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Cognitive Dynamics : a New Look at an Old Problem

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I. The Problem

In Recanati (2012) I argued that *mental files* can play many of the roles which Frege assigned to ‘senses’. In particular :

- Mental files determine the reference of expressions : an expression refers to what the mental file associated with it refers to (at the time of tokening). The file itself refers via the acquaintance relations, or ‘ER relations’, it is based on.¹
- Mental files account for cognitive significance. Frege’s Constraint states that if a rational subject can believe of a given object both that it is *F* and that it is not *F* (as happens in so-called ‘Frege cases’), then the subject thinks of that object under distinct modes of presentation (Schiffer 1978 : 180). Now the subject’s having distinct mental files about a given object is arguably sufficient to generate the possibility of Frege cases, even if the files contain the same information about the referent. This suggests that the files themselves, qua mental particulars, should play the role of mode of presentation.
- Mental files account for coreference *de jure*. If two token singular terms **a** and **b** are associated with the same file, it is presupposed that they corefer (if they refer at all) and

¹ ER relations are *epistemically rewarding* relations, i.e. relations to entities which make information flow possible between the subject and these entities.

‘trading upon identity’ (TI) becomes valid : one can move from ‘**a** is *F*’ and ‘**b** is *G*’ directly to ‘there is an *x* which is *F* and *G*’, without needing to invoke an identity premiss. (On ‘trading on identity’, see e.g. Campbell 2012 : 97-99; see also Fine 2007 for the related idea of ‘semantic coordination’.)

Onofri (2014) objects that mental files can’t simultaneously play the FC role (satisfying Frege’s Constraint) and the TI role (enabling coreference *de jure*). To play the first role, they must be fine-grained, but to play the second role they must be coarse-grained, given that cross-modal and cross-temporal integration of information licenses TI. For example, if I remember that a certain object was *F* and, upon encountering it again, notice that it is *G*, I can infer : something that was *F* is now *G*. This is TI, yet the mental file deployed in the first premiss (to the effect that the remembered object was *F*) is a memory file, while the mental file deployed in the second premiss (to the effect that the seen object is *G*) is a perceptual file. These files are distinct types of file, and we can easily imagine Frege cases involving them, i.e. cases in which the subject does not realize that the object he sees is the same he previously encounters and still remembers. Or think of a case in which I see and touch a certain glass : if cross-modal integration of information occurs as it should, I will trade upon identity and infer, from ‘that (seen) glass is yellow’ and ‘that (touched) glass is cold’, that the glass is yellow and cold ; but again, one can easily imagine Frege cases in which distinct files are deployed, one for each modality, without the identity being presupposed. The subject might wonder whether the yellow glass he sees is the cold glass he touches. So Frege’s constraint dictates that there be two distinct modes of presentation, while the subject’s trading upon identity shows that, for him, there is only one file, which integrates visual and tactile information. So : one file, or two files ? It seems that two (fine-grained) files are needed to the FC role, while a single, coarse-grained file is required to account for TI. The suggestion that a single entity

accounts for both FC and TI is therefore dubious and the whole framework threatens to collapse.

Ninan (2014) comes to a similar conclusion, based on a different type of example :

Suppose that, at time t_1 , I look at my watch and think to myself, *It's 1:00pm now* . Later (at t_2) I come to think, *Actually, it wasn't 1:00pm then; I forgot to change my watch after the flight*. Intuitively, I changed my mind between t_1 and t_2 about whether it was 1:00pm at the time in question. But my initial thought employs a *now* -file μ_1 , while my later thought employs a *then* -file μ_2 . According to Recanati, μ_1 and μ_2 are distinct files or modes of presentation. But then why should this count as a change of mind? Normally, if I ascribe a property to an object o while thinking of it under mode of presentation m_1 and then later ascribe an incompatible property to o while thinking of it under a distinct mode of presentation m_2 , I do not thereby count as changing my mind. For example: I might think in the morning that Phosphorus is bright, but then think in the evening that Hesperus is not bright. If I am employing two distinct modes of presentation on these two occasions, this does not count as a change of mind. The reason for this seems to be that the two contents in question are not incompatible in the appropriate sense. (Ninan 2014 : 2-3)

The subject changes her mind only if she thinks of the object under the same mode of presentation throughout ; otherwise there is no conflict, hence no change of mind has to be posited. But if the mode of presentation is the same, we can no longer equate modes of presentation with files *and* maintain that files are based on fine-grained ER relations to the object of thought ; for in this cases as in the others, the ER relation changes while the mode of presentation remains one and the same.

As Onofri and Ninan acknowledge, this problem is not new. It traces back to Evans' discussion of cognitive dynamics (and his introduction of 'dynamic Fregean senses') in 'Understanding Demonstratives' and *The Varieties of Reference*.² I devote a chapter to the problem in *Mental Files*, and I offer the following solution. A file can be *converted into* another one, to adjust to a contextual change which brings about a change in the subject's ER relations to the reference. In particular, a file may be converted into a distinct, more inclusive file based on more ER relations than the initial file ('incremental conversion'). Through incremental conversion, files grow new information links. Trading on identity across deployment of distinct ER relations is made possible by the *composite* nature of the inclusive file which is the output of incremental conversion. So in cross-temporal or cross-modal cases, a single file is used in the train of thought, and that file, in contrast to the initial, pre-conversion file, is based on *several* ER relations.

I stand by my solution, but it has obviously failed to convince several of my critics (including Onofri and Ninan). What follows is my defence of it, focused on the worries they expressed.

II. Allegedly Diachronic Inferences

Onofri thinks my solution does not work, for the revised theory faces a dilemma. Is the post-conversion file (the *inclusive file*) the same file as the pre-conversion file (the *initial file*)? If the answer is positive, files become coarse-grained and cannot play the FC-role. If the answer is negative, the mental file account of coreference *de jure* is made redundant. What makes two token singular terms coreferential *de jure* is no longer the fact that they are associated with the same file, but the fact that the (distinct) files they are respectively associated with are

² Evans' discussion of cognitive dynamics itself traces back to Frege (1918/1956 : 296) and Kaplan (1989a : 537-38). See also Perry 1980 for an early discussion of the phenomenon.

related through the mechanism of conversion. It is the mechanics of conversion that does all the work. As Onofri puts it,

On this account, what is it that really explains the rationality of trading on identity? Clearly, not that the same file is involved in the inference! On the contrary, the correct explanation will now be as follows: A has produced a distinct file B through conversion, and this makes it the case that the inference is rational (perhaps together with other factors). For our purposes, it doesn't matter whether this explanation is correct. What matters is that all the explanatory work is done by the mechanism relating the files, rather than their alleged sameness. It would now be unnecessary to include the assumption 'A and B are the same file' in a complete explanation of trading on identity: file sameness has become explanatorily useless. (Onofri 2014 : 10-11)

Onofri concludes that my account 'faces the following dilemma: either the files involved in trading-on-identity inferences are literally the same, in which case files are not modes of presentation; or they are distinct but related through cognitive mechanisms like conversion, in which case the appeal to file sameness plays no role in explaining rational inferences' (p. 11).

But I think the objection rests on a confusion. In TI the *de jure* coreferential occurrences correspond to deployments of *the same file*, namely the inclusive file (post-conversion). So TI is still accounted in Fregean fashion, by appealing to sameness of sense (or sameness of file). This is compatible with the fact that the single file which is deployed twice in the TI train of thought is an inclusive file resulting from the conversion of an initial file, and therefore distinct from that initial file. So I maintain that the pre- and post-conversion files are *distinct* files, but that does not entail the unwelcome consequence advertised by

Onofri : that ‘appealing to sameness of file/mode of presentation now becomes explanatorily useless in accounting for trading on identity’ (Onofri 2014 : 10). The files which must be ‘the same file’ to preserve the account of TI in terms of file identity are *the files associated with the two token singular terms* in the TI train of thought. The terms are coreferential *de jure* because they are associated with the same file. That file is an inclusive file resulting from the conversion of an initial file, and therefore distinct from that initial file. I conclude that the distinctness of the pre- and post-conversion files does not make the appeal to file identity redundant in my account of TI.

The source of Onofri’s confusion is the assumption that the pre- and post-conversion files *are* the files respectively associated with the (*de jure* coreferential) token singular terms in cross-modal or cross-temporal TI-licensing trains of thought. If this were true, Onofri’s objection would go through. But I reject the assumption : I deny that the initial file *is* deployed in cross-modal or cross-temporal TI. The illusion that it does stems from the diachronic nature of the reasoning in the sort of example Onofri focuses on.

Consider the following case, similar to Onofri’s own Jack/John example (Onofri 2014 : 13-14). Remembering a certain object from a past encounter, and remembering it as *F*, I think : ‘**that thing** was *F*’. Then I look around, recognize the object in question in the vicinity, see that it is *G* (rather than *F*) and think : ‘**it** is *G* now’. Onofri would say that the first premiss involves a deployment of a pure memory file (the initial file : a ‘memory demonstrative’), while the second premiss involves a deployment of the inclusive file (a ‘recognitional demonstrative’, resting on memory *and* perception). On that way of understanding the example, the two token singular terms are coreferential *de jure* (TI is licensed), yet they are associated with distinct files, namely the initial file and the inclusive file it converts into when the subject recognizes the object. So if we accept that there are such examples, Onofri’s objection goes through.

But I deny the legitimacy of that ‘diachronic’ understanding of the TI train of thought. For logic purposes, a train of thought has to be construed as synchronic (Kaplan 1989b : 584-85). Of course, we are free to stipulate that the subject had the initial thought, ‘**that thing** was *F*’, at time t_1 , before perceiving and recognizing the remembered object, and only later – at t_2 – thought ‘**it** is *G* now’. But in this case I hold that the train of thought *occurring at t_2* involves two premisses : one is the overt premiss ‘it is *G* now’, where ‘it’ is associated with the inclusive file, and the other one is what the subject has *retained* of the initial thought. What the subject has retained is not the initial thought itself, but a variant that *results from updating the initial thought (the thought held at t_1) through conversion of the initial file into the inclusive file*. Updating here is *necessary* to retention. The initial file is no longer available at t_2 , so the thought in which it occurs (the thought held at t_1) cannot be directly recruited into the train of thought that takes place at t_2 . At t_2 , after recognition, the initial file has been converted into the inclusive file, so only the inclusive file remains and can feature in the ongoing train of thought.

If we make the associated files explicit by adding subscripts to the singular terms, we get the following representation of the TI train of thought in the example I have just discussed:

t_1 :	that _{init} was <i>F</i>	(initial thought, featuring the pure memory file)
	\downarrow <i>conversion</i>	
t_2 :	that _{incl} was <i>F</i>	(updated thought, featuring the inclusive file based on memory <i>and</i> perception)
	that _{incl} is now <i>G</i>	(new thought, featuring the same file)
<hr/>		
	Something that was <i>F</i> is now <i>G</i>	(TI, licensed by sameness of file)

The initial thought, formed at t_1 , must be updated in order to serve as premiss in the reasoning taking place at t_2 . Updating proceeds through conversion of the constituent file. Once conversion has taken place, the train of thought involves two deployments of the same file (the inclusive file), in accordance with the theory.

Let me generalize. In diachronic cases, updating is a prerequisite for enrolling a previous thought into the current train of reasoning. Once updating has been factored in, there no longer is any temptation to regard the premisses of the reasoning as involving distinct mental files or modes of presentation.

The above generalization provides an obvious solution to the difficulty raised by Ninan in the passage I already quoted :

Suppose that, at time t_1 , I look at my watch and think to myself, *It's 1:00pm now* . Later (at t_2) I come to think, *Actually, it wasn't 1:00pm then; I forgot to change my watch after the flight*. Intuitively, I changed my mind between t_1 and t_2 about whether it was 1:00pm at the time in question. But my initial thought employs a *now* -file μ_1 , while my later thought employs a *then* -file μ_2 . According to Recanati, μ_1 and μ_2 are distinct files or modes of presentation. But then why should this count as a change of mind? Normally, if I ascribe a property to an object o while thinking of it under mode of presentation m_1 and then later ascribe an incompatible property to o while thinking of it under a distinct mode of presentation m_2 , I do not thereby count as changing my mind. (Ninan 2014 : 2-3)

Change of mind occurs only when there is diachronic disagreement between the subject and his former self. Disagreement requires a common content for the parties to disagree about,

and that common content is reached through conversion in diachronic cases. I analyse Ninan's example as follows :

t_1 : a°) *It's 1:00pm now*
conversion
↓
 t_2 : a) ***It was 1:00pm then***
b) ***Actually, it wasn't 1:00pm then; I forgot to change my watch after the flight***

There is a clear inconsistency between the updated thought 'it was 1 : 00 then', which results from converting the file in the initial thought 'It's 1 : 00 now', and the new thought which supersedes the updated thought when the subject realizes that he forgot to change his watch: 'it *wasn't* 1 : 00 then'. The contents of (a) and (b) are 'incompatible in the appropriate sense' (Ninan p. 3) and they give rise to genuine disagreement : the subject has changed his mind.

III. Dynamic Files

It is not the same thing to think of a time as *then* and to think of it as *now*. As John Perry pointed out many years ago, the actions one takes as a result of thinking one thing (e.g. 'the meeting starts now') are systematically different from the actions one takes as a result of thinking the other ('the meeting started then'). Given the constitutive connection between thought and action, we need to acknowledge fine-grained thought constituents which distinguish *now*-thoughts from *then*-thoughts even when the time referred to is the same (Perry 2000). Mental files based on specific ER relations are meant to play that role (the FC role). Yet to account for cross-temporal cases we have to make room for coarse-grained modes of presentation enabling the mixing of temporal perspectives (e.g. the simultaneous exploitation of memory and perception). Coarse-grained modes of presentation correspond, in my framework, to *composite files based on multiple ER relations* (and generated through

incremental conversion). So it is true that the FC role requires fine-grained files, while the TI role demands coarse-grained files, but thanks to the mechanism of incremental conversion we can have both ; and it is a noteworthy feature of my account that it appeals to both types of file.

This invites an objection, however. Since, to solve the problem raised by cross-modal and cross-temporal TI, I have to make room for coarse-grained files, based on multiple ER relations, in addition to the fine-grained files based on specific ER relations, it is natural to wonder whether one might not do everything with the coarse-grained files, and dispense with the fine-grained files altogether. Instead of starting with fine-grained files based on specific ER relations, and generating the coarse-grained files through the mechanism of incremental conversion, we might start from the other end. At the other end we find *maximally inclusive* files. I call them *encyclopedia entries* : files that are hospitable to information derived through *any* ER relation available to the subject. Even though I describe them as based on a ‘higher-order’ ER relation to the reference and therefore as still in line with my indexical model (which construes all files as based on ER relations), I agree with Ball (2014) that they are not *practically* indexical : they are independent of any particular contextual relation to the reference and are therefore eminently stable, in contrast to the indexical files based on specific ER relations. They are what Perry calls ‘detached files’. Encyclopedia entries are more like names than they are like indexicals (and indeed, I want to say that encyclopedia entries are the type of file associated with proper names). The suggestion, then, is that we should start with these maximally inclusive files, independent of any specific contextual relation, and distinguish different stages in their evolution.

That is the approach which Papineau (2006, 2013) advocates. When I first encounter an object, he says, I open an encyclopedia entry (a stable file) for that object. For the time being, my only relation to it may be demonstrative/perceptual, but soon I will be in a position

to gain information from it through additional ER relations (e.g. testimony). So-called demonstrative files, on this view, are nothing but stages in the development of namelike files – the only files we need. No conversion needs to take place, because the encyclopedia entry is there from the start.³

Both Ball (2014) and Ninan (2014) concur with Papineau. They think we can do everything with lasting files based on indefinitely many ER relations. Ball shows in some detail that a ‘names-only’ system can be used to represent indexical information (about time, in his example), without any need for a specialised indexical file. If the two systems (the names-only system and the indexical system) are equivalent, as Ball suggests, why not go for Papineau’s ‘simpler view’ (only encyclopedia entries) ? As Ninan (2014 : 5) puts it, ‘once we have the stable relations and piles, what need is there for unstable relations and files proper ?’

Onofri mentions that I have myself taken a step in that direction (in addition to the distinction between files and piles already in *Mental Files*). In ‘Mental Files : Replies to My Critics’, in the special issue of *Disputatio* dedicated to my book, I introduced a numerical index on files which corresponds to the fact that they are related by conversion. Co-indexing means that two files belongs to the same *sequence of files*, what we may call a ‘dynamic file’. Why, then, should we not try to do everything with dynamic files (and their stages) ? Note that encyclopedia entries are intrinsically dynamic : their function is to exploit all the ER relations available, so they are designed to grow new information links whenever possible.

³ Here is a verbatim quote from Papineau : ‘When I first encounter some item perceptually, I open a potentially permanent file in which to accumulate information about that item. That file outlasts the original encounter, and the same file is reactivated when I remember the relevant item or re-encounter it. The information earlier acquired is thus automatically available on those later occasions, and can be added to when new facts are acquired, without any need for any multiplication of files. (See Papineau 2006.) On this view, the files that we open on first perceptual encounters, and in general on coming into any contact with any new item of thought, are *name-like*. They are designed to be permanent repositories of information about the item in question, and are not dependent on any particular sources of information about that object. In this respect they are akin to Recanati’s ‘encyclopaedic’ files, whose function is to gather information about some referent from whatever sources offer themselves.’ (Papineau 2013 : 168-69)

Instead of describing conversion as an operation external to files, we can therefore take a more dynamic approach and view incremental conversion as internally generated in virtue of the function of encyclopedia entries.

I am all in favour of such a dynamic approach. Consider a descriptive name like Evans' 'Julius'. It is associated with a descriptive file, a type of file which has interesting properties and is worth investigating in its own right. 'Neptune' also started its life as a descriptive name, but acquaintance with the reference has led to conversion of the descriptive file initially associated with the name into a regular encyclopedia entry based on ER relations to the reference. So the descriptive file at the origin of the name may be viewed as a stage in the dynamic evolution of an encyclopedia entry. As Stalnaker pointed out, the same dynamic process may well happen with 'Julius' (Stalnaker 2003 : 198-99). Or consider the deferential file a person might associate with a name overheard in a conversation : when the person hears more about the referent of the name the deferential file will be converted into a regular encyclopedia entry. These examples show that we need an analysis with two levels : the local, static level, and the global, dynamic level. The dynamic level is essential for understanding informational updating, but also for understanding communication, if it is accepted that dynamic files (sequences of files) can be interpersonal as well as intrapersonal (Prosser forthcoming).⁴

So I agree that we need dynamic files, and I agree that encyclopedia entries are intrinsically dynamic. As a result, I have no objection to Papineau's picture. What I reject is only the idea that we should *dispense with fine-grained files and with operations like conversion*. I think the best way to account for dynamic files themselves is by analysing them as sequences of fine-grained files. We need the fine-grained files, in particular, to make sense of dynamic phenomena like fusion and fission of files.

⁴ The analogy between informational updating and communication has been noted several times in the literature. See e.g. Gibbard 2012 : Appendix 1.

As Prosser points out,

The problems resulting from fission and fusion for modes of presentation are very similar to those that arise for psychological continuity theories of personal identity. For every type of solution on offer for personal identity there will be a corresponding type of solution for modes of presentation. My own view is that the best solution is given by stage theory (Sider 1996, 2001; Hawley 2001). (Prosser forthcoming : 18)

Assuming that persons are both dynamic continuants (space-time worms) and stages, what is basic? Because the dynamic view which takes continuants as basic has the unpalatable consequence that distinct individuals can be located in the same place at the same time (Lewis 1976), Sider suggests that person stages should be construed as basic (Sider 1996, 2001 : chapter 5). That is the view I take in the case of mental files. I take modes of presentation (what plays the FC role) to be mental files in the fine-grained sense (file stages, as we may more aptly call them),⁵ and I take such files to undergo dynamic operations such as conversion, incremental conversion, fusion (file merging), fission (file splitting), and so on. Sequences of files related by such operations are dynamic files. These operations do not preserve file identity in the strict, Leibnizian sense: in contrast to identity, dynamic continuity between files is an intransitive relation, just like dynamic continuity between person stages.

Let us consider an example. At t_1 , I see a certain object and open a demonstrative file DEM₁ about it : ‘that thing’. At t_2 , the object I have been in contact with since t_1 disintegrates, but the demonstrative file persists because, as a result of taking a certain drug, I hallucinate the continued presence of the object. There is an issue whether or not the file continues to refer after t_2 . I think it does not, since the presupposition of the demonstrative file are doubly

⁵ File stages, or static files, may be fine-grained or coarse-grained ; so talk of ‘fine-grained file’ (in contrast to dynamic file) is inappropriate.

violated.⁶ At t_3 a doubt occurs to me and I wonder whether the object I remember seeing at the beginning of the episode (t_1) is really the same as the object that I (mistakenly) take myself to seeing at t_3 . Rational doubts about identity necessarily involve two distinct mental files, and here the two files result from splitting DEM₁, which is replaced by a memory demonstrative (referring to the object initially seen) and a perceptual demonstrative (purporting to refer to the object currently seen). So there are three files in this example: DEM₁, the demonstrative file opened at t_1 and maintained until t_3 (despite the disappearance of the object at t_2); MEM, the memory demonstrative file deployed at t_3 ; and DEM₂, the new demonstrative file, also deployed at t_3 . Both MEM and DEM₂ result from splitting DEM₁ at t_3 . At t_1 , DEM₁ referred to the object o the subject was then in visual contact with. At t_2 , DEM₁ did not refer to anything. At t_3 , DEM₁ went out of existence, and two new files were deployed: MEM inherits the reference of DEM₁ at t_1 , so it refers to o (and inherits the information in DEM₁ at t_1), while DEM₂ fails to refer because the subject is hallucinating.

It seems to me that there is as much dynamic continuity between DEM₁ (as deployed between t_2 and t_3 , while hallucinating) and DEM₂ as there is between DEM₁ (as deployed at t_1) and MEM. Such dynamic continuity can't ground identity, for if it did, we would have both DEM₁ = DEM₂ and DEM₁ = MEM. That would entail that MEM = DEM₂, which is impossible since rational doubts about identity (like the doubt harbored at t_3) necessarily involve two distinct mental files. This suggests that we should resist Ninan's claim (following Frege in 'The Thought' and Evans in 'Understanding Demonstratives') that

the mode of presentation associated with *today* on day d is the same as the mode of

⁶ The file presupposes both that there is an object to which the subject is attending, and that whatever the subject is attending to is the same thing she has attended to in previous deployments of the file. Both presuppositions are violated in this example. If the object had been 'switched' at t_2 , only the second presupposition would be violated, but the subject would still fail to refer (through confusion).

presentation associated with *yesterday* on the day after d . If modes of presentation are mental files, then the mental file involved in a *today*-thought on d should be the same file involved in a *yesterday*-thought on the following day. (Ninan 2014 : 4)

The modes of presentation are ‘the same’ only in a weak, dynamic sense which does not correspond to Leibnizian identity. In the strict sense they are not the same : they are distinct modes of presentation even though they are stages of one and the same evolving file.

IV Rational Relationships and Proper Dynamic Files

Ninan could respond by pointing out that not all dynamic relations between stages matter ; what matters are only those that support ‘rational relationships’. As he puts it,

The notion of a mode of presentation was introduced in part to describe what we might call rational relationships between beliefs. Since a rational agent can believe that Hesperus is bright without believing that Phosphorus is bright, these beliefs must have different contents, and so the two modes of presentation for Venus must be different. Here we focus on the rational relationships between the beliefs of an agent at a single time. But we can also consider the rational relationships between two beliefs of an agent that are held at different times. The reason for thinking that my belief (*It is now 1:00pm*) at t_1 and my belief (*It was not 1:00pm then*) at t_2 involve the same mode of presentation is precisely that there is rational relationship between these two beliefs: they are incompatible, which partly explains why I count as having changed my mind between t_1 and t_2 . (Ninan 2014 : 4)

If we focus on that subset of dynamic relations that qualify as ‘rational relationships’ in Ninan’s sense, it is not so clear that they can’t ground identity for modes of presentation. Arguably, in my example, there is such a relationship between DEM₁ at *t*₁ and MEM, but *not* between DEM₁ at *t*₂ and DEM₂. So perhaps we can say, on that basis, that DEM₁ (at *t*₁) and MEM are the same mode of presentation, while DEM₁ (at *t*₂) and DEM₂ are not the same mode of presentation (thus blocking the unwelcome consequence that MEM = DEM₂).

Now what is the special relationship which holds between DEM₁ at *t*₁ and MEM but not between DEM₁ at *t*₂ and DEM₂? It is something like this : A memory file inherits its reference (and its content) from the perceptual file it derives from ; so they are bound to corefer (if they refer at all). Let us call that coreference *de jure* between file stages (CDJ for short). On that basis, we could say, following Ninan (and Evans), that the perceptual file and the subsequent memory file count as the same mode of presentation because they bear the appropriate rational relation (CDJ) to each other. The situation is different with DEM₁ and DEM₂ because DEM₂ results from the *fission* of DEM₁. Whenever fission (or, for that matter, fusion) is involved, there always is the possibility that one of the twin files (or both) refer while the inclusive file fails to refer (Ball 2014 : 17). So the two files are *not* bound to corefer if they refer at all. Fusion and fission do not support CDJ. Or perhaps we should distinguish a strong and a weak form of CDJ :

Coreference *de jure* (strong): the two occurrences corefer if either of them refers.

Coreference *de jure* (weak) : the two occurrences corefer if both of them refer.

In cases of fusion and fission, the files only exhibit the weak form of coreference *de jure* : the two files are bound to corefer if they *both* refer. There is the possibility that one of the files refers while the other one fails to refer, but it is ruled out that the two files both refer while

referring to different things.

If this is on the right track, then we need three levels. We need the fine-grained files (or, rather, the stages) and the dynamic operations on them : conversion, fusion, fission etc. This gives us the notion of a dynamic file. Then we can distinguish two kinds of dynamic files : those which do and those which do not support ‘rational relationships’. The files that do may be called the proper dynamic files. It is at the level of the proper dynamic file that we can try to capture the notion of a dynamic mode of presentation which Ninan and Evans argue for, and we can do that in terms of strong CDJ. Strong coreference *de jure* between stages is a transitive relation, so it can ground the identity of (dynamic) modes of presentation of the sort Evans and Ninan are after. In contrast, weak CDJ is not transitive. For example, in fusion or fission, an inclusive file A/B may bear weak CDJ to both of the twin files A and B, while A and B do not bear weak CDJ to each other.

But it’s not absolutely clear that dynamic files *ever* exhibit strong CDJ. There are five types of dynamic file to consider : (i) deployments of the same file at different times; (ii) conversion of one file into another (*now/then, here/there, today/yesterday ...*); (iii) incremental conversion (multiplication of ER relations); (iv) fusion ; (v) fission. Fusion and fission only support weak CDJ, as we have seen. There always is the possibility that one of the twin files (or both) refer(s) while the inclusive file fails to refer. The same thing is true of incremental conversion. The incremented file may fail to refer through violation of the uniqueness presupposition (to the effect that the various ER relations converge on the same object), even if the initial file (pre-incremental conversion) succeeded in referring. More interestingly, in case (i) too we find weak rather than strong CDJ. That is what the example of DEM₁ shows : at t_1 DEM₁ refers to o , while it fails to refer at t_2 . So two deployments of the same file at different times are not bound to corefer if they refer at all ; they are only bound to refer to the same thing if they *both* refer (weak CDJ).

It seems, then, that simple conversion, illustrated by Ninan's example, would be *the only case* of a proper dynamic file, exhibiting strong CDJ. It would be an *exception* to the generalization that dynamic files only support weak CDJ. But do we really need such an exception? One may be skeptical of any account that creates too big a gap between simple and incremental conversion. Is it true that simple conversion (e.g. Ninan's *now/then* example) supports strong CDJ while incremental conversion only supports weak CDJ? I am not sure. It is well-known that simple conversion supports strong CDJ only if the thinker has managed to 'keep track of time' (see Kaplan 1989a, Evans 1981 and Perry 1997). Rip van Winkle is the case of a thinker who has not kept track of time, and whose temporal file about the previous day is confused. But the requirement that the thinker keep track of time introduces an artificial asymmetry between the case of simple conversion and incremental conversion. The sort of confusion which may give rise to reference failure in cases of incremental conversion (or fusion) are cases in which the uniqueness condition is not satisfied: the various ER relations do not converge on the same object. That is why incremental conversion only supports weak CDJ. But if we ruled out such cases by adding a condition analogous to the time-tracking requirement, e.g. the requirement that the subject 'keep track' of the object throughout the dynamic operation, then incremental conversion would turn out to support strong CDJ as well.

I conclude that it is not obvious that *any* dynamic file (without the help of extra conditions, like the time-tracking requirement) support strong CDJ. Perhaps only *synchronic deployments of the same file* do so. If that hypothesis is correct, then we cannot use proper dynamic files (based on a transitive relation) to ground the identity of dynamic modes of presentation, because there are no 'proper' dynamic files. Dynamic files only support weak CDJ, and weak CDJ is not a transitive relation.

The issue is far from settled, and I don't want to claim too much for my argument. But

one conclusion at least can be drawn : to proceed any further — to ask the questions that need to be asked in order to settle the issue — we need a framework which makes it possible to represent the stages and the dynamic operations on them. Stages are basic at least in that sense.⁷

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