epistemic modality (Jaszczolt 2009, 2013, 2017, 2018 i.a.), time_E is not a primitive concept but rather is reducible to component concepts that are themselves not temporal. Put differently, on the level of conceptual building blocks, what there is, is a degree of detachment with which we are committed to beliefs, and with which we entertain propositions, about past, present or future eventualities. This leads to the second, so-called ‘vertical’ dimension, on which I distinguish the level of the building blocks and the level of their composition. For example, for the E domain, this amounts to the level of basic, atomic, primitive modal $_E$ concepts and the level of complex, molecular temporal $_E$ concepts respectively. Time_M will figure in our discussion in two ways: (i) in the attempted sketch of a ‘vertical’ reduction of temporality within the domains L, E and M and (ii) in their respective ‘horizontal’ mapping: from expressions to thoughts (L to E), and from thoughts to reality (E to M). I will sketch how the proposed reductionism about time_E strongly suggests reductionism about time_M – in agreement with modern scientific theories of space and time. Assuming, as we have, that evidence from natural language can give us insights into conceptualization, I will reach the conclusion that temporal reference is not fundamental to our thinking about reality; what is fundamental is rather the *confidence*, in the sense of epistemic commitment, with which we can comprehend states and events. As such the human concept of time is compatible with the predominant ‘no flow’ view¹ as well as with the, less commonly propounded, symmetric perspective on time_M (Price 1996).

The structure of the paper is as follows. I begin Section 2 by juxtaposing time_M and time_E and briefly assessing the relevance of some philosophical views on time_M , settling on the so-called B-theory of time. I then move to the question of time_E in Section 3 and briefly summarise pertinent aspects of my reductionist account of temporality as modality that I have been developing for the past decade or so, pointing out some questions that are still left to be addressed. In Section 4 I move to time_L and new aspects of my reductionist picture. I

¹ I do not address the questions of time flow or the experience of the time flow in this paper in that it is an extensive topic in its own right. The literature here is vast. See e.g. Mozerky 2013, 2015; Price 2011; Prosser 2012, 2013, 2016; Torrengo 2017a, 2017b, 2018; Skow 2015; Deasy 2017; Tallant 2019, to name a few participants in this lively debate.

discuss a variety of means languages employ for temporal reference and assess their significance as evidence for the reductionist account. I focus here on the cases where $time_L$ is not straightforwardly rendered by $tense_L$, as in tenseless languages or languages with unusual tense distinctions, in this context also discussing briefly the role of aspect, mood and evidentiality in conveying $time_L$. I correlate $time_M$ with $time_E$, and subsequently $time_E$ with $time_M$, arriving at a doubly reductionist model: the ‘horizontal’ $L > E > M$ reduction and at the same time the ‘vertical’ $time_{L/E/M} > modality_{L/E/M}$ reduction. I conclude by stating the significance of the demise of the (primitive) concept of time, as well as (primitive) $time_{L/E/M}$ altogether, inherent in this reductionism, foregrounding their modal $_{L/E/M}$ underpinnings that demonstrate that the human perspective, the human concept of time, can justifiably be viewed as a ‘human imprint’, so to speak, of ‘real time’: at the level of conceptual building blocks, metaphysical time and human time are perfectly commensurate.

2 Real Time and the Concept of Time

The question about the nature of time has always been intrinsically connected with the question as to whether time is *real*. ‘What is time?’ presupposes that there *is* time, so we can either accept the presupposition as part of the common ground in the form of scientific theories of space-time, on the grounds of the conviction that time exists because we experience it, or on any other grounds whatsoever, as we normally do with theoretical assumptions that appear plausible. Now, curiously, current discussions on the topic are still couched in McTaggart’s (1908) distinction between what he called A-series and B-series of time, despite the fact that the distinction led him to the conclusion that time must be unreal. On what later became the A-theory, $time_M$ passes and reality is $tensed_M$. In other words, the distinctions between the $past_M$, the $present_M$ and the $future_M$ are part of the metaphysics of time and the $present_M$ has a privileged status from which, or with respect to which, temporal distinctions are made. On its currently upheld versions, either only what is in the $present_M$ is real (*presentism*), or what is in the $present_M$ and the $past_M$ is real (the *growing block view*, *pastism*), or what is in the $present_M$, the $past_M$, and the $future_M$ (the *moving spotlight view*, *permanentism*). On B-theory, time does not flow; reality is $tenseless_M$ and $time_M$ consists of relations of precedence and following among events. This theory is closer to the picture of the universe given to us by contemporary physics in that the time dimension is very much like space dimensions and is best represented by the *block universe* theory. We will leave McTaggart’s well-rehearsed arguments for the unreality of time aside and merely point out the fact that, more than a hundred years on, and with significant advances in the field of astrophysics, philosophers are still divided between A- and B-theory supporters, with both camps running strong.² It is impossible to

² See e.g. Prior (1967, 1968, 2003); Tallant 2007, 2013, 2019; Tallant and Ingram 2012; Smith 1993, 2002; Ludlow 1999, 2013; Bourne 2006; Tooley 1997, 1999; Parsons 2002, 2003; Deasy 2017; and Baron 2017 for a defense of various versions of A-theory. For arguments in favour of the B-theoretic outlook see e.g. Oaklander and White 2007; Le Poidevin 2007, 2011; Mellor 1998; Prosser 2012, 2013, 2016; Price 1996, 2011; Rasmussen 2012; Mozerky 2001, 2013, 2015; Torrenco 2014, 2017a, 2017b, 2018. It is not my intention here to give justice to all extant theories within the A and B orientations. For presentism, see e.g. Prior 1967, 1968, 2003; Bourne 2006. For growing block view see e.g. Tooley 1997. For moving spotlight views see Broad 1938 and e.g. Cameron 2015. For an excellent defence of the block universe view see Skow 2015.

address here even a small part of the arguments but the main reason for the buoyancy of the time wars seems to be the fact that the scientific approach to time_M favours the B-theoretic outlook of post-Einsteinian physics, while the experience tells us that reality appears tensed_M, just as it did to Aristotle or St Augustine. Even if one can attack A-theorists' arguments, one cannot deny the indispensability of A-theoretic thoughts; indexicality is all-pervasive in our lives.³ So, I am going to exploit this appearance of the plausibility of tensism_M as arrived at from tensism_E, asking what status exactly the past, the present and the future have in our concept of time (time_E). Having summarised my theory of temporality_{E/L} as modality_{E/L}, I then conclude with a proposal of a novel modal reduction *across* ('horizontal'), as well as *within* ('vertical'), all three domains: L, E and M.

3 The Demise of Time_E: The Background

In asking about the nature of the human concept of time, the question about the complexity of the concept seems the obvious place to start. Is time_E a primitive concept? Or are there underlying concepts that are not themselves temporal and on which it supervenes? In this section I present a brief summary of the theory of time_E (and derivatively time_L, where the 'L' domain comes first in the order of explanation) as modality_E (and derivatively modality_L, respectively) that will be necessary for the understanding of the new arguments in this paper.

I begin with the precis of my reductionist picture, inspired by cross-cultural linguistic evidence, that is already in place. My essentially phenomenological theory of temporality_{L/E} as modality_{L/E} (Jaszczolt 2009, 2013, 2016a) turns out a positive answer to the above question: time_E can be broken down into basic conceptual components that are modal in nature. The proposal is that, arguably, time_E is itself epistemic modality: our memories, experiences and anticipations relate the holder of the thought to eventualities in a way that allows for degrees of commitment. We can remember events more, or less, faithfully (and be aware of this fact); we can be more, or less, committed to believing situations that hold at present – for example, due to the differences in the reliability of sources of evidence that can be expressed by modal expressions and evidentials; and we can be more, or less, committed to what we anticipate is going to be the case. I argued that the fact that various linguistic expressions pertaining to the past_L-, present_L- and future_L-time reference capture this cline of epistemic commitment testifies to its conceptual significance. For example, to mark different degrees of commitment to the truth of statements about the past I can use simple past ('I read *War and Peace* last year'), past of narration ('This is what happened yesterday: I sit in my room reading *War and Peace*...'), epistemic necessity past ('I would/must have been reading *War and Peace* then'), or epistemic possibility past ('I may/might have been reading *War and Peace* then'). Such progressing detachment can also be found in the domain of present- and future-time reference in English. My proposal was to account for this modal underpinning of temporality, which I defend as modal

³ See e.g. Perry 1979 and Ismael 2016. On abduction in Prior's (1959) 'Thank goodness that's over' argument see La Vine 2016.

supervenience, by means of utilising an amended version of Grice's (2001) acceptability operator. I adapted his sentential operator $Acc \vdash p$ ('It is acceptable that it is the case that p ') to fit the meaning representations within the theory of Default Semantics (DS, Jaszczolt 2005, 2010), most notably making it operate not on sentences or propositions pertaining to sentences but on conceptual representations of the primary meaning of utterances called merger representations (Σ). Allowing ACC to operate on merger representations makes this theory more successful in attaining psychological reality than other extant semantics of temporal reference in that merger representations are not restricted by the form of the corresponding sentence. As such, they can cater for tense-time mismatches, sentences without overt markings of temporal reference, and even primary messages that are conveyed indirectly, in that they model the main message conveyed by the utterance of the given sentence, even when it is conveyed by an indirect speech act.⁴ I also added the index Δ standing for the degree of acceptance, in order to capture the degrees of epistemic commitment discussed above. The degree can pertain for example to that conveyed by the 'regular past' ('rp'). We obtain $ACC_{\Delta}^{rp} \vdash \Sigma$ which reads 'it is acceptable to the degree Δ pertaining to the regular past that it is the case that Σ '.⁵

The entire discourse condition (the formal representation in DS⁶) is then encased in square brackets that stand for the scope of the operation of a certain interpretive process that contributes the temporal reference to the overall interpretation. In this case, temporal reference is provided by the grammatical tense, so the process is the *combination of word meaning and sentence structure* (WS – one of the four processes identified in DS that produce, compositionally, the primary meaning). In the case of the past of narration ('vivid present'), this information will come from WS when the temporal adverbial is present ('yesterday') and from *conscious pragmatic inference* (CPI) when it has to be inferred from the broadly understood context. An example of a merger representation for (1) is given in Fig. 1.

1. I read *War and Peace* last year.

The modal supervenience view shows that the concept of time may be, so to speak, 'atemporal' in its essence, or at least may not rely as much on the distinctions between the present, the past and the future, or on the perception of the flow of time as the

⁴ The relevant proposition here is akin to Soames' (2014a, 2014b, 2019) concept of a *cognitive proposition* – a proposition as a type of cognitive act.

⁵ A potential objection here is that 'rp' is itself a temporal concept and yet it figures in the explanans of temporal reference. However, it figures there only as a label for which a numerical value has to be substituted. Such numerical values are obtainable empirically through the analysis of the use of relevant temporal expressions and grammatical forms in discourse. Pertinent methods here are the analysis of corpus data or neuroimaging. See also Section 4.2.1.

⁶ Discourse referents (e.g. x, y, t) and discourse conditions are theoretical constructs adopted from Discourse Representation Theory (Kamp and Reyle 1993) and amended to fit the pragmatic slant of DS. Most importantly, representations in DS are not semantic representations formed on the basis of the grammatical form of the sentence but semantic (in the contextualist sense) representations that capture the intended primary meanings that are conveyed using a variety of linguistic and non-linguistic means and recovered through corresponding processes. Such representations (merger representations, Σ s) are compositional by methodological assumption. See Jaszczolt 2005, 2010, 2016b.

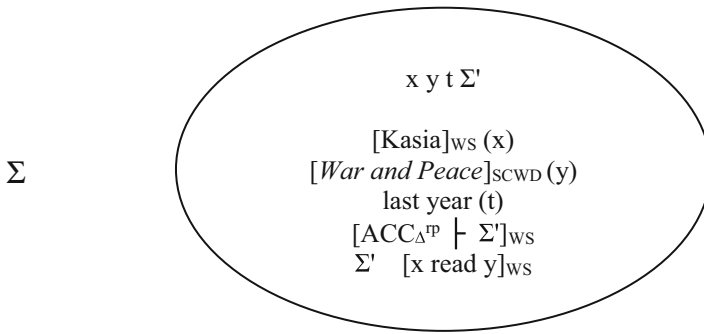


Fig. 1 Merger representation for ‘I read *War and Peace* last year’

common parlance and the common experience (represented in complex concepts) would signal. As such, it is compatible with the B-theory and so with theories of time_M advanced in modern physics. Since the past_E and the future_E are underlyingly symmetric (*qua* modal concepts, displaying degrees of epistemic commitment), the view is also broadly compatible with the symmetric view of time_M – or what Price (1996) calls the view from ‘nowhen’, founded on the results of his scrutiny of symmetry in different metaphysical domains. As Price (1996: 84) says, “Nothing in physics tells us that one end of the universe is objectively the start and the other end objectively the finish”. Even though the anthropocentric perspective has to be adopted to explain our time_E, and often has been adopted in physics as well for time_M, the essential symmetry of the laws of physics and the underlying symmetry of the human concept of time (*qua* degrees of commitment departing in either direction from the nominal highest value of the evidentially strong, say, experienced and cognized, idealized ‘here and now’), may prove to be more than a coincidence. I return to this question in more detail in Section 4.2.2.

Now, if we accept the thesis of modal supervenience (in brief, the thesis that propositions cannot differ with respect to temporal reference without also differing with respect to modal properties), we are committed to saying that modal differences throw up the basic temporal differences between the past_{L/E}, the present_{L/E} and the future_{L/E}. And this is independent from the question as to whether a given natural language marks such differences in the grammar because temporal reference can be conveyed not only by tense_L but also by temporal adverbials, aspect, modal expressions, or can even be left to pragmatic inference—a fact that I call elsewhere the ‘lexicon-grammar-pragmatics trade-off’ (Jaszczolt 2012). To account for this trade-off, mapping quantitative differences captured by Δ (see Fig. 1) onto qualitative distinctions into past_E, present_E and future_E is explained in the radically contextualist framework of DS by invoking the processes of utterance interpretation identified there. To repeat, past of narration, exemplified in (2), obtains its past-time reference not from the grammatical form of the verb (i.e., through WS) but from conscious pragmatic inference (CPI).⁷

2. This is what happened to me yesterday: I go to the station, buy a ticket, get on a train, and this guy comes to me and says...

⁷ See e.g. Jaszczolt (2009: 163).

This is the essence of what I called elsewhere the Modal-Contextualist View (MC, Jaszczolt 2013, 2016a). This completes the precis of my modal reductionist theoretical background. At this point the current inquiry fits in. Instead of being content with a theory of $\text{time}_{L/E}$, one can push further, on the assumption adopted earlier that an inquiry into $\text{time}_{L/E}$ is relevant for an inquiry into time_M . One can attempt to vindicate B-theory of time_M on the grounds of compatibility with time_E so understood. To do this, we would need evidence that conceptualization draws on time_M , or at least an argument that it is more plausible to assume their compatibility than its lack. If time_E is underlyingly not tensed $_E$, then time as dimensions of space-time (Hawking 1988, 2001) can be seen as the springboard for the human concept of time (see Section 4.2.2). In a nutshell, we have attitudes to reality, imposing the indexical, *de se* perspective on it.⁸ At the level of basic concepts, this is all there is. And, arguably, these basic concepts are crucial for theorizing because this is where conceptual and (*a fortiori* for DS) semantic universals can be found. We can then attempt a modal reduction in all three domains.⁹ For this purpose we start with time_L to see how languages execute temporal reference, in pursuit of the justification for, ultimately, tenseless $_M$ reality through tenseless $_E$ concepts (at the level of conceptual building blocks) reflected in tensed $_L$, optionally tensed $_L$ or tenseless $_L$ languages. If this enterprise succeeds, we can arguably demonstrate the plausibility of modal reduction in each of the three domains L, E and M through progressing from L to E and, here more cautiously and speculatively, from E to M.

4 From Time_L through Time_E to Time_M : A Doubly-Reductionist View

If one accepts the methodological assumption that linguistic expressions give us a reasonable guide to human concepts used in online thinking but a poor guide to the universal primitive building blocks of these, where the latter are adopted from neo-Whorfianism (Levinson 2003), then any inquiry into how languages *express* temporal reference will have to be supplemented with research into the building blocks of such lexicalised or grammaticalised concepts. In addition, it will have to be supplemented with an inquiry into pragmatic, discursive means of conveying temporality, where these means rely either on default interpretations or on pragmatic inference, as is advocated in the lexicon-grammar-pragmatics trade-offs introduced in Section 3. In what follows, I present some interesting solutions languages employ for expressing temporal reference and point out the relevance of such data for the proposed double reductionism, always bearing in mind the ubiquity of pragmatic means of communication. Having assessed the feasibility of the ‘ time_L to time_E ’ inferential path, as well as the modal reductionism in both domains, and having entertained the possibility of the correlates for the L-E mapping, I then speculate briefly about the feasibility of an analogous

⁸ See fn 3, and especially Ismael’s (2016) excellent attempt at reconciling the view of human freedom of action with the laws governing physical world. Ismael argues that the emergence of self-governing complex systems, and as such also *ego*, is compatible with the description of reality on the level of particles given by modern physics.

⁹ See e.g. Levinson (2003: 300) on neo-Whorfianism: lexical meanings often correspond to ‘molecular’ concepts and these differ from language to language. But although we normally use molecular concepts in thinking, they can be broken down into primitive concepts in a reflective process. Arguably, such primitive concepts are good candidates for semantic universals.

reduction in the M domain, the cross-domain mapping between E and M, and the nature of the M-correlates.

4.1 Time_E and Tense_E: What Languages Reveal and Hide

A language is tensed when it contains grammaticalised expressions that stand for temporal reference. These have to be absolute rather than relative, that is the coding time has to constitute the deictic centre (see Bohnemeyer 2002: 12–13; Tonhauser 2011: 258). English is a tensed language. On the other hand, languages such as Yukatek Maya, Mandarin Chinese, Paraguayan Guaraní, Burmese, Dyirbal, Kalaallisut (West-Greenlandic), or Hopi are tenseless. In addition, these languages vary with respect to the number and types of other temporal devices such as relative tenses, utilisation of aspect and mood, or temporal adverbials. Yukatek Maya has preverbal aspect-mood markers that convey information about aspect (terminative, progressive, prospective), mood (a six-way distinction, including e.g. necessitive (‘I need/needed/will need to read the paper.’) and desiderative (‘I want/wanted/will want to read the paper.’)) and temporal distance (proximate relative future, immediate past, recent past, and remote past). In addition, verbs are obligatorily inflected for the perfective or imperfective viewpoint aspect. All these are temporally relative markers: for example, prospective works as in example (3).

3. **Mukah** in xok-∅ le periyòodiko-o’.
PROSP.3SG 1SG read(**SUBJ**)(3SG) DEF newspaper.¹⁰
 ‘I am/was/will be going to read the paper.’

(adapted from Bohnemeyer 2002: 5). What is of most interest to us is the expressions of temporal distance. These make up the array of distinctions exemplified in (4).

4. Proximate future:
Ta’itak in xok-ik le periyòodiko-o’.
PROX 1SG read-**INC**(3SG) DEF newspaper.¹¹
 ‘I have/had/will have almost read the paper.’

Immediate past:

- Táant** in xok-ik le periyòodiko-o’.
IMM 1SG read-**INC**(3SG) DEF newspaper.
 ‘I have/had/will have just read the paper.’

Recent past:

- Sáam** in xok-∅ le periyòodiko-o’.
REC 1SG read(**SUBJ**)(3SG) DEF newspaper.
 ‘I read/had read/will have read the paper a while ago.’

Remote past:

¹⁰ ‘PROSP’ stands for the prospective aspect-mood marker; ‘3SG’ for third person singular; ‘SUBJ’ for subjunctive verb form, and ‘DEF’ for definiteness marker. Only the relevant grammatical information is provided.

¹¹ ‘PROX’, ‘IMM’, ‘REC’, and ‘REM’ stand for aspect-mood markers: proximate, immediate, recent and remote; ‘INC’ for the marker of incompletive status, and ‘1SG’ for first person singular.

Úuch in xok-Ø le periyòodiko-o'.
REM 1SG read(**SUBJ**)(3SG) DEF newspaper.
 'I read/had read/will have read the paper a long time ago.'

(adapted from Bohnemeyer 2002: 9). It is clear from this juxtaposition that what is foregrounded through the grammaticalised distinctions is the degree of remoteness, while the temporal distinctions are not marked. As Bohnemeyer observes, the overall effect is not unlike that of relative tenses but since the temporal reference is cancellable, the markers cannot be classified as tense markers. In addition, Yukatek Maya has very scarce expressions of temporal ordering such as 'after' or 'while', leaving such temporal relations to pragmatic inference (or pragmatic defaults). Using our terminology, it can be said that Yukatek Maya is not only tenseless_L but has very little overt time_L marking; temporal adverbials exist but are not obligatory.

Paraguayan Guaraní uses only temporal adverbials and context to mark temporal reference. Aspect, modality and mood, however, can be grammatically marked. When they are not, the default interpretation ensues where the temporality of the event, state, or process overlaps with that of the reference time (Tonhauser 2011). Mandarin is another example of a language with no morphological tenses. It makes use of temporal adverbs, modal verbs, aspectual particles, and viewpoint aspect that in combination with pragmatic means convey temporality. The pragmatic means include the recognition of defaults such as the present time associated with imperfective viewpoint aspect and past time with the perfective, where there are no overt aspectual markers in the sentence, as in (5a) and (5b) respectively.

5. (a) Zhangsan hen mang
 Zhangsan very busy.
 'Zhangsan is very busy.'
- (b) Zhangsan dapuo yi-ge huaping.
 Zhangsan break one-CL vase.¹²
 'Zhangsan broke a vase.'

(adapted from Lin 2005: 3). In the same vein, West Greenlandic (Kalaallisut), an Eskimo language, is currently considered to be tenseless. What appear to be markers of temporal reference are in fact mood markers combined with aspect. For example, the present- or past-time reference is conveyed through the factual moods (of introducing, presupposing or enquiring about facts) with further disambiguation provided by aspect and the context (see Bittner 2005). The future is rendered by prospective markers such as statives ('be likely'), inchoatives ('begin') and by prospective mood such as the imperative ('let us'). The combination of aspect, mood and context is also used for temporal reference in a tenseless language Hausa (Chadic, Afro-Asiatic). For example, sentences (6) and (7) are marked only for aspect and can be interpreted with different temporal reference assigned to them.

6. **Ta-nāŋ** wā sā
 3SgF-CONT play.
 'She is/was/will be playing.'

¹² 'CL' stands for classifier.

7. **Sun** gyārà mōtā sà
 3Pl-COMPL repair car.his.
 ‘They (have/will have) repaired his car.’¹³

(adapted from Mucha 2013: 381). Pragmatic inference and defaults are said to play a significant role in establishing the hierarchy of available interpretations. Sentences with continuous aspect are by default interpreted as having present-time reference and sentences with completive aspect as referring to the past. There also appears to be a more general ‘hierarchy of simplicity’ (see Mucha 2013: 392) where the present-time reference is preferred to the past because the first involves no displacement, while the past is preferred to the future because the latter involves not only temporal displacement but also modal displacement. All these, of course, can be overridden by an explicit lexical marking of temporal reference. The compatibility with the modal reductionism thesis summarised in Section 3 is evident here. Relying on the pragmatic default for degrees and types of displacement seems to signal that the modal component of temporality is crucial for its understanding – an idea that underlies my modal supervenience thesis, the adoption of modal basic concepts and the formalization in the modal operator of acceptability.

Acceptability can surface in yet another way in natural languages, as obligatory evidentials. Matses, a Panoan language from the Amazon region of Peru and Brazil, obligatorily specifies the source of evidence for past events. It employs what Fleck (2007) calls double tense: it specifies how long ago the event took place, combined with an evidential, as well as how long ago the speaker learned about the event, combined with an evidential. So, we obtain combinations as in (8), juxtaposing distant past inferential (DIST.PAST.INF) with recent past experiential (REC.PAST.EXP).

8. mayu-n bīste-wa-nīdak-o-ṣ.
 non.Matses.Indian-ERG hut-make-DIST.PAST.INF-REC.PAST.EXP-3.¹⁴
 ‘Non-Matses Indians (had) made a hut.’

(adapted from Fleck 2007: 590). The juxtaposition pertains to the situation where the Indians apparently made a hut a long time ago but the speaker discovered it a short time ago.

It is important to remember that the lexicon-grammar-pragmatics trade-offs come with different roles attributable to each of the three components in different, including tenseless, languages. For example, while Guaraní (and St’át’imcets discussed below) impose some semantic restrictions on the reference time, Hausa appears to resort entirely to pragmatics (see Mucha 2013: 388). The language-specific values in this trade-off then give rise to various hypotheses concerning the presence or absence of grammatical tense when the latter is understood as a highly intra-theoretic concept that can be realised by phonologically null elements. To quote Matthewson (2006: 705), “In a linguistic theory which accepts the existence of phonologically null elements, there is in principle nothing which could *prevent* tense morphology from being covert.” It is worth devoting some attention to the grammar/pragmatics interface here in order to embrace the complexity of the relevant evidence.

¹³ ‘CONT’ stands for continuous aspect and ‘COMPL’ for completive; ‘F’ stands for feminine gender.

¹⁴ ‘ERG’ stands for ergative.

St'át'imcets, or Lilloet Salish, spoken in southern British Columbia, a language investigated by Matthewson, has no overt tenses but it seems to have a semantic restriction to non-future reference time. For example, (9) can obtain past- or present-reference time but in order to refer to the future, one has to add a marker such as the clitic *kelh* in (10).

9. táyt-kan
hungry-1SG.SUBJ.¹⁵
'I was/am hungry.'

10. táyt-kan **kelh**
hungry-1SG.SUBJ *kelh*.
'I will be hungry.'

(adapted from Matthewson 2006: 676, 678). The marker *kelh* is analysed as standing for 'will' or 'would'¹⁶ and, on Matthewson's contentious account, combines with an invisible – or, to give it a theoretical patina – unarticulated or covert tense morpheme to render future-time reference. An alternative and less theoretically intrusive option would be, of course, to relegate the temporal reference to pragmatic inference, just as it has been done for tenseless languages that have been explicitly argued recently not to yield to such a covert tense analysis: Yukatek Maya, Guaraní, Mandarin Chinese, Hausa, and Kalaalliusut.¹⁷ On the other hand, since *kelh* appears to have a clear meaning of futurity as a future-oriented modal, St'át'imcets has a stronger claim to being a tensed language than the other languages on our list. This does not mean, however, that the theory proposed for St'át'imcets generalizes; speculations concerning the universal status of the semantics of future reference advanced for St'át'imcets have to be taken with caution. Matthewson (2006: 709) suggests that the future (presumably: future_L, to account for the semantic universal, rather than futurity_E) may be qualitatively different from the present and the past and as such needs to combine with tense_L. But this move is by no means mandatory. I have already flagged the importance of the search for the $X_M > X_E > X_L$ cline of inheritance of characteristics, as well as the reverse cline in the research thereof (substitute here 'future' for 'X'). In our inquiry into the E domain, we have found the underlying modality of the human concept of time. So, while Matthewson's speculation on a semantic universal to do with futurity_L seems to be on the right track, it appears that it can be obviated by the more general approach of temporality_{E/L} as modality_{E/L}. Not only do we then have the inheritance in the domain of futurity, but we can deny the 'special status of the future' (p. 708); temporality is underlyingly modal in all three types of temporal reference: the past, the present, and the future. Where there is no grammatical distinction, the pragmatic universal in the

¹⁵ 'SUBJ' stands for indicative subject.

¹⁶ The significance of the difference can be seen in the pair of examples (i) and (ii):

- i. A child *was* born who *will* be king.
- ii. A child *was* born who *would* be king.

adapted from Matthewson (2006: 689, after H. Kamp). In this context, see Abusch's (1988) proposed construct WOLL to account for both *will* and *would*.

¹⁷ See the relevant references earlier in this section.

form of the lexicon-grammar-pragmatics trade-off kicks in. Moreover, since languages do not uniformly display the past/nonpast binary distinction à la St'át'imcets but can also display past/nonpast, or can freely make use of tense/time mismatches, or, finally, like the tenseless languages discussed above, can have no grammatical foundations for such distinctions, any speculations concerning the special status of futurity, as well as a universal application of the covert tense morpheme, appear rather doubtful.

Yukatek Maya, Paraguayan Guaraní and Mandarin Chinese have been convincingly shown to be truly tenseless languages. What it means is that there does not seem to be any external justification for a plausible covert tense_L in the sense of an invisible category postulated in the syntactic analysis of expressions of the language that would facilitate the explanation of relevant facts. It is important to remember that from the functionalist point of view, there is no need for a syntactic hypothesis in the first place. Using similar argumentation to our lexicon-grammar-pragmatics trade-offs, Tonhauser (2011: 299) observes that tensed and tenseless languages exhibit equal power and success in conveying temporality; morphological differences do not make them different:

“...on this view, Guaraní and English differ only in the inventory of (covert or overt) expressions that constrain the temporal location of the antecedent reference time. Crucially, temporal reference in tenseless languages is not un- or under-determined because of the lack of tense morphemes once the contribution of the context to temporal reference is properly taken into consideration...”.

Next, the argument in favour of covert tense logically ought to apply also to languages with optional tense. If there is covert tense that makes a language only superficially tenseless, then it seems that languages with optional tense markers ought to adopt this theoretical construct to explain their behaviour. This has been attempted for Washo, an endangered Native American isolate language spoken on the border of California and Nevada (Bochnak 2016). Washo has a verbal suffix *-uɲil* that can appear only in the context of past-time reference, but marking past-time reference is not obligatory: sentences without the marker can also successfully convey it, as exemplified in (11) and (12).

11. há aši
 Ø-há aš-i.
 3-rain-IND.¹⁸
 ‘It is raining/rained/was raining.’

12. há ašujili
 Ø-há aš-uɲil-i.
 3-rain-PAST-IND.
 ‘It rained/was raining.’

(adapted from Bochnak 2016: 249). However, there seems to be no empirical justification for covert tense. There is nothing theoretically problematic with optional

¹⁸ ‘IND’ stands for indicative mood.

markers of tense; some clauses are tensed, others are tenseless and neither covert tense nor a tenseless analysis would correctly capture the facts. *Mutatis mutandis*, the same goes for languages with fully operational optional tense and aspect such as Thai. Thai has been argued to conform to the temporality as modality view whereby tenseless constructions acquire default readings explicable by the scale of epistemic commitment and as such undergo an analysis in terms of the acceptability operator (see Srioutai 2006; Jaszczolt and Srioutai 2011).

Finally, the inventory of grammatical means of conveying temporality can also differ. Tensed languages vary not only on the scale of how many distinctions they grammaticalize but also what type of distinction they make. Swahili has consecutive tense: where an absolute tense marker (e.g. *-li-* for the past) is used in the first clause, the marker-*ka-* (consecutive tense) is used in subsequent clauses with the meaning of past but subsequent eventualities (Givón 2005; see also Jaszczolt 2012). The same marker is used for subsequent future states and events. Northern Paiute, a Uto-Aztecan language spoken in western United States, has relative tenses. It has been argued that where English uses subordination with ‘after’ or ‘while’, Northern Paiute uses coordination between clauses, combined with relative tense, marked for example with a sequential suffix-*si* for temporal precedence or *-na* for simultaneity (see Toosarvandani 2016). An example is given in (13).

13. Su = naatsi’i t̄buni-hu-**si**, t̄ = pa’mogo yaa-hu.
 NOM = boy wake.up-PFV-**SEQ** REFL = frog miss-PFV.¹⁹

‘After the boy woke up, he missed his frog (i.e. the frog escaped while he was asleep).’ (adapted from Toosarvandani 2016: 867). To compare, in English a sequence of events can be marked by the sequence of tenses or be left to pragmatic inference, captured for example by Asher and Lascarides’ (2003) rhetorical structure rule of Narration: where two sentences (s) refer to events (e), then normally the event referred to in the first sentence takes place before the event referred to the second sentence, as represented in (14).

14. $s_1 < s_2 \Rightarrow e_1 < e_2$

(14) is one possible way of capturing in a general schema the empirically testable phenomenon of a pragmatic default.

This brief survey of selected solutions languages employ to expressing temporal reference reveals a lot about time_E. Firstly, it reveals that temporality is inherently intertwined with aspectuality, that is the time that is internal to the state or event and as such permeated with subjectivity: whether we conceptualise an event as extended in time or punctual, repetitive or single, completed or not, is largely left up for grabs, depending on how the concept fits in the overall schema, what is considered important and as such is foregrounded in the mind, and so forth. It is also intertwined with mood and modality, as well as with evidentiality.²⁰ This interrelation suggests that what is

¹⁹ ‘NOM’ stands for nominative; ‘PFV’ for perfective; ‘SEQ’ for sequential suffix; ‘REFL’ for possessive reflexive pronoun, and ‘=’ marks clitic boundary.

²⁰ This seems to be the case independently of whether one adopts the definition of evidentiality as a (i) grammatical, or (ii) any, marking of the source of information and as (a) separate, or (b) not, from modality. For opposing views see e.g. Aikhenvald 2004 and van der Auwera and Plungian 1998. For extensive references see Aikhenvald 2018.

foregrounded in the concept of time is its perspectival, indexical character: aspect is a perspectival, subjective category, so is epistemic modality, and as such they are perfect candidates to contribute to the externalization of the subjective assessment of time reference and also, as signalled by aspectual choices speakers make, the subjective feeling of the passage of time.

All in all, languages grammaticalize or lexicalize different temporal concepts and distinctions, leaving the remainder of relevant temporal information to pragmatic inference and default interpretations. The employed trade-offs between overt and covert means (where by ‘covert’ I mean pragmatic, but sometimes also, arguably, covert structural à la Matthewson) result in perfect effability of the speaker’s tensed thought (time_E and within it, tense_E), although what a given language draws attention to may vary, to wit the obligatory marking of the source and time of the eventuality as well as of obtaining information about it in the double tense in Matses discussed above. This diversity of foregrounded information, combined with unproblematic effability and translatability, signals that there are universals on which such solutions are built. However, *pace* Matthewson, they are not to be found at the level of syntax, as no extant account of covert tense, no matter how successful in its original sphere of application, seems to generalize. Instead, they are to be found at the level of concepts that underlie this variety of foregrounded information and the variety of solutions to temporal reference. So, it seems that just as neo-Whorfianism proposes conceptual building blocks that underlie very different conceptualizations of space and spatial relations in different languages (Levinson, e.g. Levinson 2003), so we can discern conceptual building blocks for such diversified solutions to temporal reference. Different languages just cut the pie in different ways, and while doing so, give preference to its different components that are likely to be selected from one conceptual pool. If one pays due attention to lexical, grammatical, as well as pragmatic means of conveying temporality, this appears to be the natural conclusion to reach; the onus of proof would have to lie with linguistic relativists.

4.2 Modal Reduction for the L, E and M Correlates

4.2.1 Correlating Time_L and Time_E

I have argued so far that the theory of temporality_E as modality_E is consistent with linguistic data and that the perspectival, epistemic-detachment-based view of the human concept of time is in principle defensible and empirically well supported. Now, if the modal reduction is to hold in the L and E domains, then the next necessary step is to decide on the respective correlates that enter into such a mapping. In the L domain, we make use of the value of the ‘delta index’ on ACC that pertains to a particular language construction in context, that is a construction as it is interpreted using the lexicon-grammar-pragmatics trade-off. In other words, we take into account the meaning in context, allowing for tense-time mismatches, no overt tense markings, and so forth. In the E domain, we can propose the following. We obtain the value on the scale from weak belief (or disbelief) to knowledge (or even knowledge on a ‘high-

stakes scenario’) to capture degrees of epistemic commitment represented by ACC_{Δ} .²¹ The method used in establishing this mapping from L to E will have to be empirical. At present we can only speculate about the general direction to be pursued and it seems plausible to suggest here (i) the use of large corpora to delimit how the ‘E’ values are externalised by linguistic expressions (the ‘L’ values), or alternatively (ii) neuroimaging techniques to correlate the linguistic expression in context of the utterance with the epistemic value. To be more precise, the value of the ‘delta index’ on ACC will have to be taken either from (a) the default interpretation of, say, a grammatical tense, or, in time-tense mismatches, through (b) the lexicon-grammar-pragmatics trade-off, from a process that leads to conveying particular temporal reference. In (a), the WS process recognised in DS will suffice because the value is provided by the grammar, while in (b), the case of tense-time mismatches in English (such as the use of Simple Present for past events in the past of narration in (2)), in DS the value will be provided by CPI,²² or, if primed by previous context, by default interpretation called in DS a socio-cultural and world knowledge default (SCWD). Empirical evidence for the exact mappings is a topic for a separate extensive inquiry into the fields of corpus linguistics or neurolinguistics.

In short, the correlates in the E domain will have to be discerned using some external evidence or an independent argument for their theoretical justification. While the continuum on the cline from disbelief to knowledge-on-a-high-stakes-scenario can be assumed as a direct output of the view of temporality as modality, the discrete correlates have so far been left up for grabs. In Jaszczolt (2009: 150-160), while presenting the L clines such as that from the simple past/past of narration, through epistemic necessity and epistemic possibility past, correlated with strong-to-weak commitment respectively, I explicitly left the marking of the relevant values on the scale undetermined, pointing out that if these can be specified at all, the values would have to be provided in the course of an extensive empirical study and would correspond to regions rather than points. It now seems to me that establishing these regions is a task that is more important than it had seemed then. Correlates and values are crucial if we want to move forward with the reductionist account.

It also has to be borne in mind that the correlates can be relative to a goal, type of discourse, or some other regulating factors. For example, practical utility, such as their role in ethical arguments, is one possible option. At present, the relative freedom in adopting the assumptions for delineating correlates in the E domain makes the enterprise look like, so to speak, a matrix of possible enterprises: if ethical considerations are at stake, the correlates may be justified by different criteria and by different methods than, say, correlates that are founded on mere strength of an epistemic attitude. In other words, before we ‘measure’ the strength of commitment, we may have to establish its utility.

²¹ ‘High-stakes scenarios’ is a term used in the philosophical literature on knowledge attribution. The most widely discussed example is the so-called Bank Case (DeRose 1992; Stanley 2005; Blome-Tillmann 2013; Lutz 2014): when the stakes are low, for example when a cheque could also be deposited in the bank the day after, ‘I know the bank will be open tomorrow’ can be judged as said truly. But when stakes are high, for example when not depositing the cheque would result in an overdraft, missing a deadline, or wasting a cheque, the same utterance is judged as false.

²² See Figure 1 in Section 3.

Next, the constitutive role aspectual and modal categories play in time_L strongly suggests that time_E expressed by them is not only perspectival but also permeated with attitudes, subjective accounts of actual and possible action, and as such is not a simple conceptual category but rather an outcome of a bundle of information and thoughts that make the agent accept an eventuality as a more, or less, accurate depiction of a situation in the world. Epistemic modality *qua* attitude to eventualities has been theoretically represented using alternative, possible, speaker-centered worlds (Kratzer 2012) and one can here follow Kratzer's conception in delimiting the correlates. One can employ here Stalnaker's (1978) and Lewis' (1979a, 1979b) *centered worlds*, or its offshoot, Roberts' (2015) *doxastic centers*. Centering possible-world approach would result in a perspectival view that we require for $\text{time}_{L/E}$: the worlds are theoretical constructs viewed from the speaker's (or other deictic centre's) perspective and they are delimited in some principled way that results in a deictic, subjectivist picture of reality. The E-correlates on the scale of modality will then correspond to the ordering of worlds.

This concludes the first leg of the reductionist account: in the order of explanation, time_L takes us to time_E and both are reducible to modality understood as the semantic modal underpinnings of temporal reference in the L domain and as the epistemic concept of acceptability in the E domain respectively. Once we have descended to the basic level of modal concepts, that is concepts that do not entail temporal reference or time flow, the second leg of the reduction ($E > M$) becomes possible. To repeat, giving a better airing to the time flow in the context of this reductionist model is a substantial but separate exercise that cannot be ignored. After all, the experience of moving time cannot be denied and as such has to be explained in the L and E domains. It is safe to predict that as a corollary of the proposed reduction, it will be inadvertently exorcised in both domains, paving the way to compatibility with 'real', non-flowing time_M . But the argumentation itself will have to be left for another occasion.

4.2.2 Correlating Time_E and Time_M

Analogously, relating the E and M domains will require a commitment to some externally justified correlates, although empirical justification for this correlation lies at present much more in the domain of speculation than that of L and E. In addition, the search for M correlates clearly falls outside the domain of cognitive science. We can only sketch a programmatic proposal for this domain, following our method of inquiry to its natural end, but it has to be remembered that a thorough discussion of this domain belongs to the philosophy of physics and as such falls outside the scope of this paper.

First, to recap, we have suggested here that the correlation of L and E exhibits not only parallel modal reductions (our 'vertical' reduction: down to the level of basic modal concepts) but also the reduction of the linguistic to the conceptual (our 'horizontal' reduction, from what is expressed to what is thought), in agreement with the effability guaranteed by the lexicon-grammar-pragmatics trade-offs. Analogously, the E and M correlation can be hypothesised to exhibit a horizontal reduction and, in addition, the M domain can be hypothesised to exhibit an analogous vertical reduction. Let us begin with the first hypothesis: the second leg of the correlations, that is of E with M, can arguably yield to a 'horizontal' reduction (of time_E to time_M). We now need good arguments in support of such a correlation and ultimately also a reduction. We can utilise here (i) Hawking's (1988, 2001) argument of the coordinated direction of

the three arrows of time and (ii) the anthropic principle in its strong version: we live in a kind of universe that is correlated with our form of existence. First, Hawking (1988: 145) juxtaposes here three arrows of time: thermodynamic, which stands for the direction of the increasing entropy (the degree of disorder in the system); psychological (the direction of the passing time_E); and cosmological (the direction of the expansion of the universe). He points out that for intelligent life to exist, these directions have to be commensurate. Just as we need energy in the (ordered) form of mass (food) to transform it into the (disordered) form (heat), so we live in time that passes from what is anticipated to what was experienced. And we do so when the universe is expanding. But the question is how to interpret this linearity and co-directionality. In the domain of time_E, it may correspond to the degrees of commitment to an event that at the level of ‘conceptual molecules’ (complex concepts) gives rise to the sense of temporal location and the feeling of the flow or passage. In the domain of time_M, it may be the causal order of events that gives rise to the feeling that time_E flows.²³ We see the world in a certain way because we exist in a certain way, as the anthropic principle sums up. Arguably, if the anthropic constraint could be lifted, the agent could acquire the sense of relative time: one could vary the speed of movement significantly enough in order to record the slowing time. ‘Record’ here is significant: in our reality, we can ‘feel’ the slowing time but we ‘know’ that our time doesn’t really slow down. We have to reconcile this feeling with what we take to be the objective measurement.²⁴ Or, perhaps, upon lifting the constraint, the agent could even acquire the sense of symmetrical time and we could disregard the ‘arrow of time’ altogether: the past and the future could swap places.²⁵ Or, perhaps at the level of the ultimate units of description of the universe, time does not even figure at all, as predicted by loop quantum gravity.²⁶

With the above disclaimers in mind, the co-directionality of these three arrows has some explanatory use for our reduction. It shows the parallelisms in the three domains regarding their linearity and provides the conceptual matrix for the interpretation of this linearity. We have now established that linearity *qua* gradation can be taken as the underlying fundamental category and, arguably, this can constitute the foundation of the second leg of our correlations of respective reductions. I do not know what would constitute proof in this domain other than successfully mapping the values of the ‘delta index’ on ACC obtained through a quantitative analysis in the domain of time_L onto degrees of commitment in the domain of time_E and these in turn onto, we speculate, the values obtained in a quantitative analysis of the expansion of the universe. At this point, in order to continue with the hypothesis of the E > M reduction, we have to descend to the level of modality and pursue it on that lower level, namely through the *parallelism of the vertical reductions* in the L, E, and, as is to be demonstrated, the M domains.

²³ A further supporting argument comes from the denial of presentism: arguably, the present_E, the past_E and the future_E are *intuitively* equally real, and so eternalism is intuitively plausible (see Torrenco 2014, 2017b).

²⁴ To repeat, I sketch an account of the subjective feeling of the rate of passage in a separate paper, pointing out the importance of the awareness of its subjectivity.

²⁵ See Price 1996 and Section 3 above on symmetrical universe and symmetry in the laws of physics.

²⁶ ‘That the gravitational field has quantum properties is a shared conviction, albeit one currently supported only by theoretical arguments rather than by experimental evidence. The absence of the time variable from the fundamental equations ... is plausible – but on the form of these equations the debate still rages.’ Rovelli (2018: 172).

In Jaszczolt (2018), I tentatively suggested considering metaphysical modality as the M correlate of epistemic modality: just as we are committed to propositions to a certain degree on a scale from weakly believing to ‘strong’ knowing, so eventualities *can* or *must* (in the sense of *metaphysical modality*) take place. Using a procedure analogous to that in Section 4.2.1, we have now identified the units that are to enter into a quantitative analysis of such a correlation. In the E domain, they are, to repeat, the independently motivated units on the scale disbelief – knowledge-on-a-high-stakes scenario, that is the epistemic correlates of the ‘delta’ values of ACC (obtained from the mapping from the L domain onto the E domain using one of the empirical research methods stipulated above). In the M domain, they are metaphysical probability values that, arguably, are theoretically obtainable. This is a highly speculative construal at present but, I believe, the overall sketch may be on the right track. Moreover, due to the fact that the M correlate will, arguably, always have to depend on the chosen assumptions and as such will remain a theoretical construct, the practical applications will also have to be assumption-driven. After all, we correlate here a deictic, subjectivist picture (time_E) with what in domain M would become striving at omniscience about past, present and future events, so perhaps we ought to be humbled and satisfied with at least having a procedure potentially leading to a theoretical model rather than expecting absolute values. On the other hand, recent advancements in astrophysics that make it possible to measure the rate of the expansion of the universe may render this cautious relativism unnecessary.

4.2.3 Summing up: From Time_L through Time_E to Time_M

All in all, we conclude on a tentative note: there is significant evidence, and an argument has been sketched, for proceeding from time_L to time_E , on the assumption that the lexicon-grammar-pragmatics trade-offs are recognised in the domain of time_L , and with the disclaimer that the units and values in the L domain (value of the ‘delta index’ on ACC) as well as in the E domain (value on the scale from disbelief to knowledge-on-a-high-stakes-scenario) have to be pursued through an empirical method yet to be worked out. In the L domain, one can use large corpora or evidence from neuroimaging. In the case of the E domain, one has to employ assumptions concerning distinctions within the epistemic scale that can obtain the strongest independent support. In other words, the continuous gradation of commitment can be broken down into discrete concepts that are motivated by categorical distinctions between, say, ‘knowing’, ‘believing’ and ‘doubting’ simpliciter, perhaps aided by additional qualifiers, or can be externally justified on some grounds other than epistemic, for example ethical or goal-specific, as tentatively suggested above. Here we can also interpret units on the disbelief – knowledge-on-a-high-stakes-scenario scale (the E domain) as units obtained through limiting and centering possible worlds. Open methodological as well as theoretical questions concerning the correlates, and the relative freedom in adopting relevant criteria, make the enterprise largely confined to metaphilosophy at present.

Concerning the second leg of the attempted ‘horizontal reduction’, that is $E > M$, and at the same time correlating the modal (‘vertical’) reductions in the second leg (time_E to modality_E and time_M to modality_M), there is some evidence, and an argument has been sketched, for the plausibility of the reduction of time_E to time_M , on the methodological (and ontological) assumption of the co-directionality of the time arrows in the

thermodynamic, psychological and cosmological domains and by stipulating a correlation between epistemic and metaphysical modality. But the best bet at present seems to be to pursue parallel modal reductionism directly, utilising the correlation between the epistemic modality (E domain) and the metaphysical (M domain) modality. We have added a disclaimer here that the selection of the units to be correlated in each domain makes the enterprise more speculative than that pertaining to the first leg. It also limits its practical applicability – but, as I argued, perhaps this is the horizon of what there is to be found out: we are working out the M equivalents of these essentially E-domain terms, being ourselves essentially E-domain agents.

In short, the value of the current proposal is in the novel, two-dimensional reductionist model of time and in the associated methodology of a cross-domain inquiry into time rather than in particular empirical findings. We end up with the schema of the relevant reductions in Fig. 2. The vertical reduction was presented here as a theory of modal supervenience, while the horizontal reduction was adopted as a partially supported methodological (and ontological) assumption about a cline of vertical correlations.

5 Conclusion: The Significance of the Two-Way Reduction and Some Loose Ends

I have sketched here a proposal for a reduction of temporal concepts: ‘vertical’ from temporality to modality, and ‘horizontal’ from $time_L$ to $time_E$ and from $time_E$ to $time_M$. In other words, by correlating $time_M$ with $time_E$, and subsequently $time_E$ with $time_M$, I arrived at a doubly-reductionist model: the ‘horizontal’ $L > E > M$ reduction and at the same time the ‘vertical’ $time_{L/E/M} > modality_{L/E/M}$ reduction. By (i) demonstrating the significance of the demise of the (primitive) concept of time, as well as (primitive) $time_{L/E/M}$ altogether, inherent in this reductionism, and (ii) foregrounding their modal $_{L/E/M}$ underpinnings I have shown that the human perspective, the human concept of time, can justifiably be viewed as a ‘human imprint’, so to speak, of ‘real time’: at the level of conceptual building blocks, metaphysical time and human time are perfectly commensurate.

It has to be borne in mind that while the reductionism captured in Fig. 2 helps delineate our vast playing field, the main rationale behind this project was more modest. It was to demonstrate that when we analyse $time_L$ as modal and as such as, so to speak, ‘time-free’ at the level of its building blocks, there is a direct route to the level of conceptualisation, that is $time_E$, and a plausible possibility that further reductionism to $time_M$ also obtains. To repeat, the unified analysis of the three domains

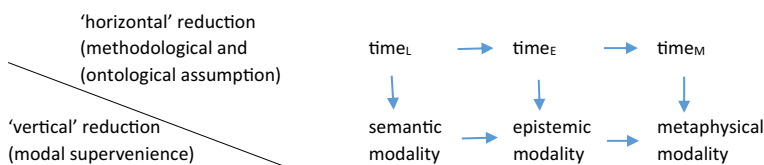


Fig. 2 Horizontal and vertical reductions in the $time_{L/E/M}$ domains

shows that real time leaves an ‘imprint’ on human time, making the study of time in all three domains conducive to a unified inquiry and a unified picture.

My modal view is essentially B-theoretic in that it denies the objectivity of the past, the present and the future. But it is B-theoretic in a very unusual way. The past, the present and the future are reduced to values of the index on the acceptability in the semantic representations in the L domain. The correlates in the E-domain are obtained through the processing of conceptual structures. As such, the latter are partly empirically supported (if we adopt the assumed correlation between language and thought) by what happens in the L domain of linguistic externalizations of these concepts. So, arguably, there still is the present, the past and the future on the molecular level in each domain: L, E, as well as M! The past_M, the present_M and the future_M become reduced, but do not completely disappear if we want to adhere to a horizontal reduction that necessitates vertical supervenience in all three domains. Time is exorcised from all three domains but *only* on the tier of the building blocks depicted on the lower cline in Fig. 2. And when it *does* appear on the upper tier, its inescapable indexicality brings back the A-theoretic concepts.

Throughout this discussion I have been reverting to a disclaimer in that there is an obvious, albeit arguably tangential, question that stays at the back of anyone’s mind while theorizing about time: it is the question of the human experience of the flow of time. In the model proposed here, modal reductions across all three domains make use of the interpretation of linearity of time as degrees in measurement and as such overcome (or bypass) the problem with the experience of the flow of time. But the feeling of the flow cannot be explained away so easily: both the human experience of flow with all its vagaries, and the concept of the flow itself, cannot be explained away by pointing out that they do not occur on the level of conceptual building blocks of my vertical reduction from temporality_{L/E} to modality_{L/E}. More has to be said. The next step, and a separate project, is to see whether the reductionist account as proposed so far can be used for the analysis of the meaning and status of this flow.

The defence of tensed reality (tense_M) in philosophical literature seems to be launched largely from the E-domain vantage point, although versions have been recently defended that are compatible with our L/E/M convergence and as such also with time_M as it is represented in current theories of space-time. Baron (2017) conjectures that modern physics could endorse the A-theoretic perspective in that asymmetry of time could explain physical phenomena. To defend A-theory it suffices to defend the objective passage, even if only by using empirical evidence of the objectivity of human experience or a theoretical argument from the utility of asymmetry in physics. Deasy (2017) entertains the possibility of explaining tensism through modal terms for passage and indexicalism for the ‘now’ anchoring, for example juxtaposing presentism with actualism to point out their common pitfalls.²⁷ The first utilises the M-E convergence, while the latter utilises the modal view of temporality. It is perhaps in a similar spirit that our ‘tensed but only through supervenience’ view of reality can be taken: in the spirit of our horizontal and vertical reductions respectively, always remembering that, should we pursue this line of reasoning, the anthropocentric perspective is assumed in all domains – albeit for different, better or worse, reasons in each of the three domains. In a nutshell, on the molecular level of time_{L/E/M}, the human perspective governs it all: speaking about time, thinking about time, and the limits of what we take to be real time

²⁷ For criticism see Tallant 2019.

in that, for humans, the past and the future cannot just swap places and time appears to be dynamic, with a flow and its direction.²⁸ But at the level to which, as we have shown, $\text{time}_{L/E/M}$ can be reduced, we have the demise of time in all three domains alike. There is no flow, direction, or change. And there is no indexicality other than what may or must happen (modality_M) or may or must be known (modality_E) and said (modality_L). But deconstructing these is a different reductionist project altogether. We are still a long way from fully understanding how “[t]ime emerges from a world without time” (Rovelli 2018: 117) but this exercise in double reductionism offers a possible harbinger of findings and methods to come – at the very least, it suggests that, as far as time is concerned, ‘a world’ is best understood at the same time as a physical world, a private, inner world, and social reality. To adapt Rovelli’s apt motto, “ $\text{time}_{M/E/L}$ emerges from a world $_{M/E/L}$ without $\text{time}_{M/E/L}$ ”.

The doubly-reductionist model proposed here is also incomplete in another way – and some of this incompleteness is incompleteness by necessity. The incompleteness in the vertical reduction stems from the fact that while the modal supervenience in the L and E domains is well supported and evidenced, and falls within the scope of philosophy of language and linguistic research, reduction in the M domain has to rely on an argument from parallelism that shows how scientific theories correlate with the modal supervenience in the other two domains. Metaphysical modality, in the sense of metaphysical possibility and necessity, is the relevant explanans here. Incompleteness in the horizontal reduction is even harder to avoid: the reduction relies on the thesis of the inheritance, or at least correlation, between certain properties in each domain and the feasibility of discerning M-correlates for values that correspond to the value of the ‘delta index’ on ACC in the L domain. Again, while this has been plausibly worked out for the L and E domains, the correlates for the M domain have only been tentatively sketched and will have to remain such in any philosophico-linguistic inquiry.

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²⁸ On the nature of this dynamism see Torrenço 2018.

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