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#### **Author**

Bullot, Nicolas J.

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# Object Files, Anchoring, Sortals and the Problem of Singular Perception

Nicolas J. Bullot (nbullot@interchange.ubc.ca)

Department of philosophy, University of British Columbia, 1866 Main Mall  
Vancouver, BC V6T 1Z1 Canada

## Abstract

What are the abilities that are to be taken into consideration if one wants to understand the performance of *singular perception*, i.e. the incremental perception and tracking of an object as the *same unique*, or distinct and numerically identical, object? This question formulates what one can term the Problem of Singular Perception (PSP), which presents both philosophical and psychological aspects. Section 1 introduces and formulates PSP. Illustrated by the visual tracking of a flying object which is difficult to identify sortally, section 2 outlines two distinct strategies which aim to resolve PSP, and which are often considered as incompatible approaches. The first strategy appeals to proto- or non-conceptual skills (e.g., visual object files or indexes) whereas the second concentrates on elaborate conceptual abilities (e.g., sortal-based identifications, perceptual inferences). In order to propose a framework for studying PSP and argue that non-conceptualist and conceptualist strategies are not mutually exclusive, this article brings together ideas from three fields that have traditionally been progressing in isolation from each other: the philosophy of reference; the philosophy of object perception; and the psychology of attention. Section 3 presents an ‘argument from updating’ that supports the use of the concept of *object file* – or, of *singular content* – to study PSP in an interdisciplinary framework. In addition, it provides the basis for a taxonomical classification of distal properties controlling visual files. While the research on visual object files seems to support a non-conceptualist approach to PSP (and thus to refute a *generalized* sortalist view), section 4 argues that the object-file framework offers both (1) a minimalist and non-conceptualist and externalist explanation to PSP based on the *perceptual anchoring* onto a particular distal object and (2) a hybrid conceptualist solution based on perceptual *inferences* which aim to produce judgments of demonstrative identification.

**Keywords:** singular perception; numerical identity; object file; binding problem; demonstratives; attention; anchoring; tracking; sortal; perceptual inference.

## 1. The Problem of Singular Perception (PSP)

To explain the nature of object perception, Dretske (1995), Evans (1982), Campbell (2002), Clark (2004), and Matthen (2005) tend to admit, *mutatis mutandis*, that *object* perception depends on establishing a direct, causal and informational relation with a set of external physical objects.<sup>1</sup> Such analyses tend to agree with a direct and externalist theory of object perception upholding that,

<sup>1</sup> In this context, the ‘physical object’ refers to a realist concept of object: that of any unique material body that possesses hierarchically organized and cohesive parts, (such as the body of a human agent, an artifact or a building), which exists independently of internal states of the perceiver and her perceptual systems.

essentially, perceptual content has to be defined *broadly*, i.e., with respect to external objects. For Dretske (1995) the perceptual link between the perceiver and the object depends on the informational function of the sensory systems. This function consists of representing properties instantiated in the perceiver’s environment. In this analysis ‘to perceive a physical object *x*’ is approximately equivalent to obtaining the descriptive content informing that the property, or feature, *F* of *x* is exemplified in the spatio-temporal region analyzed by some sensory system. There is, however, a problem nested in the attributive phrase ‘of *x*’. How are we to explain that the property *F* – for instance GLOWING – is perceived as being ‘*that of* the unique object *x*’ and not *that of* some other object *y* or *z*? Are there ‘singular perceptual states’ which would refer to a unique object, and which would operate as counterparts of names in language? These questions relate to what I term ‘the Problem of Singular<sup>2</sup> Perception’ (or PSP), which can be expressed as follows:

PSP: What are the (non-conceptual or conceptual) capacities that are to be taken into consideration if one wants to explain how a perceiver can perform *singular perception*, i.e. the perceptual individuation or identification of an object as the *same unique* (i.e., token-identical, numerically identical) object perceived at successive moments in time?<sup>3</sup>

PSP relates to the epistemic, pragmatic and emotional values of singular perception because singular perception of object *x* is necessary (1) for the acquisition of perceptual knowledge bearing strictly on *x*, (2) for performing actions that must be targeted to the ‘one and only’ individual *x* (e.g., a precious artifact, a particular person, a military target), (3) for having reactions accurately directed at the ‘one and only’ individual who deserves a particular emotional care such as your spouse and child. If one wants to resolve PSP,

<sup>2</sup> The epithet *singular* is used in the article to refer to the specific ability of tracking the target’s uniqueness/distinctness (i.e., its numerical identity).

<sup>3</sup> What is specific to PSP, as opposed to other problems akin to PSP such as the Parsing Problem (Spelke, Gutheil, & Van de Walle, 1995: 298-300), the Binding Problem (Treisman, 1996) or the Many Properties Problem (Clark, 2004: 447-51; Matthen, 2005: 277-82)? The problem refers to the study of the perceiver’s capacity to track or know the target uniqueness/distinctness determined by its token-identity or numerical identity (Evans, 1982; Locke, 1975 [1689]: Bk. II, ch. 27; Parfit, 1986: 200-4; Strawson, 1959: 31-8). This problem is not necessarily dealt with by works on object recognition, since recognition can be limited to recognition of type, instead of identification of tokens. PSP might perhaps be classified as logically subordinate to more general problems such as the Binding Problem.

an analysis of sensory perception as description of (general) property by perceptual representations<sup>4</sup> must be supplemented. This kind of analysis does not provide any explanation about how perception can latch onto a particular token, exemplifying a *unique* series of causal and relational properties, as well as a *unique* spatio-temporal path in the world. Yet there are reasons<sup>5</sup> to consider that object perception is jointly based on (1) an *anchoring function* such as the sensory-motor anchoring of the perceiver onto an individual objects and (2) a *descriptive function* such as the description of the properties of the perceived object.

## 2. Non-conceptualist and conceptualist views

Consider the revision of demonstrative judgments based on a hypothetical recognition of a visible target. Take the case of observers who look without the help of instruments at an object moving slowly in the night sky (cf. Fig. 1 below). The object seems to emit light but, like all celestial bodies, it is difficult to identify it without optical instruments. Suppose this object is subsequently proved to be a plane on its nocturnal flight. The plane is a luminous body when it moves at night, since there are lights on its wings and tail. In the darkness of the night, the observers on the ground looking at the object cannot be sure that they are reliably classifying it as member of the correct natural or artifactual kind. Following a long-standing tradition of studies on sortal<sup>6</sup> concepts, one can regard this puzzling classification as a problematic case of *sortal* identification. A sortal identification of an individual is its categorization as a member of one particular sort, or kind, of things. One of the observers can thus state successively the following judgments based on perceptual demonstratives: ‘This luminous object [*visual tracking of the luminous x*] is a PLANET or a STAR. No... it’s some thing else because it is moving quickly. It’s a FALLING STAR. No... it’s an AIRPLANE, because the light is flickering at regular intervals.’

*Prima facie*, in this sequence of statements, it seems that each judgment results from the combination of one relatively stable mental procedure with another which is relatively less stable. The procedure which appears unstable or uncertain is that of obtaining an elaborate sortal identification of the essential kind of the target object. The instability is revealed by the asserted or denied connection between the same tracked object and four different sortal

concepts. In spite of the problem of an unreliable sortal classification, the dynamic maintenance of *perceptual reference* to the object *x* does not seem challenged during the episode. Thus, in absence of the correct sortal and descriptive classification, some sensory-motor procedure might be reliable to secure the act of perceptual reference and to keep record of the fact that *this* is one single, unique and, enduring entity. However, how can the perceiver ‘implicitly’ access the ‘perceptible sameness’ of *x* without grasping the ‘sortal sameness’ of such *x*? Why would ‘perceptible sameness’ be strictly indexed on ‘sortal sameness’? These questions raise PSP.

The possible theoretical moves to analyze such an example, and to formulate a strategy aiming at resolving PSP, vary between explanations that emphasize the role of conceptual abilities and others that insist on the role of non-conceptual skills.

I will regard as a *non-conceptualist* approach or solution to PSP any account based on the idea that sensory-motor capacities or perceptual contents, make it possible for a perceiver to latch on to, or to track a target *x* as being the *same* (numerically identical) target *without* the help of complex conceptual, sortal or descriptive capacities. Such capacities must be able to perform anchoring of the perceiver onto the object *x* and provide perceptual reference to *x*, notwithstanding the fact that they fail to match some usual criteria of conceptuality<sup>7</sup>. Tracking skills would fail to match a usual criterion of conceptuality if, for instance, they could anchor the perceiver on to *x* without the mediation of an elaborate understanding of the ‘identity conditions’<sup>8</sup> of this object *x* – instead of tracing *x* over time and space on the basis of the understanding that *x* is a member of a kind parsed by a learned sortal concept (e.g., AIRCRAFT or STAR).<sup>9</sup> This type of anchoring might be exemplified by the visual tracking of an aircraft by the observer who cannot, in the situation of action, have the mastery of the sortal concept AIRCRAFT and cannot form the demonstrative belief that ‘This is an aircraft’ (either because the agent cannot correctly apply the concept given the characteristics of the

<sup>4</sup> See, e.g., Marr & Nishihara (1978), Dretske (1995).

<sup>5</sup> See, e.g., Pylyshyn (2003), Matthen (2005).

<sup>6</sup> After Locke, the idea of a sortal concept was introduced namely by P. Strawson (1959) as follows: ‘A sortal universal supplies a principle for distinguishing and counting individual particulars which it collects. It presupposes no antecedent principle, or method, of individuating the particulars it collects.’ (Strawson, 1959: 168). Grasping a sortal concept *F* enables the thinker to trace an instance *x* of *F* because understanding that *x* is an *F* supplies a tentative knowledge of the identity and persistence conditions of this individual *x*: the sortal can be used to reply to the question ‘What is it?’; cf., e.g., Hirsch (1997), Wiggins (1997; 2001), Carey & Xu (2001; Xu, 1997), Campbell (2002: 61-83).

<sup>7</sup> Criteria of conceptuality are given for instance by the purported properties compositionality, cognitive significance or reference determination; see, e.g., Laurence & Margolis (1999) and Gunther (2003) for their discussion.

<sup>8</sup> The notions of ‘identity/persistence conditions’ of a material object *x* refers to the material conditions that determine the identity or persistence of *x*. The traditional sortalist view – cf., e.g., Wiggins (1997; 2001) and Ayers (1997) for its critical discussion – holds that an understanding of the identity conditions of *x* (provided by the relevant sortal) is required for its determinate individuation and tracking. In Wiggins’ words, the making of identity judgments has to be thought of ‘as an extension of our practical capacity to single out things of a given kind and then, in the light of an understanding of the behaviour of things of that kind, to keep track of them’ (Wiggins, 2001: xiii).

<sup>9</sup> In other words, sensory-motor tracking skills would be non-conceptual if the sensory-motor anchoring did not hinge on a belief content that singles out the target *exclusively* via the descriptive specification of the target identity and its persistence conditions (e.g., the belief that is it an AIRCRAFT because it fulfils the description that it is a flying artifact with wings and a tail, etc.).

situation or because the concept is absent of his/her conceptual repertoire).

A *conceptualist* approach or solution to PSP is any account based on the idea that some conceptual and classificatory capacities allow perceivers to track the target of perception as being the same target. One possible directing idea of a conceptualist solution is that the ability to track the object of perception requires, typically, an *understanding* of the identity conditions (or the nature or essence) of the object to be parsed or tracked. According to a strong *generalized* sortalist solution to PSP, the key capacity to understand perceptual anchoring is thus conceptual *classificatory* abilities.

Although it is worth trying to combine them (see sect. 4), non-conceptualist explanations of PSP (Clark, 2004; Kahneman, Treisman, & Gibbs, 1992; Pylyshyn, 2003; Spelke et al., 1995) have to be distinguished from conceptualist explanations (Carey & Xu, 2001; Wiggins, 1997, 2001). Non-conceptualist and conceptualist solutions are often said to be incompatible (but see sect. 4). For instance, Wiggins (1997; 2001) upholds a generalized conceptualist/sortalist view, which is incompatible with a number of non-conceptualist accounts.

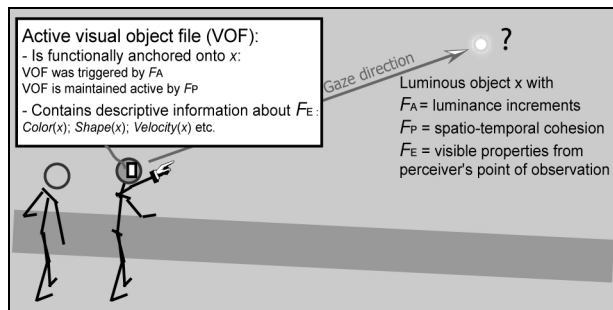


Figure 1 : Tracking a non-sortally identified flying object, the PSP and visual object file (see text for details)

### 3. Object files, file-controlling properties and the Argument from Updating

Plausible solutions to PSP can be based on a set of distinctions introduced by the *theories of object files*.<sup>10</sup> The general concept of file is used to express the idea that subjects store, accumulate and update information about individuals or objects in a 'mental repertory' called a 'file', which is a state exhibiting singular content that can be split (if its referent divides) or fused with another file (if two files happens to have a single referent). An object file is not only a mental state which possesses an intentional content, in the philosophical sense that it is 'about' or 'of' something else. In addition, it is specialized for tracing or tracking a *unique*

<sup>10</sup> The notion of *file* or *object file* in thought or language has been employed by, e.g., Bach (1987) and Perry (2001). The concept of *object file* in vision has been developed or discussed namely by Kahneman et al. (1984; 1992), Pylyshyn (2003), Henderson & Anes (1994), Carey & Xu (2001) and Mitroff, Scholl, & Wynn (2005). Bulot and Rysiew (2005) suggest extending the use of this notion in relation with the problem of tracking the uniqueness of intentional agents.

object – it is a *singular* mental state such as the representation of an individual in working or long-term memory.

Why is the theory of object files relevant for resolving PSP? The argument I suggest is based on the notion of updating or reviewing specific to incremental perception. The main problem to resolve PSP is to determine the nature of the capabilities that can keep track of a unique physical object *in spite of its property changes*. For objects undergo many different types of changes (such as changes in their visible surfaces or their spatio-temporal location), which are especially salient in contexts of discontinuous perceptual encounters. The notion of an object file is thus relevant here because it refers to a cognitive system that has the function to track or trace a *changing* physical element and perform the relevant internal updating or reviewing operations. The concept of object file is thus a placeholder for that of *updating system* (or updating state with singular content).<sup>11</sup> For this reason, it is not surprising that several accounts of PSP and other analogous problems concerning tracking individuals are dealt with the notion of *file* or *object file*. This notion is one of those rare concepts considered to be explanatorily relevant simultaneously by semantic theorists of mental and linguistic reference – e.g., to resolve the problem of empty names (Perry, 2001: 123-72) – and by psychologists of perception (Kahneman et al., 1992).

In the psychology of vision, several authors have hypothesized that the visual system uses temporary object files for tracking and identifying objects.<sup>12</sup> *Prima facie*, there is a striking similarity between the psychological hypotheses about visual files and the philosophical notion of 'file' used in causal theories of names (Bach, 1987; Perry, 2001). Both accounts (1) are object-centered approaches of mental reference (Kahneman et al., 1992: 178) and (2) share conceptual claims about the organization of the representation of individuals. Nonetheless, the roots of the psychological tradition (Kahneman & Treisman, 1984; Kahneman et al., 1992; Treisman, 1992) differ from those of

<sup>11</sup> The argument from updating holds for the concept of visual object file. Visual object files are *updating* systems that are responsible for the evolution of incremental singular representations. According to Kahneman et al. (Kahneman et al., 1992: 179), a object file allows an observer to gain knowledge about an individual object because it carries out the three following updating procedures, constitutive of visual object tracking. (1) A *correspondence operation* determines, for each object in the scene, whether it is 'new' or whether it is an object recently perceived, now at a different location. The system uses spatio-temporal information to determine whether a given element is (or refers to) a new object or if it is *the same* object which moved from a former location to a new place. (2) A *reviewing process* retrieves the characteristics of the initial object, no longer in view. (3) An *impletion process* uses simultaneously currently available information and retrieved information to produce a conscious percept of a newly appearing object or of the displacement of previously seen object. Each visual file is maintained active as long as the target object is visible in the visual field, and could be destroyed a short time after its disappearance from the visual field.

<sup>12</sup> Cf., e.g., Kahneman & Treisman (Kahneman & Treisman, 1984; Kahneman et al., 1992), Pylyshyn (2003), Yantis (1998).

the philosophical tradition in at least one important respect: in psychology, the theoretical construct of *visual object file* appears as a rather non-conceptualist solution to PSP (and thus goes against generalized sortalism) because it refers to a temporary visual representation which can track a persevering object in the visual field *without* the use of sophisticated conceptual or descriptive contents.

D. Kahneman and A. Treisman (Kahneman & Treisman, 1984; Kahneman et al., 1992; Treisman, 1992) have introduced in psychology the concept of an object file as a temporary representation, within which successive states of an object are linked and integrated. They suggest that the main result of processing visually a particular scene is to construct a set of separate (visual) object files. An object file is a mechanism of visual attention whose function is to store information about an object in the visible scene. It is responsible for the *perceived continuity* of the seen object (Kahneman et al., 1992: 177). In contrast to the causal theorists of names (Bach, 1987; Perry, 2001) in which object files are storage mechanism of long-term recognition networks, Kahneman and Treisman hypothesize that the construction of object files can be independent of long-term visual recognition and long-term beliefs.

I will henceforth concentrate on the contribution of the file theory for the debate between non-conceptualist and conceptualist/sortalist approaches to PSP. I need first to sketch a taxonomical classification of the properties that can exogenously trigger and control a file (cf. Fig. 1). A first group of properties encompasses the properties governing the *initial anchoring* of a file (henceforth abbreviated ' $F_A$ '), which cause the visual indexing of an object (Pylyshyn, 2003) and the opening of a visual object file (in Kahneman's and Treisman's terminology). This procedure is exemplified by the exogenous capture of visual attention. It can be said that an intentional agent  $A$  is initially anchored onto a physical object  $x$  if and only if:

*File Initial Anchoring:* A direct relation occurs between (1) a set of  $x$ 's properties ( $F_A$ ) and (2) the perceiver's visual mechanisms of attentional capture and multimodal anchoring.

The detailed specification of the properties responsible for the initial visual anchoring of visual attention is an open empirical question, which relates to the debates about automaticity and attentional control – cf., e.g., Yantis (1998) and Folk & Gibson (2001). For instance, it is known that abrupt visual onsets capture attention. Possible mechanisms for explaining this phenomenon include a luminance-change detection system and a mechanism that detects the appearance of a new perceptual object (Yantis, 1998; Yantis & Hillstrom, 1994).

In addition, one must distinguish the former group of properties from the properties of *sustained maintenance* of the visual file, which correspond to the continued visual tracking of the object. These properties play a causal role in the persistence of a visual object file. An intentional agent  $A$  tracks visually a physical object  $x$  in a situation  $\sigma$  if and only if:

*File persistence:* There is a relation maintained between (1) a set of persistent properties ( $F_P$ ) of  $x$  and its surrounding situation  $\sigma$  and (2) the visual processes ensuring  $x$ 's dynamic visual tracking in spite of disturbances during movements and actions (e.g., the maintenance of perceived continuity during occlusions or saccades via trans-saccadic integration).

It is likely that the properties that cause the initial anchoring on to the object of visual attention ( $F_A$ -type) are different from those ( $F_P$ -type) which make it possible to maintain an open file for the same object in spite of temporary occlusion.

A third group includes the *properties* (henceforth abbreviated ' $F_E$ ') which are *encoded* in the visual object file during the performance of perceptual tracking. They can be expected to causally determine the content of visual experience. They are properties or features of the object about which internal states of the file deliver information to visual working memory or conscious visual experience. These internal states of the file are vehicles for an intentional and descriptive content and serve as descriptions of the properties which are available for further cognitive processing. In this analysis, an agent  $A$  encodes visually information about the properties ( $F_E$ ) of a physical object  $x$  if and only if:

*Encoding in a file:* The internal states of an object file referring to object  $x$  (in perceiver  $A$ 's visual system) accumulate descriptive information (e.g., perceptual predicates) about features or properties ( $F_E$ ) of  $x$ .

This notion of property encoding is helpful for distinguishing the 'contents' of a file. In philosophical terms, a visual object file has an intentional content; it refers to, or is *about* an external individual, which is the *broad* content of the file. However, the object file is not identical with its referent. The *content* of the visual file is a *narrow* (i.e., dependent on an observer and a point of observation) and presumably *descriptive* intentional content.

#### 4. Resolving PSP in the object file framework

Even though an active visual object file does not necessary entail the complete demonstrative identification<sup>13</sup> of its referent, it nonetheless singles out one unique individual via the initial and sustained anchoring onto its referent. This means that the file's capacity to track uniqueness is not dependent on a conceptual capacity to understand the identity or persistence conditions of the object. Such capacity to track uniqueness thus remains 'implicit'. However, if an elaborate recognition or identification of the object happens on the basis of visual information, it *must* be on the basis of information contained in the file.

<sup>13</sup> 'Demonstrative identification' is meant in the philosophical sense – examined namely by Strawson (1959), Evans (1982), McDowell (1990) or Peacocke (1991) – of an identification judgment in which the perceiver is able to *discriminate* the object of her thought from any other object, including from other objects of the same kind.

Consequently, it can be said that the properties encoded in the file correspond to the 'proto-identification' of a target, which is necessary for (but not equivalent to) more elaborate forms of perceptual recognition and identification.

The distinction between the three groups of properties ( $F_A$ -,  $F_P$ - and  $F_E$ -types) refines the idea that the visual content depends on both anchoring routines and descriptive operations. The anchoring component is based on initial anchoring and file persistence (controlled by  $F_A$ - and  $F_P$ -types properties), and the descriptive component corresponds to the internal states which describe the encoded properties ( $F_E$ -type). Descriptive information is based on a temporary intentional content that may lead to the proto-identification of the object, and then eventually to its recognition and complete demonstrative identification. The conditions of initial anchoring onto an object (depending on the occurring relation to  $F_A$ -type properties) and of the file persistence (depending on the relation to  $F_P$ -type properties) contribute to the *object-based perceptual anchoring*. It seems to be necessary for the formation of the singular content of perception, but it does not imply the instantiation of a descriptive visual content.<sup>14</sup>

Objecting to the claim that non-conceptualist and conceptualist solutions to PSP are mutually exclusive, I suggest that at least two solutions to PSP can be outlined in the file theory. The first such solution comes from the fact that a visual file (or index) permits the *implicit* tracking of an object's identity. This is a *non-conceptualist*, externalist and minimal solution to PSP. According to file theory, the initial anchoring onto an object  $x$  and the persistence of the file are constitutive of the non-epistemic, or non-doxastic, tracking of  $x$ . This visual tracking is performed via a mechanism that requires neither the use of encoded descriptions of  $x$ 's encoded properties ( $F_E$ ) nor the understanding of a sortal concept. This explanation is possible since initial anchoring and file persistence are primarily controlled by causal and spatio-temporal properties of the target object. These spatio-temporal properties may be, for example, the properties of an object's abrupt appearance for the initial anchoring, and the properties of spatio-temporal continuity/cohesion for the persistence and maintenance of visual tracking (Fig. 1).

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<sup>14</sup> This analysis avoids thus the risk of circularity present in the explanation of the anchoring of a representational content by means of a representational content. The initial anchoring determined by the automatic and exogenous capture of attention by the appearance of a new object in the visual field can depend on anchoring properties (of  $F_A$ -type) of which one has no reason to consider *a priori* as been identical to the properties which are encoded in the object file and are constitutive of the narrow content of the visual experience – and which belong to the  $F_E$ -type. As a result, functional anchoring can occur without prior knowledge of the agent about the situation or the target. Perceiving completely new objects is not a problem in this account. (Perceiving a completely new object is a problem for the theories that claim that perceptual individuation depends on *prior* conceptual knowledge because perceivers do not possess knowledge about completely new objects – cf. Kahneman et al. (1992), McDowell (1990), Peacocke (1991).)

This explanation can be applied to the example of the visual tracking of an aircraft previously noted (Fig. 1). The properties which determine the opening of a visual file and the initial anchoring of the visual states on to the tracked aircraft are luminance increments (caused by the lights on the aircraft). The properties that determine the persistence of the object file are the spatio-temporal regularities of the light pulses. The encoded properties give rise to the visual experience of a moving object in the sky. When the perceiver speculates on the object's sortal identity, she relies on the maintenance of the visual reference guaranteed by the visual object file. The perceiver ascribes successively, by a series of predicative acts, different kinds of descriptive properties to the target object, which may be about the identity conditions of the tracked object. Yet, in the minimal case, the visual tracking is performed independently of the cognitive use of the descriptive information. Indeed, the basic operations performed on the visual files, such as file splitting and file fusion are performed on the basis of spatio-temporal constraints and Gestalt principles, independently of the perceiver's conceptual understanding of the situation.

In philosophical terms, the spirit of this minimal explanation is *externalist* because it explains perceptual tracking by means of a relation of causal dependence between the visual states and the object in a manner which does not depend primarily on the encoding of an *internal* representation/description instantiated in this system (such as the descriptive states about the encoded properties). It presents a case where the perceiver tracks the same object dynamically, but only in an implicit way, by exploiting external spatio-temporal information which depends on the objective fact that it is actually the same object which follows a continuous spatio-temporal trajectory.

A second solution to PSP afforded by the notion of (visual) object files is what might be termed a 'hybrid' solution. It refers to the possibility of keeping track of an object's identity by means of a *cognitive* tracking (accessible to conscious revision), which rests on the articulation of perceptual anchoring, proto-identification and memorized information. This is a solution in which the tracking of identity operates by means of concepts understood as internal and memorized descriptions. In this type of case, the perceiver can use the kind of information associated with an understanding of the sortal identity of the object to infer whether *this* thing is the same as *that* thing. The perceiver would use (1) the information about encoded properties in an object file for the perceptual inferences on which visual attention is anchored functionally and (2) a comparison carried out between the encoded information in the visual file and the memorized knowledge needed in order to recognize it, or to draw the epistemic inference, *that* the file is (or is not) about the *same* individual.

In the example of aircraft-tracking above, one can assume that the visual tracking of the flying body is carried out merely via the perceptual anchoring provided by a visual object file. However, when an observer has demonstrative thoughts and attempts to reach a sortal identification of the object, the situation is different since the observer uses the information about the encoded properties to classify the tracked object. In addition, when an observer says, 'It's an

airplane, because the light is flickering at regular intervals', and reaches a correct sortal identification, he or she is using the file-encoded information about the spatio-temporal regularity of the light-emitting behavior of the flying body as a clue to both its sortal and numerical identity. The agent's reasoning here might be: only an artifact could exhibit this kind of spatio-temporal behavior, and this spatio-temporal behavior matches that of the entities subsumed under the (sortal) concept AIRPLANE.

Far from being exclusive, the minimal explanation and the composite explanation seem thus complementary if one seeks to account for the capacity to keep track of the individuals in *both* perception and thought – and to give an analysis of varieties of attentional strategies to resolve PSP.

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