

Introduction

It is a widely held view that perception is a kind of representation of external objects, events and their properties. In perception we gain access to features of our environment. Perception provides us with information about the environment and it guides successfully our interaction with external objects. Perceptual states are therefore about something and have a representational (or intentional) content. Intentionalism, the view that perception is a representational state, is shared by many philosophers, although not uncontroversial, as shows the growing debate about relationalism. Less broadly shared is a consistent explanation of the representational status of perception. How can we explain that perception represents something? Several explanations of what makes perceptions representational have been given and the debate is still not closed concerning what the best explanation may be or even if there is any possible explanation of this representational status. In this paper I will mainly try to clarify what is meant by the attribution of such a representational status to perceptions and why philosophy of mind and the cognitive sciences concur to attribute this status to perceptions. I will not decide here if the intentional view should be accepted or rejected, but I want only to clarify what this view implies and commits us to. Furthermore I want to examine if there is one unitary conception of the intentional view of perception, or if different disciplines (philosophy of mind, psychology, the neurosciences) mean different things with the claim that perception is a form of representation.

When we say that perception is a representation, about which specific states are we speaking? (1) It has to be cleared first what we mean by perception and to which states we attribute a representational status and representational content. To answer this, I will delimit perception from other mental states which seem to share with them the property to be *about* something. I will also delimit perception from other representational states which are not mental. (2) Then I will consider the concept of representation used in the philosophy of mind, especially in the representational theories of the mind. (3) I will show how this concept of representation was then applied to the special case of perception. (4) I will compare this concept of perceptual representation to the one used in the psychology of perception. (5) Finally I will state the main challenges which are raised against the intentional view of perception in psychology and philosophy, although I cannot discuss here the possible answers to these challenges. The aim of this paper is to state the position and the problems of the intentional view of perception and to clarify the concept of representation as it is used in the content view.

1. Perception: A conceptual clarification

We have different sensory systems which provide us with information about the external world. The sensory systems register through some sense organ a physical stimulus which impinges on some receptor, e.g. the light on the retina. The physical stimulus is itself caused by some external object or event. The sensory receptor "transduces" the stimulus into an electrical impulse of the nerves. Different stages of cognitive processing in the sensory areas of the brain lead finally to a perceptual state, which is generally described as a conscious perceptual experience. Traditionally perception has been identified with this conscious output: a conscious perceptual experience with its specific phenomenology. The conscious experience can furthermore be used and modulated by

higher cognitive functions. Attention can more or less be directed to the experience or to specific parts of it, through categorization the experience can be classified under different concepts and through perceptual judgments the perceptual experience is used in reasoning and linguistic utterances. Although we have the immediate intuition of a perceptual experience with its qualitative aspects, the psychology and the neurosciences of perception present us with a far more complex process which begins with the physical stimulus and ends with the use of perception in higher cognitive processing. When psychology or the neurosciences speak about perception, their investigation is not limited to the conscious output of perceptual processing, the phenomenology of perception. Before giving a definition of perception, I will draw some distinctions: first, between processes in the sensory systems and phenomenal experience and second, between phenomenal experience and representational content.

We can distinguish in the case of perception between phenomenal experience and the larger perceptual processing in our sensory systems which describe how that experience is caused and how it is used in further cognitive processing. Mostly, this perceptual processing is not conscious and we are only aware of some aspects of it, namely its results in conscious and phenomenal experience. Phenomenal experience is defined by the *qualitative character* of our conscious states. It is generally described by "what it is like" to have that experience, e.g. what it is like to see something red. Perceptions, emotions, feelings and moods are distinguished from other mental states (thoughts, beliefs) by this phenomenal character, the fact that it feels a certain way to have them. All such states which have a phenomenal character are states of our phenomenal consciousness (Block 1995). Traditionally a further distinction was made about perceptual experience, that between sensations and perceptions properly. Sensations were conceived as the simple qualitative building blocks out of which were built more complex perceptual experiences, e.g. the experience of objects or scenes. Because it was thought that in sensations we have only the feeling of simple qualities and no representation of external objects, the concept of perception was restricted only to these more complex perceptual experiences (of objects, scenes). Only the latter was conceived as a perception of external states, while sensation was seen as an inner qualitative feeling which was not about something external.

From the phenomenal character of perception we have to distinguish *the representational content of perception*. My thoughts, beliefs, desires and generally all propositional attitudes represent something, namely what is expressed in their "that"-clause. If I believe that tomatoes are red, then "tomatoes are red" is the content represented by this belief. Such mental states can represent something without feeling a certain way, i.e. without a phenomenal character.¹ We do not need to be phenomenally conscious, to have the qualitative feeling of "what it is like" in order to have representations. Equally in the case of perceptual experience, we have to treat separately the question of the phenomenal consciousness of perceptual experience from the fact that they represent something. Although representationalists suppose that the phenomenal character of an experience is explained by its representational content (Dretske 1995, Tye 1995, Lycan 1996), they do not identify phenomenal character and content. For them also, there are mental representations without phenomenal character and representation has to be explained by

¹ Some philosophers defend the position that believing something has also a phenomenal character. It feels like something to have the belief attitude toward a content. Owen Flanagan first proposed that view (Flanagan 1992: 65), which has been taken over by a whole research program on cognitive phenomenology (see Bayne and Montague, 2011).

something else than phenomenal consciousness.² It is certainly an important problem to explain how representation and phenomenal character are connected, but as a first step, these two aspects of perception have to be kept separate.³ Here, I will limit myself to an explanation of the representational status and content of perception without trying to explain their phenomenal character.

Although we should separate the phenomenal character from the representational aspect in perception, it might still seem that we can pick out perceptual states only through phenomenal consciousness. Traditionally philosophy made such an identification of perception with conscious perceptual experience, but there are strong reasons not to limit perception to conscious, phenomenal experience and to look at the larger perceptual processes described by the sciences. The phenomenology of perception is therefore not sufficient for a definition of perception. The main reasons for this are such phenomena as blindsight (Weiskrantz 1986) and the dual process theory of vision (Milner and Goodale 1995/2006).

Both phenomena show that we can use perceptual information in our behavior and guide our actions in accordance with the properties represented by this perceptual information without being phenomenally conscious of that perceptual information. Weiskrantz showed in his experiments that people without a perceptual experience of certain areas of their visual field still perceptually represent information about this blind area. When forced to attribute a color to the visual area they cannot (consciously) see, they still give with a high probability a correct answer about the color. Goodale and Milner showed that only a part of visual processing is used for the conscious representations in visual experience (this processing for conscious representation is done in the "ventral stream" of the visual brain). The guidance and control of action heavily relies on visual information which is not conscious (and which is processed in the "dorsal stream" of the visual cortex). People with damage in their ventral stream and therefore with blindness or heavy impairment of their visual experience can still accurately guide their behavior towards objects they cannot consciously see. In forced choice tests in which they are pushed to grasp into their invisible environment, they correctly reach an object in front of them. This grasping movement cannot be explained if we do not attribute the use of visual information to these people.

These cases show that people still have perceptual representations (of color, object distance, object size or shape) without perceptual experience i.e. phenomenal consciousness of these representations. They still use these perceptual representations in their behavior without being conscious of them. Cases like these show that we cannot identify perception with perceptual experience i.e. with the perceptual states we are phenomenally conscious of.⁴ A theory of perceptual representation should not exclude such cases where there is no phenomenal experience. Perception and perceptual representation extends beyond phenomenal experience. We have perceptual states which are conscious and others which are not.

² Representationalism claims that the phenomenal character of a mental state supervenes on the representational content of that state. Opposed to that view, the philosophers who defend the position of "Phenomenal Intentionality" (Horgan and Tienson 2002, Kriegel 2013) want to explain intentional (or representational) content by phenomenal consciousness. Representationalism has to be distinguished from intentionalism, see footnote 8.

³ See Chalmers (2004), for the relation between phenomenal character and representational content.

⁴ For a similar position, see Brogaard (2011), Prinz (2010 and 2015).

I distinguished earlier the mostly unconscious perceptual processing in our sensory systems from phenomenal perceptual experience. The perceptual processing in the sensory systems has perceptual experiences as its output, but is much more extended than the states we are conscious of. What are then the perceptual states we are talking about when we do not want to limit perception to conscious perceptual states? Are these all states between the stimuli and the higher cognitive functions (belief, action) using perceptual information. Some philosophers situate perception more closely to the stimulus (Dretske 1969 and 1995) and some assimilate it more to the higher cognitive processes, to conceptual classification (McDowell 1996) or perceptual beliefs (Armstrong 1968). It seems somewhat arbitrary where to situate perception. Are all states of the complex processes in the sensory systems and all their output perceptual states? Should therefore all these states have a representational content, if the intentional view of perception is true? Obviously we must constrain somehow which states are classified as perceptual states. Here I will follow some attempts to define perceptual states by their functional role, as this has been attempted by Dretske (1978).

Perceptual states can be delimited (1) by their etiology, by what causes them or what normally causes them. Here perceptual states should have some causal relation to external stimuli. (2) Perceptual states can be delimited by the function they have. Here perceptual states are supposed to serve some other cognitive or psychological mechanism, e.g. by providing for this mechanism some information about the environment. So, perceptual states can be defined by their functional role, by the causal relations to their input and output.

(1) By perceptual states we mean some neurophysiologic state of the sensory systems, e.g. a firing rate of some neuron in the visual sensory system (visual brain). A lot of states in these systems do not carry any information about external conditions.⁵ They have a different physiological function and do not vary with any changes in the environment. Therefore only such states which do vary or which usually vary with external conditions, which therefore carry information about these conditions or have the function to carry such information can count as perceptual states. Perception cannot be restricted to states which *actually* vary with some external condition, because that would make perceptual illusions and hallucination impossible i.e. seeing a property or an object which is not there. There must be the possibility for perceptual states which seem to indicate some external condition although there actually is no such external condition. But generally we can say that this etiological condition for perceptual states fits well with the way neurophysiologists study perception by looking at those neurons which vary with a certain external stimulus presented to the tested individual (Hubel 1995).

(2) There may be some states of my body which vary with external conditions, but which would hardly be considered as perceptual states. For example states of my respiratory system may vary with the condition of the atmosphere; my lung may register poor oxygen in the atmosphere. A scientist could even "see" by looking at my lung that the atmosphere is poor in oxygen. It would indicate that external condition to him. But as this state of the lungs is not a state of any of my sensory systems, this would not fulfill the previous etiological condition.

But there can be similar cases in our sensory system. For example the rhythm of internal organs of the body is regulated by day/night cycles, the circadian rhythms. These rhythms adjust to external conditions by using external cues, called "zeitgeber". The light conditions are detected by the retina

⁵ I limit my investigation to external perception i.e. to the perceptions of conditions outside the body. I will explain this pragmatic limitation later on in this section.

and sent to the brain (to the suprachiasmatic nucleus in the hypothalamus). From there, this information is sent to different bodily organs which adjust to this cue. The states in the retina and in the brain vary with external conditions (intensity of the light) and at least the state in the retina is part of my visual system. But it would be strange to call this case of regulation by circadian rhythms a case of perception. The state which carries information about some external stimulus must serve some specific *psychological* system to be a case of perception. Dretske (1995), following Evans (1982), thought that a mental state must serve as input to some concept-using and reasoning system, contrary to non-mental natural representations i.e. states, like those of a "zeitgeber", which carry information and are used by non-mental systems of the body.⁶

In an earlier attempt to define perception, Dretske thought that a state, to be perceptual, must make "stimulus information" available not to a part of a system, but to the system as a whole (the whole organism) (Dretske, 1978). A state which fulfills the right etiological conditions is a perceptual state, if it serves the desires, needs and the behavior of the organism as a whole and not only some sub-system of the organism. If we look at the dual process theory of vision, it is not appropriate to define perception as the input to only one specific psychological system or mechanism (for example only as the input for central and conceptual processing, i. e. the "reasoning system"). Some perceptual states directly serve the guidance of action without the intermediary of a reasoning and concept using system. They serve a specific sub-system (action) without being accessible to other psychological systems (conscious experience). In this sense they do not serve as input to the organism as a whole.

There is a further reason, why it is preferable not to restrict perceptual states to the states which serve as input to some central processing system, generally conceived as a conscious concept-using and reasoning system. The standard conception of the mind subdivides it into perception, central processing and action. Every perception is considered as an input to central processing and every action follows from central processing. This picture has been strongly criticized as the "sandwich-picture" or the "input-output picture" of the mind (Hurley 1998, Bermudez 2005). It is better to avoid this traditional view of the mind.

I will therefore give the following definition of perceptual states: Perceptual states are those states of our sensory systems which are normally caused by some external stimulus and which serve *some* mental function or *some* psychological mechanism (e.g. cognition, guidance of action, emotion).

A further distinction is necessary to delimit perception from higher cognitive processes. *Perceptual states are distinguished from perceptual judgments and beliefs.* We can have a percept without forming a corresponding perceptual judgment. Furthermore the content of beliefs and judgments is composed of concepts. Beliefs and judgments have therefore a conceptual content. This needs not to be the case for perceptual content. Although conceptualism identifies the content of perceptions with conceptual content, this identification is highly debated and contested (see Kelly 2001 for the arguments against conceptualism) and many philosophers defend the position that perception has a non-conceptual content (Dretske 1995, Tye 2005). But even if conceptualism is accepted, it is recommended to keep the distinction between perception and perceptual judgments.

As the previous discussion showed, we cannot identify perception with phenomenal experience. Still we have a phenomenal experience of a lot of our perceptual states. The question has been

⁶ Fodor (1983) also defines perception as an "input system", meaning by that an input to central symbolic processing.

raised how far perception extends into our phenomenal experiences. Is the feeling of pain a perceptual experience? Are emotions cases of the perception of bodily states (see Prince (2004) for a perceptual theory of emotions)? How far can the concept of perception be applied to the consciousness of inner states? I cannot answer these questions here and for pragmatic reasons, I will limit my investigation to so called external perception i.e. the perception of objects, events and properties outside of our body, the perception of the environment. The distinction is not always sharp and has to be somewhat softened where the perception of external objects relies partially on information about the body. The distinction is only pragmatic and I do not want to suggest an essential difference between the perception of internal states of our body and the perception of external things. I will not discuss here, how far the concept of perception can be applied to inner states and how far proprioception can be extended, from the unproblematic cases of the perception of the position and movements of our limbs to emotions or higher mental states (see perceptual theories of emotion and of consciousness i.e. the higher order perception theory of consciousness). Equally, I will not address the question how far the intentional view of perception can be extended to internal perceptions.

2. The Representational Theory of the Mind and the Concept of Representation

After this delimitation of perceptual states, I want to address the question why many philosophers consider that perceptual states are representational states. But to address this question, I will consider first and more generally the appeal of the representational view of the mind, of which the representational view of perception forms just one part. The *Representational Theory of the Mind* (RTM)⁷ claims that all mental states are representational states. It can be seen as a restatement of the Brentano thesis (Chisholm 1957) that intentionality is the mark of the mental.⁸ But contrary to Brentano and Chisholm, the Representational Theory of the Mind tries to explain representation in a naturalistic framework. Brentano (and Chisholm) explained intentionality as a relation between a representation (some psychological state) and its content, the intentional object of the representation. Brentano considered the intentional object to be a non-existent object.⁹ As every physical relation presupposes the existence of its relata, the intentional relation could not be in his view a physical relation. For Brentano and Chisholm mental states as intentional states were therefore non-physical. Contrary to this claim, the Representational Theory of the Mind wants to give a naturalistic (or physicalist) explanation of mental representation.

The Representational Theory of the Mind was originally a "happy" combination between the mental states folk-psychology attributes to us and the computational conception of the mind developed by the cognitive sciences.¹⁰ Let us look first at the mental states folk-psychology intuitively attributes

⁷ See Fodor (1985).

⁸ I consider the terms "representational" and "intentional" as equivalent. Every state which has intentionality is a representational state and every representation has intentionality. Still, it is useful to distinguish "intentionalism" from "representationalism", intentionalism being the general claim that mental states have intentionality, "representationalism" being a more restricted claim about consciousness which states that the phenomenal character supervenes on intentional content. I will only discuss intentionalism in this paper. Intentionalism was initially introduced and discussed under the name "Representational Theory of the Mind", so I will use here also the older name.

⁹ Brentano (1874/1955: 124-25).

¹⁰ It seemed a "happy combination" in the sense that our folk-intuitions seemed to give support to the scientific theory and because the scientific theory seemed to explain folk-intuitions. On this "happy" combination, see Ramsey (2007: chap. 2).

to minds. We explain the behavior of people by attributing to them mental states like beliefs and desires. Someone goes to see a movie because he believes the movie *M* is playing now and he desires to see the movie *M*. We have also the intuition that these mental states can be evaluated. They can be correct or true in the case of belief or fulfilled in the case of desire. Such folk-psychological notions as beliefs or desires are generally analyzed as propositional attitudes. The belief is a certain attitude toward the proposition expressed by the sentence "the movie *M* is playing now", for example. This sentence expresses the content of the belief. The sentence and the proposition expressed by it have semantic properties. The proposition means something, refers to certain states of the world and has truth conditions. The proposition is true if my movie theater actually is playing *M*. These semantic properties of the proposition, and therefore of the belief, can explain the intuitive evaluation of beliefs which take place in folk-psychology. We evaluate beliefs as correct or incorrect, as true or false and they are true or false because they have a semantic content which specifies truth conditions. As we have similar intuitive evaluations of our perceptions, as we also consider some of them as accurate and others as inaccurate, the representational theory of the mind suggests an explanation of our intuitions about perceptions on the model of the explanation of beliefs or other propositional attitudes.

Far back in the history of philosophy, we can find theories which defend that mental states represent something because they have a content. And we can find the analysis of folk-concepts like beliefs and desires in terms of propositional attitudes since Russell (1921). But the Representational Theory of the Mind as it was developed by Fodor (1980 and 1985), Field (1978) and Dretske (1981 and 1988) combined this analysis of propositional attitudes with the computational conception of the mind developed in the cognitive sciences. This conception explains mental processes on the model of computation. A mental process is composed of physical symbols and syntactical rules which specify how the symbols are combined, manipulated and transformed. The syntactical rules only take into consideration the physical properties of the symbols, their intrinsic properties. The rules indicate how a symbol with certain intrinsic properties (a symbol of type A) is to be transformed in a symbol with other intrinsic properties (symbol of type B). Such a purely syntactical computational description could explain how a belief follows inferentially from other beliefs by just giving the rules about how tokens of symbols are transformed into other tokens of symbols.

But such a description does not take into account any semantic properties of the symbols i.e. what these symbols might mean or refer to. The advantage of this computational theory is that the physical implementation of such symbolic processing is no mystery and is already realized at a certain level of complexity in computers. The disadvantage is that the theory ignores the semantic relations mental states seem to have to external events or objects. We do not just want to know how arbitrary symbols are transformed, but how beliefs *about* X are transformed into beliefs *about* Y, how for example a perceptual state *about* physical stimuli is transformed into a perceptual state *about* a 3-dimensional object. The Representational Theory of the Mind combines the computational theory with the idea derived from folk-psychology that mental states have semantic properties, that they mean and represent something. For the Representational Theory, the symbols of the computational theory have these semantic properties. They are the vehicles of

representation. This representational view explains mental processing computationally and needs an additional theory to explain why symbols represent and what they represent.¹¹

We saw already how the Representational Theory of the Mind analyzes mental representations like beliefs or desires. But we have to address now more specifically which concept of representation is used in that theory? Representations are states which have content. Pictures, maps, linguistic expressions are representations and they have content. Their contents are the properties or objects represented by them. Contrary to these external and *non-mental* representations, we can characterize beliefs, mental images, perceptual states as *mental* states which have content.

In a representation we have to distinguish between the *vehicle of representation*, e.g. the physical image (photo) or a neural state in the brain, and what is represented by that vehicle. We have therefore also to distinguish between the properties of the vehicle and the properties represented by the vehicle and given by its content. A black and white photo of a person has the property to be two dimensional, to be made of paper with black and white areas on its surface. These are the properties of the vehicle of representation. But the represented properties are for example the properties of a person (legs, hands, face etc.), properties instantiated by the represented person. Sometimes the properties of the vehicle and the properties represented by the vehicle are confused. It is not the case that when we represent a red object, there must be some mental state which has the property "red" (a mistake sense-datum theorists often made) (Harman, 1990).

When I speak of the *representational content*, I refer to what is generally meant by intentional content, i.e. the content given for a state which has intentionality. Representation is here used synonymously with intentionality and we can define representation by the features of intentionality. Chisholm characterizes all "psychological phenomena" by intentionality, what he calls also "relation to a content" (Chisholm 1957: 168). He gives essentially two criteria for intentionality (Chisholm 1957: chap. 11)¹²:

(1) The *power to misrepresent*. The content of intentional states may refer to something which does not exist. Intentional states have therefore the power to misrepresent, to indicate something which is not the case. From this property, it follows for any intentional content, that we cannot existentially quantify over statements which express this content. Let us take for example some ascriptions of belief: "Peter believes that the king of France is bald", or "Peter believes that the Queen of England is married". From the truth of these sentences we cannot conclude that there exists an X which is king of France and bald or that there exists a Y which is queen of England and is married. There is failure of existential quantification over the intentional content. The same is the case for perceptual states: "I have a visual experience of a white rat" does not imply "There is a white rat". My experience of a white rat may be an illusion or a hallucination.

(2) *Intensionality*. In an intensional context (in a that-clause expressing the content of a belief, for example) the substitution of co-referential terms does not preserve truth. In these contexts not only the extension of the terms, but also their intension plays a role for the truth of the proposition. In the case of intentional states like propositional attitudes, this criterion for intentionality applies easily. They have a propositional content and propositions are composed of concepts which have an intension. It is less easy to see how this second criterion may apply to the

¹¹ For a good description of the combination of the computational theory with the representational view about mental states, see Sterelny (1991: chap. 2) and Ramsey (2007: chap. 2).

¹² We give these two "marks of intentionality" the names they have now usually in the literature. Chisholm did not give them these names. But we follow Chisholm in his description of these "marks" or criteria of intentionality.

content of perception. What may be co-referential terms in the case of perceptual content, if we suppose that perceptual content is not conceptual?

A representation must at least show one of these "marks of intentionality" to be qualified as a representation. In the philosophy of perception mainly the power of misrepresentation has been emphasized as criterion of perceptual representation (Dretske 1986, Tye 1995: chap. 4). I will take this first criterion as the essential one to define the intentionality of a mental state. I turn now to the question how this concept of representation applies to perception.

3. Perceptual Representation

The representational theory of the mind was originally developed to explain the semantic properties of the propositional attitudes, but it was then extended to perception (Searle 1983, Dretske 1986 and 1995, Matthen 1988, Tye 1995, Lycan 1996). A belief represents through the semantic properties of the proposition toward which we have the belief-attitude. The representational theory of the mind conceives that perception is similar to propositional attitudes: a perceptual state represents by expressing some content (a proposition or some non-propositional content).

Generally, the representational theories of perception state that a perceptual state X represents some property P of an object due to some regular correlation between the perceptual state and that property. Influenced by the causal theory of reference (Kripke 1980 and Putnam 1975), this correlation is conceived as a causal one: the perceptual state X represents P, if P normally causes X. Dretske (1995) describes in the following way the condition for perceptual representation: some internal states of a sensory system represent some property P of the environment (for example shape), if the internal states causally vary with the values of property P. The internal states ($x_1, x_3, x_3...$) of the sensory system represent shape if these internal states change with the shape of some external object (given that the shape of an object changes with our perspective on it). Perceptual states cannot represent every kind of property, but are limited to certain types of properties. For example in visual perception these properties are generally color, size, shape, orientation and distance of an object. We cannot perceptually represent abstract properties like "object" or general categories of things (kind properties) like "tree", "animal" etc. We believe or judge that this thing we see is an animal, but we cannot perceptually represent that this is an animal. Only shape, size and color of the thing are represented perceptually.¹³

But for a theory of perceptual representation, the causal relation between the objects which have property P and the internal state is not enough. We need a further criterion to characterize the relation of representation, because if the relation between a perceptual state and its represented property is only defined by a causal relation, this would exclude the first condition of intentionality: if "P causes X" is true, then it is also true that P and X exist. If X represents P only when it is actually caused by P, then X will never falsely represent P. Perception only defined by a causal relation would exclude intentionality, it would exclude the power to misrepresent and it would exclude perceptual illusions. For an explanation of perceptual representation by some causal relation, it has to be added that X represents P when it is *normally* caused by P or when it is caused by P under *optimal* conditions. This lets open the possibility that X represents P also in the case where there is no P and where it is caused by some other property (the first condition of

¹³ For a defense of the position that kind properties are represented by perceptual experience, see Susanna Siegel (2010). I will discuss which properties can be represented in perception in chapter 5.

intentionality). In such a case X would be caused by Q but we could still claim that it represents P. P is *normally* its cause, but in this case the perceptual state is caused by some other property. X would falsely represent Q as a P. It would be a case of perceptual illusion.

For a theory of perceptual representation we need therefore to give some coherent way to explain what these *normal* or *optimal* conditions might be, the conditions which must be met for a causal relation to be content-fixing. Without such a specification of the normal or optimal conditions, the causal relation between a property and a perceptual state can not be called a mental representation. It would not fulfill the conditions of representation given in the definition of intentionality.

The second condition for intentionality is more problematic, because it implies the substitution of co-referential terms. A representation is intensional, if its truth-conditions are not preserved with the substitution of co-referential terms. This implies different modes of presentation which refer to the same thing or property. It is difficult to see how perceptual experiences can be different and refer to the same property. Block (1990) defends a view, where the same property can be represented through different sense modality. The same property, for example the shape of a ball, can be represented by touch or by sight. In this case we would have two sensory modes of presentation of the same property, roundness. This implies the assimilation of perceptual content to concepts, to entities which have an extension and an intension (or to Fregean senses, a position defended by Chalmers, in 2006). As it is contested that there actually are such sensory modes of presentation, I consider the first requirement for intentionality, the power to misrepresent, as a sufficient condition for the attribution of the representational status.

A further characteristic generally admitted in representational theories of perception is that perception is a natural form of representation and that it has *original intentionality*. A theory of representation must explain why certain entities are representations and what gives them this representational status. But there are representations which can be explained in a derived manner. Pictures, instruments of measurement, language represent because we have certain intentional states when we use or interpret them. They are representations in a derived manner. Their representational status is derived from other representations, from other intentional mental states. Obviously, we cannot explain all representations by deriving them from other representations, because that would lead to an infinite regress. Therefore theories of mental representation accept that there are some mental states which are not derived representations: non-derived, natural representations (Searle 1983, Dretske 1995). Perception seems to be of this non-derived type. Perceptual states do not represent, because they are derived from other mental representation. They have original intentionality. This implies that we have to explain why they are representations without recurring to other mental representations. We have to explain that either by some intrinsic properties of these states or by some mechanisms which are simpler than mental representations. Naturalistic theories of perceptual representation have generally tried to explain why perceptions represent by some causal mechanisms and some teleological and functional properties of the perceptual states (Fodor 1990, Dretske, 1995, Millikan 1989 and 2004).¹⁴ These teleological or functional properties of perceptual states try to spell out what the perceptual states have the function to represent. If a perceptual state has the function to represent P, then we could explain how it can represent P even in those cases where it isn't caused by P.

¹⁴ Fodor (1987, 1990) explains representation only by some causal mechanism and rejects the use of biological functions in his explanation. Other theories of perceptual representation combine causal explanations with explanation by biological functions (Dretske 1988, Matthen 1988, Millikan 1989).

It is essential for a theory of perceptual representation to be able to *give the content* of a perceptual state. A theory of perceptual representation must give criteria which permit to determine what the content of the state is. Through these criteria we must be able to say which properties or objects a state represents. For beliefs, we say that the content gives the truth conditions of the belief. As perceptual states can be partially true and partially false, we do not speak of truth conditions in the case of perception, but preferably of *accuracy conditions*. The content of a perceptual state therefore indicates the accuracy conditions of the state. It says which properties and objects must obtain in the world in order to make that perceptual state accurate.

There are therefore several requirements for a theory of perceptual representation:

- (1) The theory must show that perception has the power to misrepresent. Perception has accuracy conditions. It must be possible for a perceptual state to be inaccurate.
- (2) The theory must show by which mechanisms perceptual states can have that power to represent. It must show which mechanisms explain this power to misrepresent.
- (3) The theory must give the criteria which permit to determine what the specific content of a perceptual state is.

To fulfill the first condition, we could for example rely on our intuition that perceptions are sometimes inaccurate and can therefore fail to represent correctly certain properties of the environment. That would not explain how perceptual states represent but would just reflect our intuition that they do. As our intuition could be wrong, it is a further (second) requirement, to show through which mechanisms sensory systems represent and through which properties perceptual states have their representational status. That is what naturalized theories of mental representation generally try to do. They try to explain that perceptual states represent, because they are caused in such and such a way by certain properties or objects and that they have certain functions to provide information about these properties or objects.

Still that might not be enough for a theory of perceptual representation, because these causal and functional relations may leave the content indeterminate. This is a central problem for representational theories. For example, a causal explanation of representation lets the content indeterminate, because the cause of a perceptual state is a sequence of events. It is not clear which element in that sequence determines the content.¹⁵ The same indeterminacy can appear in the explanation of content by biological functions. Is it the function of the frog's eye to represent flies, small black dots or flying food. These are different properties. Which ones are part of the content of the frog's perceptual states and which ones determine its accuracy conditions? As it is essential for perceptual representation to have a content which gives accuracy conditions, a theory of perceptual representation must be able to specify this content and these accuracy conditions. If these conditions cannot be met, it is tempting to claim that perception after all is not representational.

Until now I have stated that the representational view is widely accepted in the philosophy of mind and I have stated the requirements for such a representational view. I have also indicated that it seems to many philosophers intuitively plausible that perception has a representational content. But I have not addressed the question what makes this intuition so plausible and strong. Certainly we think that perception can mislead us and that it can be inaccurate. And this impression is fueled

¹⁵ Galen Strawson called this the "stopping problem".

by the phenomenon of perceptual illusions. Illusions seem to require an explanation of perception in terms of representations, i.e. in terms of states which can be false, erroneous or inaccurate.

4. The View from the Cognitive Sciences

In the previous sections I discussed the intentional view of perception as it is defended in the philosophy of mind and the philosophy of perception. In the psychology of perception, the term "representation" is also heavily used and many psychological theories of perception defend the position that perception is a form of mental representation. The question arises therefore if psychologists use a concept of representation similar to the concept used by philosophers. This question has to be clarified also, because philosophers often defend their views of perceptual representation with reference to the use of the concept of representation in psychological (or neurophysiological) theories of perception (e.g. Burge 2010). Others claim that perception is not a form of representation, because psychologists have strongly contested that in perception we construct a complex mental model of the external world, an internal model often called "representation" (e.g. Noë 2004). Psychologists have often contested that view of perception as model construction by saying that such perceptual representations do not exist. But that rejection of "representation" is not a rejection of the representational view as defined in the previous sections. It is possible to reject such a complex representation and still think that perception has representational content. A neural state may have the perceptual content "red" without being an inner model of the external environment. It is therefore important to describe the different notions of "representation" used in the psychology of perception and to see how much these notions overlap or differ from the philosophical concept of representation defined as a mental state with intentional content.

I will here distinguish three uses of the term representation in psychological theories of perception: (1) a mental representation is a mental state which indicates or informs about properties of the external distal stimulus. This use is more or less similar to the use in the previously described philosophical theories. (2) Representation as an *inner mental model* or picture, (3) representation as *information storage* in the mind or more specifically in memory. Only the first use corresponds more or less to the concept used in the representational view of the mind. The two other uses of the term "representation" do not directly affect the arguments for or against the representational view of perception as it is defended in the philosophy of mind.

(1) In the psychology of perception, representation is often used to emphasize that our perceptual states cannot be explained by the properties of the proximal stimulus alone (for example, in vision, by the properties of the "image" on the retina). In perception, this information at the proximal stimulus is used to get some information about the external objects (the distal stimulus).¹⁶ In this view of perception, what we see is the result of some constructive addition to the information present in the stimulus to get information about objects in the world. For example, the information in the two-dimensional "image" on the retina is processed to get a three-dimensional representation of some object.

The psychologist Irvin Rock (1983) calls such theories "constructive theories" of perception. With the rise of cognitive psychology and its computational description of mental processes, this

¹⁶ I will use here the notion "stimulus" for the proximal stimulus and "object" for the distal stimulus. "Stimulus" refers to physical properties at the perceptual receptors and "object" refers to the properties of external physical things.

constructive process in perception was described as a form of *inference*. Constructive theories of perception, as developed by Marr (1982), Rock (1983), Palmer (1999) or Pylyshyn (2003), describe perceptual processing as the constructive process whereby some inner principles and assumptions are used in the sensory systems to "infer", from the often poor information at the proximal stimulus, the properties of external objects. Through this inferential processing a representation of external objects is constructed. Palmer (1999) states that perception is confronted with the so called "inverse problem" (Palmer 1999: 23): in our perceptual experience we have representations of properties which are not given in the sparse information present in the proximal stimulus. For example, we represent *three-dimensional* objects which have to be inferred from a *two-dimensional* retinal image. Quite different three-dimensional objects can project the same two-dimensional image on the retina. How does the visual system "decide" which three-dimensional shape is actually in front of us? This is the inverse problem. Palmer supposes that we actually see in our perceptual experience the properties of distal objects and that these properties are the product of some inference solving the inverse problem.

These psychological theories posit that perception is the result of some process which represents properties of external objects and events. This is expressed most clearly by Irvin Rock (1983), who writes:

External objects and events are *represented mentally in the form of propositional knowledge*. The very essence of intelligence in living creatures, in my opinion, is *the capacity to 'know', to represent objects, events, and relations* in a form that is subject to confirmation and disconfirmation. The claim, then, is that perception also is based on this form of representation. (Rock 1983: 15)

Later he adds: "*perception is the mental representation of external objects and events* that is based upon or in some way corresponds to the stimulation reaching our sense organs" (Rock 1983: 28).¹⁷ Perception is described here as a mental state which has semantic properties; a state which can be accurate or inaccurate (confirmed or disconfirmed). It can misrepresent. Palmer (1999) has a similar view, when he defines visual perception as "the process of acquiring knowledge about environmental objects and events by extracting information from the light they emit or reflect" (Palmer 1999: 5). He underlines that the information gained in perception can be evaluated for its accuracy.¹⁸ These descriptions of perception correspond quite closely to the philosophical view that perception is a representation which has intentional content specifying accuracy conditions.

A similar use of representation can be found in neurophysiology, when scientists try to determine the function of certain neurons or group of neurons in the areas of the brain dedicated to process of information coming from the sensory organs, for example the functions of the neurons of the visual brain. Studies like those of Hubel and Wiesel (1962) tried to determine the function of specific neurons in the visual cortex of cats. They recorded the activation of particular neurons when a specific stimulus was presented to the cat. They showed that specific neurons react to only vertical long objects (black bars). These neurons are triggered by this type of stimulus. Sometimes

¹⁷ Emphasis added by me.

¹⁸ That perception has accuracy conditions for Palmer is clear from the following passages: "Indeed, vision is useful precisely because it is so accurate. By and large, *what you see is what you get*. When this is true, we have what is called *veridical perception* (...): perception that is consistent with the actual state of affairs in the environment" (Palmer 1999: 6). He also says: "vision provides spacially accurate information from a distance." (Palmer 1999: 6)

in the neurosciences the notion of representation is just used as an equivalent of such a causal correlation between stimulus and a certain brain activity. A state is said to represent an external property, if it correlates with the presence of that property. Such a use of "representation" would diverge from the meaning of the term in the philosophy of mind. But generally, the neurosciences do not only describe causal correlations, but determine furthermore the function of certain parts of the brain, certain neurons or groups of neurons. Such was also the aim of the single neuron recordings done by Hubel and Wiesel. They wanted to determine the biological function of specific brain areas. In that sense a neuron can have the function to represent a certain color, even if it does not react in an actual case to that color and even if it can be triggered sometimes by some other internal or external event. It simply would be mal-functioning in these cases without losing its function. Similarly, we would still attribute to a mal-functioning heart the function of pumping blood (see Neander 1995). Such neurophysiological theories of perception are not far away from a teleological theory of intentionality.

We can therefore find in the psychology of perception and in the neurosciences the term and concept of representation used in a similar way as in the representational theory of the mind. But the term is also often used in other ways which diverge from the discussed philosophical meaning. We have to discuss these other uses in order to avoid confusions.

(2) The psychology of perception often uses "representation" in a much broader sense, namely as equivalent for an inner picture or inner model of the outside environment, of outside objects or events. It is supposed that perception is representational, because it consists in the construction in the mind of a complex and detailed picture-like layout or map of the environment. Artificial intelligence (Brooks 1991) as well as recent psychological studies on change blindness (Levin and Simons 1997a and b) and inattentive blindness have criticized the idea that there actually is such an inner model or picture. Although we have virtually access to a great diversity of details in our visual environment, these experiments seem to indicate that we do not visually represent the environment like a rich and continuous photographic image. We pick up certain salient details and other sometimes massive aspects in focal vision escape from our view or our attention. In a video testing the phenomenon of inattentive blindness, a gorilla dancing through a team of basketball players is not seen, when the observers are asked to attend (and count) ball exchanges (Simons and Chabris, 1999). Some psychologists said therefore that this view of visual representation as a complex, rich and photographic inner picture is a "grand illusion" (O'Regan, 1992).¹⁹

In artificial intelligence, Rodney Brooks (1991) also contested the necessity of a complex inner representation in order to fulfill the tasks of a complex interaction with the environment. For Brooks, it is sufficient for complex behavioral tasks in robotics that information is picked up just when it is needed and just those details that are needed without constructing a complex map or inner representation. Sometimes these developments in the cognitive sciences are used as arguments against the notion of representation in general. Certainly, inner pictures and models were conceived as representations of the environment, but a rejection of such pictures and models only affects a certain type of representations. It mainly affects certain claims about the richness of perceptual representations. The described developments in the cognitive sciences show that

¹⁹ Based on this research, Alva Noë criticizes what he calls the "snapshot conception" of visual perception. This snapshot conception is one example of a representation in the second sense discussed here, see Noë (2004: chap. 2).

perceptual representations are much poorer than thought, but they do not show that there is *no* perceptual representation.

We can find psychologists like Pylyshyn (2003) who reject the picture view, but still defend the notion of perceptual representation as defined in (1). The two notions of representation are actually independent: it could be that there is some topological mapping between the structure of some external stimuli and some internal structure in the brain caused by these stimuli. There would be a picture-like relation between the stimuli and the brain region, but still these events in the brain may lack any semantic properties. They would not be representations in the sense (1). On the other hand a neuron could represent some external property without being a picture. It would just be an arbitrary symbol for some external feature without any similarity relation to what it represents. In this case, we would have representations without any inner model or picture.

Brooks also suggested that the information about the environment needs not to be given through a central model, but may be distributed in different parts of the robot. This distributed representation would preserve the richness of the information about the environment without being bundled in a central picture or model. Each part of a robot (or of an organism) has just access to the information it needs for its behavior. In this case we would still have a representation without inner models or pictures.

(3) In the psychology of perception the notion of representation is sometimes used in the sense of *preserved or stored information*. In debates about change blindness the question whether perception is representational was assimilated to the question how extensively we store perceptual information between views (Simons 1996; Simons, Chabris, Schnur 2002). Psychologists claimed that visual information is mostly used online and is not preserved when the stimulus changes i.e. when there is some change in the visual field. This would explain why in change blindness experiments massive changes in seen videos were not noticed: from one screen shot to the next the information is just not kept. The information in the new screenshot cannot be compared to the old one and therefore the difference is not noticed. Simons et al. (2002: 78) say for example:

The pervasiveness of the inability to detect changes is consistent with the theoretical notion that we internally represent relatively little information from our visual world from one glance at a scene to the next. However, evidence for change blindness does not necessarily imply the absence of such representation – people could also miss changes if they fail to compare an existing representation of the pre-change scene to the post-change scene.

Here the "absence of representation" neither implies that perception cannot be evaluated for accuracy (sense (1)), nor that we do not have a complex model or picture of the environment (sense (2)), but only that in perception the information is mostly used online and is not stored. Opponents to intentionalism in the philosophy of perception often use the argument that perception is not representational, because it is mostly an online access to the environment. We therefore use the world as an "external memory" (O'Regan 1992) instead of storing the information internally. This criticism of "representations" only rejects this third sense of the term. It neither implies that when we perceive something online, this perceptual experience cannot be evaluated for accuracy and does therefore have no content, nor does it imply that perception is no inner picture. It rejects representation as inner storage in memory.

The three senses of the concept of representation in the psychology of perception (and in the cognitive sciences) are sometimes confused. It is not uncommon to encounter a general criticism of

intentionalism based on the rejection of representation in the second or third sense. When I will speak about the intentional view of perception, I mean it in the first sense only, representation as an intentional, content bearing state. A rejection of that intentional view cannot just be based on the rejection of representation as inner picture or representation as internal storage. Certainly some aspects of representation as inner picture or as storage can be used in an argument against the intentional view. For example the view that perception is mostly an online access to the environment without much storage can be used to argue for a relational view of perception. But online perception per se is not in contradiction with the intentional view. A rejection of perceptual representation in the sense (2) and (3) does not per se imply a rejection of the intentional view. It is therefore important to separate these different meanings of "representation".

5. Challenges to the Intentionality of Perception

The intentional view of perception has been confronted with different challenges. We can distinguish three types of challenges: (1) a general rejection of intentionality; (2) a rejection that specifically perceptions have intentionality; (3) challenges to specific versions of the intentionality of perception. Let us look at three types of challenges.

(1) The rejection of intentionality in general: Such views, which can be called *intentional irrealism*, reject that any mental state has intentionality, therefore also perceptual states are not intentional states. *Intentional irrealism* rejects generally the notion of mental representation and intentionality for mental states. We can distinguish a computationalist version and an anti-computationalist version. The computationalist version accepts that mental processes are symbolic and governed by rules, but rejects that we can give a semantics for these symbols. Stich's syntactic theory of the mind is such a position (Stich 1983). Dynamic systems theory is a more radical form of intentional irrealism, because it rejects also the symbolic processing of classical computationalism (Van Gelder 1995). There are only causal interactions between internal and external events which can be modeled mathematically by a series of differential equations. There is no specific difference of the interaction between mind and world to any other physical interaction in nature.

The emphasis on extended cognition (Clarke/Chalmers 1998) is another development which tries to reduce the role of inner representations. Mental processes are seen here in interaction with bodily activities or continuous with processes external to the human body. Causal interactions between the brain, the body and the world are emphasized and the semantic relations between inner states and the external world lose their importance in this framework. But the extended mind hypothesis per se does not imply a rejection of the intentionality of mental or perceptual states and advocates of this thesis criticize the rejection of intentional states (Clarke 2008). Only certain radical versions of extended cognition want to reject mental representations (see Chemero 2009).

(2) A rejection of the intentionality only as far as it is applied to perception: Such views accept that there are mental states which represent and which have intentionality, but they reject the view that perceptual experiences or perceptual states are among these intentional states. Certain forms of *enactivism* (Noë 2006, 2009, 2012) reject the intentionality of perception, but mainly *relationalism* does so (Campbell 2002, Travis 2004, Martin 2004, Johnston 2004). For relationalism, we have in perception a direct contact to the entities we perceive. Perception has to be analyzed as a relation between a perceiver and the perceived entities. Relationalism denies that perceptual states have a content which may represent some properties in the absence of a relation to objects which have these properties. Perceptual states do not fulfill Chisholm's first criterion for intentionality.

(3) Challenges to specific theories of perceptual representation: These views do not reject the intentional view of perception, but challenge only certain versions of it. It is not denied that perceptual states have content. The intentionality of perception is not rejected, but only certain explanations of that intentionality. Often these challenges are presented as some alternatives to the naturalistic theories of intentionality, given by causal or informational semantics or teleosemantics and their explanation of perceptual (and mental) content. Such alternatives explain intentionality by *normativity* or *phenomenal consciousness* and often, these are considered irreducible to a naturalistic explanation.

Some philosophers for example reject the naturalistic theories of intentionality, but do not reject the project to attribute content to perceptual states. More specifically, there are positions which consider that a naturalistic theory of intentionality is impossible, given the *normativity* of content (Kripke 1982). It is claimed that normativity cannot be naturalized and that therefore intentional content cannot either.

Another alternative to the theories of naturalized intentionality is the program of *phenomenal intentionality* (Horgan/Tienson, 2002). In this program, the intentional content of perception is explained by the phenomenal character of our experience. The attempt to explain content by external causal or historical relations of the mental state is rejected (Kriegel 2013).

Although these challenges to the representational view of the mind and to intentionalism cannot be discussed in the present paper, it was the intention here to give a clear formulation of what the intentional view is and implies and what a challenge to it should address.

Conclusion

Intentionalism is the view that perceptual states are mental representations. Perception has representational content. I defined perceptual states as states of the sensory system which vary with external conditions of the environment and which are used by some psychological systems for further processing. If intentionalism is right, then these states must have a representational content. They must have intentionality. I defined intentionality by the power to misrepresent, that is, the power to represent external conditions which may fail to actually exist. Finally an analysis of the concept of representation in the cognitive sciences showed that these sciences use, at least in a certain sense, a concept of representation which is similar to the one used by philosophers who defend intentionalism. It is therefore plausible to claim that the massive use of the concept of representation in these sciences gives a strong support to the intentional view of perception, as it is defended in philosophy. Although I mentioned the most important challenges to intentionalism, it was not the purpose here to address these challenges or defend intentionalism against them, but the main purpose was to get a clear formulation of the intentional view and its implications. And although intentionalism seems to me the most plausible view of perception, a defense of it has to be given in another paper. A further clarification of intentionalism would have to discuss especially the nature of representational content, the question what content is, what it is constituted of, and how it can be specified in a precise and determinate way. Intentionalism is only viable if a concrete theory of intentional content can be given.

References

- Armstrong, David M. (1968) *A Materialist Theory of the Mind*, London: Routledge and K. Paul.
Bayne, Tim and Montague, Michelle (ed.) 2011 *Cognitive Phenomenology*, Oxford: Oxford University Press.
Block, Ned 1990 "Inverted Earth", *Philosophical Perspectives* 4: 52-79.

- Block, Ned 1995 "On a Confusion about a Function of Consciousness", *Behavioral and Brain Sciences*, 18/2: 227-247.
- Bermudez, José Luis 2005 *Philosophy of Psychology. A Contemporary Introduction*, London: Routledge.
- Block, Ned 1990 "Inverted Earth", *Philosophical Perspectives* 4: 52-79.
- Brentano, Franz 1874/1955 *Psychologie vom empirischen Standpunkt*, Volume 1, Hamburg: Verlag Felix Meiner.
- Brogaard, Berit 2011 "Are there Unconscious Perceptual Processes?", in: *Consciousness and Cognition*, 20: 449-63.
- Brooks, Rodney A. 1991 "Intelligence Without Representation", *Artificial Intelligence* 47: 139-159.
- Burge, Tyler 2010 *Origins of Objectivity*, Oxford: Oxford University Press.
- Campbell, John 2002 *Reference and Consciousness*, Oxford: Oxford University Press.
- Chalmers, David 2006 "Perception and the Fall from Eden", in: T. Gentler, J. Hawthorne (eds.) *Perceptual Experience*, Oxford: Oxford University Press.
- Chemero, Anthony 2009 *Radical Embodied Cognitive Science*, Cambridge, MA: The MIT Press.
- Chisholm, Roderick M. 1957 *Perceiving: A Philosophical Study*, Ithaca (New York): Cornell University Press.
- Clarke, Andy; Chalmers, David 1998 "The Extended Mind", *Analysis* 58/ 1: 7-19.
- Clarke, Andy 2008 *Supersizing the Mind*, Oxford: Oxford University Press.
- Hurley, Susan 1998 "Vehicles, Contents, Conceptual Structure, and Externalism", *Analysis* 58 (1): 1-6.
- Dretske, Fred 1969 *Seeing and Knowing*, Chicago: University of Chicago Press.
- Dretske, Fred 1978 "The Role of the Percept in Visual Cognition", in: *Minnesota Studies in the Philosophy of Science: Perception and Cognition*, vol. 9, Minneapolis: University of Minnesota Press.
- Dretske, Fred 1981 *Knowledge and the Flow of Information*, Cambridge, MA.: The MIT Press.
- Dretske, Fred 1986 "Misrepresentation", in: R. Bogdan (ed.) *Belief*, Oxford: Oxford University Press.
- Dretske, Fred 1988 *Explaining Behavior. Reasons in a World of Causes*, Cambridge, MA: The MIT Press.
- Dretske, Fred 1995 *Naturalizing the Mind*, Cambridge, MA: The MIT Press.
- Evans, Gareth 1982 *The Varieties of Reference*, (ed. by John McDowell), Oxford: Oxford University Press.
- Flanagan, Owen 1992 *Consciousness Reconsidered*, Cambridge, MA: The MIT Press.
- Field, Hartry 1978 "Mental Representation", *Erkenntnis* 13 (1): 9-61.
- Fodor, Jerry 1980 *The Language of Thought*, Cambridge, MA.: Harvard University Press.
- Fodor, Jerry 1985 "Fodor's Guide to Mental Representation: The Intelligent Auntie's Vade-Mecum", *Mind* 94 (373): 76-100.
- Fodor, Jerry 1987 *Psychosemantics: The Problem of Meaning in the Philosophy of Mind*, Cambridge, MA: The MIT Press.
- Fodor, Jerry 1990 *A Theory of Content and Other Essays*, Cambridge, MA: The MIT Press.
- Harman, Gilbert 1990 "The Intrinsic Quality of Experience", in: James E. Tomberlin (ed.) *Philosophical Perspectives, Vol. 4, Action Theory and Philosophy of Mind*, Ridgeview Publishing Company. 31-52.
- Horgan, Terrance E.; Tienson, John L. 2002 "The Intentionality of Phenomenology and the Phenomenology of Intentionality", in: David J. Chalmers (ed.), *Philosophy of Mind: Classical and Contemporary Readings*, Oxford University Press.
- Hubel, David H.; Wiesel, Torsten N. 1962 "Receptive Fields, Binocular Interaction and Functional Architecture In The Cat's Visual Cortex", *Journal of Physiology*, 160: 106-154.
- Hubel, David H. 1995 *Eye, Brain, and Vision*, New York: W. H. Freeman and Company, 2nd edition.
- Johnston, Mark 2004 "The Obscure Object of Hallucination", *Philosophical Studies* 120: 13-83.
- Kelly, Sean Dorrance 2001 "Demonstrative Concepts and Experience", *The Philosophical Review* 110 (3): 397-420.
- Kriegel, Uriah 2013 "The Phenomenal Intentionality Research Program", in: Uriah Kriegel (ed.) *Phenomenal Intentionality*, Oxford University Press (forthcoming).
- Kripke, Saul A. 1980 *Naming and Necessity*, Cambridge, MA: Harvard University Press.
- Kripke, Saul A. 1982 *Wittgenstein on Rules and Private Language*, Cambridge, MA: Harvard University Press.
- Levin, Daniel T.; Simons, Daniel J. 1997a "Failure to Detect Changes to Attended Objects in Motion Pictures", *Psychonomic Bulletin & Review* 4 (4): 501-6.
- Levin, Daniel T.; Simons, Daniel J. 1997b "Change Blindness", *Trends in Cognitive Science* 1 (7): 261-267.

- Lycan, William 1996 *Consciousness and Experience*, Cambridge, MA: MIT Press.
- Martin, Michael 2004 "The Limits of Awareness", *Philosophical Studies* 120: 37-89.
- Marr, David 1982 *Vision. A Computational Investigation into the Human Representation and Processing of Visual Information*, New York: W. H. Freeman and Company.
- Matthen, Mohan 1988 "Biological Functions and Perceptual Content", *Journal of Philosophy*, LXXV: 5-27.
- McDowell, John 1996 *Mind and World*, Cambridge, MA: Harvard University Press.
- Millikan, Ruth Garrett 1989 "Biosemantics", *Journal of Philosophy* 86 (6): 281-297.
- Millikan, Ruth Garrett 2004 *Varieties of Meaning: The 2002 Jean Nicot Lectures*, Cambridge, MA: The MIT Press.
- Milner, A. David; Goodale, Melvyn A. 1995/2006 *The Visual Brain in Action*, Oxford: Oxford University Press, 2nd Edition.
- Neander, Karen 1995 "Misrepresenting and Malfunctioning", *Philosophical Studies* 79 (2): 109-141.
- Noë, Alva 2004 *Action in Perception*, Cambridge, MA: The MIT Press.
- Noë, Alva 2006 "Real Presence", unpublished manuscript available at: <http://socrates.berkeley.edu/~noe/RealPresence.pdf>. A different version was published in Noë 2012.
- Noë, Alva 2009 "Conscious Reference", *The Philosophical Quarterly* 59/ 236: 470-482.
- Noë, Alva 2012 *Varieties of Presence*, Cambridge, MA: Harvard University Press.
- O'Regan, J. K. 1992 "Solving the 'real' mysteries of visual perception: The world as an outside memory", *Canadian Journal of Psychology*, 46 (3), 461-488.
- Palmer, Stephen 1999 *Vision Science: Photons to Phenomenology*, Cambridge, MA: The MIT Press.
- Prinz, Jesse 2004 *Gut Reactions. A Perceptual Theory of Emotion*, Oxford: Oxford University Press.
- Prinz, Jesse 2006 "Putting the Brakes on Active Perception", *Psyche*, Vol. 12, Issue 1. Online publication: <http://psyche.cs.monash.edu.au/>
- Prinz, Jesse 2015 "Unconscious Perception", in: Mohan Matthen (ed.) *The Oxford Handbook of Philosophy of Perception*, Oxford: Oxford University Press.
- Putnam, Hilary 1975 "The Meaning of 'Meaning'", in: Keith Gunderson (ed.) *Mind, Language, and Knowledge*, Minnesota Studies in the Philosophy of Science Vol. 7, Minneapolis: University of Minnesota Press, p. 131-193.
- Pylyshyn, Zenon 2003 *Seeing and Visualizing. It's Not What You Think*, Cambridge, MA: The MIT Press.
- Ramsey, William 2007 *Representation Reconsidered*, Cambridge: Cambridge University Press.
- Rock, Irvin 1983 *The Logic of Perception*, Cambridge, MA: The MIT Press.
- Russell, Bertrand 1921 *The Analysis of Mind*, London: George Allen & Unwin.
- Searle, John 1983 *Intentionality* Cambridge: Cambridge University Press.
- Siegel, Susanna 2010 *The Contents of Visual Experience*, Oxford: Oxford University Press.
- Simons, Daniel J. 1996 "In Sight, out of Mind: When Object Representations Fail", *Psychological Science*, 7 (5): 301-305.
- Simons, Daniel J.; Chabris, Christopher F.; Schur, Tatiana 2002 "Evidence for Preserved Representations in Change Blindness", *Consciousness and Cognition* 11: 78-97.
- Sterelny, Kim 1991 *The Representational Theory of Mind. An Introduction*, Oxford: Basil Blackwell.
- Stich, Stephen 1983 *From Folk-Psychology to Cognitive Science. The Case Against Belief*, Cambridge, MA: The MIT Press.
- Travis, Charles 2004 "The Silence of the Senses", *Mind* 113 (449): 57-94.
- Tye, Michael 1995 *Ten Problems of Consciousness. A Representational Theory of the Phenomenal Mind*, Cambridge, MA: The MIT Press.
- Van Gelder, Tim 1995 "What Might Cognition be if not Computation?", *Journal of Philosophy* XCII (7): 345-81.
- Weiskrantz, Laurence 1986 *Blindsight. A Case Study and Implications* Oxford: Oxford University Press.

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