

Rebuttal

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March 6, 2024

System of Abbreviations and Short Titles

For simplicity's sake I have added the table of abbreviations again here, so that I can use the abbreviations in the text.

Abbreviations	Works by Kant
<i>CPR or A/B</i>	<i>Critique of Pure Reason</i>
<i>CPrR</i>	<i>Critique of Practical Reason</i>
<i>CJ</i>	<i>Critique of the Power of judgement</i>
<i>MFNS</i>	<i>Methaphysical Foundations of Natural Science</i>
<i>OP</i>	<i>Opus Postumum</i>
<i>JL</i>	<i>Jaesche Logic</i>

1 Response to commentary and questions by Ronald

First of course I would like to say thank you for your incisive comments and questions. I will deal with them in reverse order, as I think I can better talk about which parts of the current implementation are essential and which are arbitrary once I have discussed the notion of the representation-independent memory system. This I will thus discuss first.

1.1 Representation-independent memory

To refresh, the question asked was the following:

"If one were to design a representation-independent memory system for the AE, what are the main conceptual/technical challenges that one would have to overcome, and do you see a direction for solutions for these challenges?"¹

¹I include here also the commentary provided as I will refer back to it later: "An important downside of the implemented memory system, in my opinion, is the following. The method seems to depend on *how* data is encoded, e.g., looking at similarities in variable names, etc. Ideally, a memory system would be representation-independent. In other words, ideally, a memory system also provides a form of analogical reasoning: if it encounters similar situations in the future (that differ slightly in representation), it would detect the similarities and be able to use its memory. Such representation-independent memory is a great remaining challenge (and one that is certainly not trivial to solve in the first place, admittedly). It is not addressed at all in the thesis."

This question is a very urgent one for the project, which I did take up at first in the theoretical discussion of the memory tree, and as a task to solve in the computational implementation, but ultimately only figured in an implicit fashion in the final product. Before I continue to answer the question I would like to note a slight conceptual caveat to the commentary in footnote 1, which states that "The method seems to depend on **how** data is encoded, e.g., looking at similarities in variable names, etc. Ideally, a memory system would be representation-independent." I fully agree with the thrust of these comments, but I want to note that technically the memory system would not need to be "representation-independent" in a strict sense, as for now we are still working in the *symbolic* environment, and the terms for the concepts taken up into the memory should be generated by the apperception engine, which is a part of the same larger system as the memory component. The idea of this memory system is to work in tandem with a concept generation system like the apperception engine, so the way detects and interacts with the concepts provided by the concept generator *should* be representation-dependent, exactly because the representations *should* be produced by the same integral system!

As an analogy, I can only integrate knowledge into my own system of concepts if it is represented in a language I know: when I am presented with a book on biology in Chinese I would first need to translate it to Dutch or English to be able to integrate the concepts in my memory. A maybe more pertinent example would be if I were presented with the final chapter of a textbook on something like algebraic topology, which is represented in a language that I can not yet parse. To be able to integrate these concepts in my conceptual system I would first need to apply my 'concept generation system' - or Understanding as Kant would say - to the start of the textbook (and maybe some preliminary textbooks), slowly making sense of the technical terms and exercises I am presented with, integrating these into my own conceptual system by explaining them *in my own terms*, to ultimately come back to the final chapter of the textbook, when the terms I am presented with no longer seem like arbitrary variables, but now cohere with my system of concepts because I already am in possession of the right terms and concepts to now make sense of these new terms and concepts. To some extent this might be representation-independent of course, because it should not matter too much in what font the terms are put, but this takes place in the *sub-symbolic* domain, while the *symbols* should remain the same. Now note that in the set of simple examples presented to the AAE discussed in section 5.1 our setup included sensors that could either be *on* or *off*, or be fed symbols like "a", "b", "c", etc. In the first case the *on* or *off* value of a sensor is thus a representation internal to the AAE system, which means that we can without loss of generality let the memory component of the AAE check if a concept like *on* or *off* is present in the input, because the idea is that this input is generated by the sensors of the AAE itself. In a similar but different vein we can argue the same for the letter sequences, for if we do not descend to the *sub-symbolic* realm an "a" can be only an "a"! Now this of course only holds for simple and pure conceptual relations like learning the successor relation from a sequence like "abcd", where in more complex situations symbols might be ambiguous, stand in for each other or worse: we would need to use a symbol to represent a sub-symbolic sensation! These situations do represent serious problems, and agree with the thrust of the question on representation-independent, so we will discuss these in turn. Now to finish this section

I want to reiterate that even though I agree this should have been touched on more in the thesis, still because the variable names are part of the internal representation of the whole AAE system, it is in my opinion justified to use these to navigate our memory. This will be clarified further when we discuss the problem of sub-symbolic sequences, but first we turn to ambiguous symbolic situations.

1.1.1 Ambiguous symbolic sequences

First we discuss the problems that can arise in the symbolic context, namely the ambiguity of symbols, which is functionally the same problem as one symbol standing in for another, as they both have the same solution. An example of such a problem would be a Sokoban environment where both the Player and the Block objects are indicated by the same symbol, say X, as can be seen in figure 1.

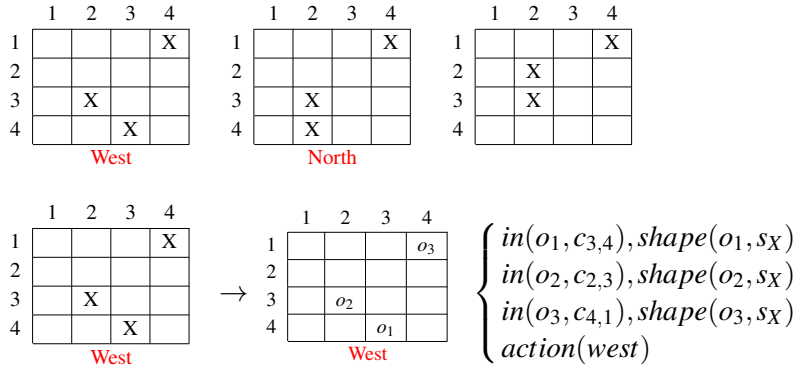


Figure 1: Example of a Sokoban environment with ambiguous symbols

Here we can not determine the correct types and rules to use by the symbol given in the input, but the AAE will have to make use of its ability to produce different hypotheses to determine the correct type and rule for each object. Keep in mind that for the AAE to determine that a type and ruleset applies to an object in a sensory sequence it will always have to test the hypothetical rules it has reproduced, which means that using symbols to assign types and rules is more a heuristic than a definite judgement. In this case we can observe this in a more concrete fashion, as it can not use the symbols as a heuristic for the right types for each object, thus the AAE will need to produce several hypotheses, trying to assign the Player and Block types and rules first to one and then to another object, until it is able to determine a configuration that *makes sense* of the input. It can however use the other concepts it is presented with as heuristics for the types and rules it can try and apply to the sequence, thus thanks to the *action(west)* and the *shape* predicates it can determine that it needs to try and apply the Player and Block types, instead of for example the letter types and rules used for a Seek-Whence problem.

Implementing this in the computational environment would not require any serious overhaul, but is a mere extension of the capacity for the AAE to produce hypotheses, which I had intended to include in the code and the thesis, with the above example, but could not do due to time-limits. An extension that would not be strictly necessary to make this work,

but would benefit it greatly, would be to find a way to make sense of parts of the sequence instead of the whole sequence, thus to isolate the Player object and try different rulesets for it, without having to try rulesets for the other objects at the same time, allowing us to cut down on the combinatorial costs. This would need a larger change in the structure of the AAE, as to be able to make *partial* sense of a sequence it would need to isolate parts of a sequence using a form of attention, which is crucial for more complex sequences, but is non-trivial to implement in the AE environment. Still this is not conceptually necessary to disambiguate which types apply to which objects, only computationally efficient. Now we move to the sub-symbolic sequence problem.

1.1.2 Subsymbolic sequences

Another problem is of course when the AAE is presented not with a symbolic, but a subsymbolic sequence, or raw input as described in chapter 5 of [Evans, 2020]. How can the AAE connect the symbolic representations of concepts to the subsymbolic sensory data? Luckily it does not have to do this directly, but it can use the same Neural Network infrastructure as provided to the AE, which will now represent implicit memory.² The neural network, a Binary Neural Net in the case of the AE, is namely intended to map subsymbolic features to different possible symbols, thus in the MNIST example it maps drawings of numbers to the numbers as symbols, where it provides a distribution over different possible symbols when the drawings are ambiguous. This is a form of *implicit memory*, as it still needs to be trained on previous instances of mappings from drawings to symbols, to be able to store an implicit mapping³ of the different drawings to the different symbols, afterwards usable as input to an *apperception task*. The upshot of using this neural network in the context of the AE is the fact that the AE can decide on ambiguous drawings of the numbers by inferring back from its place and role in the sequence of symbols, allowing it to differentiate for instance a 1 from a 7 by its role in the larger sequence.

When we expand our discussion to the memory part of the AAE we can note that the regular apperception task already only interacts with the symbols, or a disjunction between symbols for ambiguous input, given as output by the BNN when it is given a subsymbolic input. The AAE can thus function in the same way as it did in earlier stages, given that it is expanded to handle ambiguous input, as the input it needs to interact with is still symbolic. This is in accord with the discussion above on the fact that the AAE only needs to interact with the 'internal' representations of sensory data, as the system of concepts we have implemented is a form of *explicit* or *symbolic* memory, which does not directly need to be concerned with interpreting *subsymbolic* sequences. Yet the larger system, the total AAE, does need to concern itself with subsymbolic sequences, but this it can do by adding a neural network as *implicit* memory to interface with raw data. And as the system of concepts only interacts with the symbolic output of the neural network, which is internal to the greater system, it can again be fully representation-dependent, as the representations, or variable names, or symbols, are generated by the system itself to represent patterns in the raw sensory data. Still it is of course very important that the AAE can actually use a neural network like the

²Or schema's for Kant

³Thus a schema

AE, which would provide a decently large technical challenge as discussed in the discussion of my thesis.

1.2 Essential and accidental features of the implementation

The question posed was as follows:

"Which of the design choices that you made in the proof-of-concept implementation of the memory system are 'essential' (meaning: they determine the core working of the memory system) and which ones are 'arbitrary' (meaning: it's one of many valid choices that only leads to a slightly different working of the system)?"

In some sense I have already answered part of this question implicitly in the previous section, but I will list some further 'arbitrary' features of the implementation here:

1. First of all I want to restate from the above discussion that in my opinion it is not arbitrary to use the predicates given in the input to determine the types given to the objects. This is because these represent internal symbols for predicates, that would always be used. What *is* arbitrary is the fact that the implementation also looks at the objects given in the input, which also hold some information, but should in principle be wholly subordinate to the predicates applied to their object. We can only determine what kind of object an object is by the predicates applied to it, not by the name or position it has.
2. Secondly an arbitrary feature of the current implementation is that every node in the concept tree needs to be a type, while it might be possible to determine subconcepts to a specific node without it needing to be a different type. Take for example the *direction* type with its specific objects *east*, *west*, *south* and *north*, which would ideally be represented as subconcepts to the *direction* concept in the concept tree, each with their own rules, without necessitating the inclusion of an *east* or *west* type in the template.
3. Finally it is essential *that* the tree is traversed, but *how* it is traversed can be differentiated to a large extent, and the current implementation, which iteratively goes through the input and calls the tree for each step of the input, instead of for example stepping recursively through the tree and checking the whole input at disjunction in the tree, works well for the current configuration, but can be improved upon in the future.

2 Response to commentary and questions by Michiel

Again I would like to extend my thanks for your comments and questions, which prompt a deeper philosophical reflection on important facets of the current implementation. I would like to go through the comments one by one, which I will present in quotation, to in turn respond to each concern raised.

2.1 Disjunction and the 'object in general'

The first comment I will respond to is as follows:

"The author hopes to achieve this by introducing concepts , tree-like data structure encoding the programs which make sense (Evans' expression) of the data under consideration. The way these concepts are defined seems very un-Kantian to me. For example, the disjunctive judgement figures prominently in these constructions, but it is treated like a classical disjunction satisfying $A \longrightarrow A \vee B$, which allows one to glue to a given type A a wholly unrelated type B, and this seems to be essential in the author's construction of the tree. By contrast, Kant starts from a whole which is exhaustively decomposed into disjoint parts. Presumably, the 'object in general' occurring at the root of the tree plays the role of a 'whole', but it is hard to see how this object which lacks definite properties could figure in the disjunctive inferences that Kant allows."

A very prescient concern is raised here regarding the specific use of disjunction in the current implementation of the AAE, which I as a matter of fact share. It was my initial plan to include a larger section on the function of disjunction in the thesis, and at first the internal variable name for the extension of each of the nodes in the computational implementation was even called 'disjunction', but ultimately I decided to leave this discussion out of the thesis as it was not necessary at this stage of the computational implementation. This is mainly because in the computational implementation I did not fully implement constraints, nor did I make it a necessary condition that if a type is included in a template all its supertypes should be included in the template as well, as described in my discussion. This differed from the theoretical exposition of the system of concepts I presented in chapter 3, which implicitly included a Kantian view of disjunction, while the computational implementation only used the classical disjunction. In hindsight I should have spelled this out in these terms, but I will now explain why the theoretical exposition of the system of concepts does incorporate this view of disjunction, and how for the reasons I stated above this does not apply to the computational implementation.

As you spelled out the Kantian view of disjunction presupposes a whole that is exhaustively decomposed into disjoint parts, instead of the classical disjunction, which can be arbitrarily extended. Thus concretely, a whole like 'all animals' can be subdivided into *cat, dog, tiger*, etc., where the disjunction of $cat \vee dog \vee tiger \vee etc$ describes the extension of the concept *animal* and it is impossible to add a concept like *truck* to this disjunction, because it does not include all the *essential marks* that are the necessary conditions for the concept of *animal* to be applied to it, thus *animal* does not lie in its *intension*. The superconcept *animal* and its essential marks thus demarcate the boundaries of the whole, the extension, which a

disjunction then subdivides exhaustively into parts. Different disjunctions are possible for the same whole, as *animal* can be subdivided into for example *animal with 1 leg* \vee *animal with 2 legs* \vee *animal with 3 legs* \vee etc. or it can be divided into *mammals* \vee *birds* \vee *insects* \vee etc. Each of these subdivisions divide the same whole, as defined by the *essential marks* in the superconcept *animal*, and can be explicitly defined as a disjunction using the *extensional constraints* as discussed in section 3.3.2. Because the theoretical exposition of the system of concepts in chapter 3 includes the constraint that any concept that is a subconcept to a superconcept must inhere all the *essential marks* of the superconcept, and we can use *extensional constraints* to subdivide these concepts into subconcepts⁴, I argue that this system of concept *does* make use of the Kantian notion of disjunction under a whole, instead of the classical notion of disjunction, for to be able to add a new concept to the disjunction it must be able to be placed under the superconcept by satisfying the necessary conditions captured in the *essential marks*.

Now because I have not yet included constraints and do not by necessity include the supertypes and their essential marks of a chosen type in the template in the computational implementation, as noted in the discussion, I do agree that here only the classical notion of disjunction applies, which is a major, though amendable, defect of the current implementation. This can be solved in the future by letting the AAE check if every essential mark in the supertype of a type can also be applied to the objects in that type.

Now a final note on the 'object in general' figuring at the top of the hierarchy, which seemingly lacks definite properties necessary to demarcate the boundary of the whole. This is of course true, but that is exactly why Kant then proceeds to define its properties *a priori* using the categories, as the categories are "concepts of an object in general"(B128), by which we can determine if the "object"⁵ under consideration is *Something of Nothing*, which if we apply this principle to the notion of an 'object in general' in general, thus in the system of concepts, allows us to subdivide it first into Something and Nothing, and then subdivide those again on the basis of the categories. This process is what Kant calls critical metaphysics, thus the *a priori* definition of the system of concepts.⁶ The notion of *Something* is for Kant an *object in space and time*, thus an empirical object, which he then defines as *Matter* in the MFNS. Using the categories he then seeks to define again this notion of matter and the empirical object *a priori*, a project undertaken in the MFNS exactly to answer the question you pose regarding the *object in general*. But of course matter can not be wholly defined *a priori*, which is what informs Kant's notion of scientific investigation as the continual definition and approximation to complete determinacy of the highest concept of *matter*. Besides the exhaustive categorization of empirical objects we have of course all the 'objects' that are not empirical, thus the Ideas and Forms of Intuition⁷, which constitute a system of

⁴Even if this is not always explicitly done, but this should not matter, because the *extensional constraint* is merely a way to make explicit the disjunction captured by the placement of the subconcepts under the superconcept

⁵With object here being the object of thought, not already a material object!

⁶This is what the *Metaphysics of Morals* is, and what the *Metaphysical Foundations of Natural Science* lay the groundworks for, which Kant wanted to complete with a book on the *Metaphysics of Science*. Yet this proved more difficult than he thought, resulting in the *Opus Postumum*, which can be seen as an archive of the developments he made in this problem and the reappraisal of his whole philosophy in light of this question.

⁷I will return to this later

their own. Later he will come the system of freedom, the Metaphysics of Morals, located here as well, as morality can of course not be taken as an empirical object, as *Something*. Uniting this System of Nature and System of Freedom, Something and Nothing, will prove to be a lasting concern for Kant⁸ and the German Idealists after him, exactly because as you said we want to determine this unity beyond the empty notion of an 'object in general',⁹ yet we must start somewhere to define this, and we can't begin with it already completely defined, for that is the end-goal! Suffice it to say that I agree that there is a very important problem here, but I would argue that this problem is deeply Kantian, because it is Kant who first properly brought it into view!

2.2 Accidental properties

Before I engage the question on Nothing I will quickly respond to this comment:

"Also, labeling 'shape' an accidental property, is both empirically false (the shape of a crystal is determined by its essential properties) and thoroughly un-Kantian."

This comment seems also to be prompted by the fact that I did not make all of my considerations fully explicit, as I tried to show in chapter 3 and especially in the example in section 3.4.2 that the notions of *essential* and *accidental* marks are relative to the tree and situation under consideration. Every distinction between *essential* and *accidental* marks is for Kant always relative to their position in the tree, and not to be taken absolutely. The point I tried to make in section 3.4.2, which is mirrored in section 1.1.1 above on ambiguous symbolic sequences, is that in some situation the specific shape of an object can not be taken for an essential or sufficient mark, but must be taken as accidental for determining which concept applies to the object. Let's take the Sokoban example above, here the fact that it has a shape X is of course not ultimately accidental to the object, and allows us to determine that we are dealing with a Sokoban object here, which is thus *essential* to higher concept of *Sokoban object*, but it does not allow us to determine whether the object under consideration is of the *Player* or *Block* type, thus related to *these* concepts it is an *accidental* property! We need something else besides its shape, namely its behaviour, to determine which type applies. In the same vein it is *essential* to a table that it has a board and support in the form of a singular or multiple legs, but it is *accidental* to the table how many legs it has, or if the board is circular or rectangular. Shape is of course essential to the determination of a concept, but its essentiality or accidentality depends on the question under consideration and its location in the system of concepts, for a diamond is still a diamond, regardless of if it is hewn into the shape of a heart or found raw in the rock!

2.3 Forms of intuition and Nothing

In this section I will discuss the following comment and the question related to it:

⁸[Guyer et al., 2005, Ferrarin, 2015]

⁹A notion of the One which Hegel will famously denounce as that night in which all cows are black, that whole without differentiation in its parts.

"Here we touch upon a fundamental issue: which parts of the first Critique are most relevant to the aims of the project? The author mostly relies on the Transcendental Doctrine of Method, which is more metaphysical in nature than the Transcendental Deductions in the A and the B editions. In fact, the Transcendental Deductions are the main source for Kant's views of the connection between concepts, memory and synthesis (cf. the treatment of the 3 syntheses in the A deduction). The author's choice of the Transcendental Doctrine of Method starts to grate when he discusses 'non-naive' concept trees, which now include space and time, surprisingly introduced via the concept of Nothing. He leans heavily on the following passage: "The mere form of intuition, without substance, is in itself not an object, but the merely formal condition of one (as appearance), like pure space and pure time, which are to be sure something, as the forms for intuiting, but are not in themselves objects that are intuited (*ens imaginarium*). " The effects can be seen in Figure 4, p. 35, where Nothing is now subsumed under Object in general, and space and time are subsumed under Nothing. This is pure phantasy, caused by not distinguishing between space (and time) as Form of intuition (which is not an object) and as Formal intuition (which is an object whose unity makes it possible to trace the outline of an object; cf. footnote to B 161 and the 'house' example in the same section)."

"Treating space and time as subconcepts of 'Nothing' is wrong and confuses 'form of intuition' and 'formal intuition'. Suggest a different way of dealing with space and time."

I agree with the fact that I should have done more to connect the concerns in the Transcendental doctrine of Method to Kant's reflections on memory and reproduction in the Deduction, as I have more concerned myself with the connections between the Unity of Reason and the Unity of the Understanding laid out in the end of the CPR and in the later books such as CJ, OP and MFNS. Yet it would indeed be interesting to show how Reason not only directs and prepares the ground for Understanding, but how in the act of transcendental apperception itself, memory plays a crucial role. This is something I might engage in the philosophy thesis. Now in regards to your concerns regarding my taking space and time as *ens imaginaria*, thus as entities of the imagination or Nothing: I have been reading and re-reading Longuenesse, the Deduction and the Schematism and must say that it is a very complicated and cloudy matter to determine what the best option is, although I still tend towards calling the forms of intuition Nothing, without confusing formal intuition and forms of intuition.¹⁰ All in all making this case would take a whole new essay, and I would be glad to discuss it with you in person, but for the time being I will try to make some preliminary points.

The most important point for me is that one must not give too much weight to the designator

¹⁰Between which I think with Longuenesse it is not even possible to draw an ontological distinction, or a distinction in kind, but only a distinction in form, or precisely I think the formal intuition is a necessary part of the form of intuition. If we look at how Kant treats absolute space in the MFNS, namely as a necessary presupposition for determining any local space as space, thus we can only draw a local space if we presuppose an absolute space, which means that formal intuition as absolute space is needed for any application of the form of intuition of space, with the same obviously being true of time. Longuenesse argues a similar point, but then specifies further the 'epigenetic' form on pages 216-225 of [Longuenesse, 2020].

of Nothing, because I think that for Kant Something is just that to which a sensation corresponds, thus a being in time.¹¹ Something has reality if a sensation in time corresponds to it, but time itself can not present itself in time. For this Kant devises the schema of substance, as that which corresponds to time in appearance.¹² But substance is only a schema, only a product of the imagination¹³ as Kant has no substance metaphysics, it is only the schema of the subject of judgement and anything can be the subject of judgement! Thus if that which corresponds to time in appearance is only a product of the imagination, an *ens imaginarium*, might we not say that time itself is an *ens imaginarium*, a product of the imagination not as itself an imagined object, but a form as a formal condition for the unity of intuition? This has become hairy quite quickly, but I want to reiterate that the *ens imaginarium* being Nothing simply means that it is not a positive determination in time. Kant is not talking of the pure Nothing of uncreation, but also calls something like a shadow or cold Nothing, because they are not themselves positive determinations of a thing, but only exist if something else exists. This we can see as analogous to the forms of intuition, as without any objects space or time as forms of intuition are Nothing!¹⁴ Space and time are thus as we know empirically real,

¹¹"Reality is in the pure concept of the understanding that to which a sensation in general corresponds, that, therefore, the concept of which in itself indicates a being (in time). Negation is that the concept of which represents a non-being (in time)." (A143/B182)

¹²"The schema of substance is the persistence of the real in time, i.e., the representation of the real as a substratum of empirical time-determination in general, which therefore endures while everything else changes. (Time itself does not elapse, but the existence of that which is changeable elapses in it. To time, therefore, which is itself unchangeable and lasting, there corresponds in appearance that which is unchangeable in existence, i.e., substance, and in it alone can the succession and simultaneity of appearances be determined in regard to time.)" (A144/B183)

¹³"The schema is in itself always only a product of the imagination but since the synthesis of the latter has as its aim no individual intuition but rather only the unity in the determination of sensibility, the schema is to be distinguished from an image." (A140/B179) Might we add that here the schema is analogous to the form of intuition, while the image might be seen as analogous to the formal intuition?

¹⁴"Under the heading of relation, "nothing" is *ens imaginarium*, which Kant identifies with the forms of intuition when they are deprived of any empirical content: "The mere form of intuition, without substance, is in itself no object, but the merely formal condition of an object (as appearance), as pure space and pure time (*ens imaginarium*). These are indeed something, as forms of intuition, but are not themselves objects which are intuited" (A291/B347). Thus *nihil privativum* (under quality) and *ens imaginarium* (under relation) have this in common, that both of them are nothing by virtue of the mere absence of a sensory given. Kant emphasizes this proximity a few lines further: "the *nihil privativum* and the *ens imaginarium* are empty data for concepts. If light were not given to the senses we could not represent darkness, and if extended beings were not perceived we could not represent space. Negation and the mere form of intuition, in the absence of something real, are not objects" (A292/B349). That Kant should define space and time, considered as "the mere form of intuition, without substance," as being, metaphysically speaking, nothing, is striking. This characterization of space and time is related to Kant's assertion, in the *Transcendental Aesthetic* and the *Prolegomena*, of their transcendental ideality and empirical reality.²³ Space and time are "real" only insofar as they are cognized as relations of things, whose reality is "what corresponds to sensation." Outside this function of ordering sensations, space and time are nothing: they are purely ideal. Yet they are not a mere *nihil privativum*, because they are still beings for imagination, products of synthesis speciosa and as such, *entia imaginaria*, just as under the first title of "nothing," noumena were beings for reason (*entia rationis*), although they were not realities, "truly affirmative beings or determinations, *entia sive determinationes vere affirmativae*." It is interesting that Kant should list *ens imaginarium* as falling under the category of relation. The explanation for this might be as follows: as we saw, it is difficult to separate the categories of quality from those of relation, since reality is defined as "that which corresponds to sensation," or as that through which our sensations are related to "something existing in space and time": but "something" is determined as "existing in space and time" by means of the categories of

but transcendently ideal, which means that ontologically they are ideal, thus Nothing, just like the Ideas and pure concepts, such as the categories and 'fundamental laws' are Nothing, even the Idea of systematic unity, thus my whole thesis, is Nothing, but as *ens rationis*!¹⁵ Metaphysically speaking these forms of thought and intuition are thus Nothing, in an analogous sense to the Nothing of shadows, yet different from the Nothing of contradictions, while still Nothing. Thus if we were to locate them in our grand system of everything, we would, as Kant does, locate them under the concept of Nothing, right under the concept of the 'object in general'.

References

- Richard Evans. *Kant's cognitive architecture*. PhD thesis, Imperial College London, 2020.
- Alfredo Ferrarin. *The powers of pure reason*. University of Chicago Press, 2015.
- Paul Guyer et al. *Kant's system of nature and freedom: Selected essays*. Oxford University Press, 2005.
- Immanuel Kant. On a recently prominent tone of superiority in philosophy. *Theoretical Philosophy after 1781*, pages 428–445, 1781.
- Immanuel Kant. *Opus postumum*. Cambridge University Press, 1995.
- Immanuel Kant. *Critique of pure reason*. Cambridge University Press, 1998.
- Immanuel Kant. *Critique of practical reason*. Hackett Publishing, 2002.
- Immanuel Kant. *Lectures on logic*. Cambridge University Press, 2004a.
- Immanuel Kant. *Metaphysical foundations of natural science*. Cambridge University Press Cambridge, 2004b.
- Béatrice Longuenesse. *Kant and the capacity to judge: sensibility and discursivity in the transcendental analytic of the Critique of pure reason*. Princeton University Press, 2020.

relation. Indeed, as we shall see in chapter 11, realities, negations, and limitations can be reflected only as properties of substances interacting in space and time. Now, we may radicalize in thought our concept of negation or nihil privativum to the point of supposing, not the absence of some particular determination (say, darkness as the absence of light; silence as the absence of sound, etc.) but the absence of every real determination. Then substance itself disappears. So do space and time as empirically real. What remains are space and time as entia imaginaria, beings of imagination, or metaphysically speaking: nothing." [Longuenesse, 2020, p. 304-5]

¹⁵"But reason cannot think this systematic unity in any other way than by giving its idea an object, which, however, cannot be given through any experience; for experience never gives an example of perfect systematic unity. Now this being of reason (*ens rationis ratiocinatae*) is, to be sure, a mere idea, and is therefore not assumed absolutely and in itself as something actual, but is rather taken as a ground only problematically (because we cannot reach it through any concepts of the understanding), so as to regard all the connection of things in the world of sense as if they had their ground in this being of reason; but solely with the intention of grounding on it the systematic unity that is indispensable to reason and conducive in every way to empirical cognition of the understanding but can never be obstructive to it." (A681/B709)