

White can be transparent: why Wittgenstein is wrong

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This work is divided into three parts, the first deals with Wittgenstein approach to the language of colour, the second presents transparency models studied in science of perception, and the third deals with the impossibility, according to Wittgenstein [4] (hereafter W.), that white be transparent and how to interpret it.

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Part one – On Wittgenstein: language, logic and reference

Wittgenstein is regarded as one of the greatest philosophers of the twentieth century. He certainly played an important role in analytic philosophy, and is one of its most prominent representatives. His works symptomatically characterised two different and competing conceptions of thought in analytic philosophy: the neo-positivism of the Vienna Circle and the Oxonian philosophy of ordinary language. In both cases, the identification made by Wittgenstein between philosophy and philosophy of language restricts the task of the philosopher to the analysis of concepts that explain the structure of language, which is the linguistic expression, the assertion, the meaning, the use. Historians of philosophy identify roughly two periods in Wittgenstein's philosophical production of that match the ideas presented in the *Tractatus* [1], and the later ones presented in the *Philosophical Remarks* [2] and the *Philosophical Investigations* [3]. According to Wittgenstein's *Tractatus*, language consists of the totality of meaningful statements, seen in relation to the totality of the objects of those statements. The world is the totality of facts, and it is expressed by independent atomic propositions provided by denotation, from which connotative dimensions – emotional, intentional and contextual – are obviously excluded. The task of the philosopher is essentially that of analysing arguments and refuting fallacies: a circumscribed area of inquiry on the border between logic and linguistics. An argument is a reasoning intended to prove a point and to reach persuasive conclusions starting from premises (assumed to be true) through inference rules. The task of logic is to make the assumptions (axioms) explicit; the task of philosophy of language is to verify their correctness. Doing philosophy, rather than building a theory or posing a problem, is therefore the endeavour to clarify the truth or falsehood of statements about the state of things in the world. A true statement is ontologically matched by a state of affairs in the world, and vice versa. In this sense, for example, in the *Tractatus*, space, form and colour are shapes of objects.

Apparently, Wittgenstein's conception starts from the idea that only applied logic can solve the ontological question of what are the (simple) objects in the world (Tractatus 5.557). In the Tractatus Wittgenstein states that, to describe reality, a language must possess the exact logical form, i.e. the exact combinatorial possibilities. The grammar of names, which are the objects of the world, copies or depicts the logical form, and the objective meaning of the sentences is given by it. Meaning of course coincides with the truth conditions of a statement. Consequently, the Tractatus distinguishes the conditions for what can be said (i.e. thought in statements) from what cannot be expressed linguistically, but possibly only shown, and that, starting from this perspective, you can just be remain in silence.

The next period, which the historians of philosophy classifies as 'the later Wittgenstein' arises also from some objections raised by Frege against the Tractatus and shifts the analysis from the logical form of the states of the world expressed by sentences to analysis of the paradoxes and ambiguities of ordinary language, with the intention of unmasking those philosophical problems that are considered false. The meaning of linguistic expressions is no longer related to the logical form but to the intentions and purposes of the speaker, or to the context of the pragmatics of communication: "the meaning of a word is its purpose" (PB, 15), and the sense of a proposition is given by a set of actions and words, by the language game in which it is played. In short, meaning is the use of language, and sentences have a variety of uses depending on the context in which they are uttered. Concepts are then redefined on the basis of family resemblances, and therefore lose their well-defined properties of statements that the Tractatus analysis assigned them. Language games are designed to bring order to the linguistic usage of a language: one of many possible orders, and certainly not the order (132).

The change of perspective is evident in the *Philosophische Bemerkungen* [2] and in the *Philosophische Untersuchungen* [3], which have different styles of reasoning and content. In Wittgenstein's own words, this inquiry is a criticism and an integration of the "serious errors" formulated in the Tractatus (Preface). In *Philosophical Observations* all that is given are the phenomena of the physical world (colour, sound, touch, etc.); and the meaning of every assertion and statement about the world (i.e. phenomena) is verified by the same phenomenon. If the Tractatus ended with the proposition that one must be silent about everything of which one cannot speak, the new point of view expressed in his later works induced Wittgenstein to say that what is essential for our propositions about reality to make sense is that our expertise, in whatever modality, agrees or disagrees with them. Again, however, the task of philosophy is only to describe the *modus operandi* of the language, leaving everything as it is. In this context, Wittgenstein's remarks on colour can be considered a test of his changed point of view, or what at first glance may appear such with respect to the ideas expressed in the Tractatus. His explicit statement of the need to consider a theory of colour that does not rely either on physical or on physiology, but should be essentially a phenomenological theory, his distinction between colour (a priori concept) and coloured (linguistic expression), and his comments on pure colours and mixed colours, should not in fact be misleading. Wittgenstein's analysis, even when it refers to the appearance of colours and their mixtures, is a linguistic analysis, or an analysis of the arguments for or against a certain state of affairs.

Take as a paradigmatic example the following passage: "... it seems to be clear from the beginning that you cannot say that red has a tinge of orange in the same sense in which the orange has a red tinge. In other words, it seems clear that the two ways of saying 'x is a mixture of y and z', and 'x is the common element of y and z' are not interchangeable here. If my way of thinking is right, 'the red is a pure colour' is not a proposition, and what you should show by these words is not subject to experimental verification". That the analysis of colours, in spite of Wittgenstein's statements, is not a phenomenological analysis is clearly demonstrated by other statements. These show the references of

his descriptions and formulations on the phenomenon of colour. The focus of his analysis is the relationship between a concept expressed by a certain language and specific contexts: for example, the relationship between the term 'red' and the linguistic practice in which it is used. The kind of question that Wittgenstein can ask, is for example: "how does the grammar show the difference between 'lighter' and 'darker'?" (PB, 40). The problems of what may be the ontological entity 'colour' are completely irrelevant to him, and in any case colour still seems to be inferred rather than perceived. And again irrelevant to him is the large asymmetry between the number of perceived colours (in the order of thousands) and the scarcity of terms existing in a language to express them. The mode of appearance of a colour, about which he speaks, is not given by its specific phenomenal nature (Katz) but by the linguistic-conceptual scheme that allows the reference: the meaning of 'red' is the use made of it within a language that consents to the linguistic game, or the technique of using it. If, as Wittgenstein thought, philosophising means rejecting erroneous arguments (The Big Typescript, § 87.6), then his claims about white and transparency are paradigmatic cases of fallacious arguments. Even worse, despite what he says, his arguments are based on physics, not on the phenomenology of colour. The concept of 'white' and the concept of 'transparent' would not in fact be associated, according to Wittgenstein, because there is a logical incompatibility between them, or by thought they cannot be together: a transparent white, therefore, cannot exist even though one can see it.

Part two – Transparency models

The first obstacle that scholars have encountered in the study of perception has been the problem of the relationship between vision and reality (physics). Mistakenly, many people think that we see a transparent object because it is transparent, i.e. it lets radiation pass through it so that one can see not only the object itself, but what is behind it through it.

The transmission of electromagnetic radiation, in the visible range, seems the requirement for an object to be perceived as transparent. However it was noticed that, even in this field as in many others, the impression of transparency does not depend on the optical properties of the physical object, but rather on the relationships between various stimuli that fall on the retina. These relationships are of figural, topological, and chromatic nature.

The first systematic studies of transparency describe the figural structure, the topological relationships, and the chromatic conditions that must be met to induce perceptual transparency [5-6], especially which colour the superimposition area where the transparent and opaque object overlap must assume to perceive transparency [7-9]. The first mathematical model of phenomenal transparency is due to Metelli [10] which describes the colour of the overlapping area as determined by a partitive mixture of radiation coming from both the background and the transparent object. This model, albeit with important adaptations, is still considered the basis of studies of the phenomenon. An important point of the Metelli model is the possibility that the perceived colours of the background and the transparent object are determined by the radiant stimulus simultaneously with the degree of transparency. This means that the amount of radiation coming from the object in the background and from the transparent object in front is not just the stimulus for the perception of their colours, but also for the perception of the density of the transparent object. Therefore the two colours are not determined by the radiant stimulus in the same way as are determined their non overlapping areas, but in a special way.

For example, if only 50% of the background radiation reaches the observer's eye because the rest is cut from the filter, one might state that its perceived colour appears darker than when the background is in plain view: on the contrary you see the same colour of the background, but with the addition of

appearing filtered to 50%. And the same is true for the colour of the filter: if the eye gets only 25% of the radiation that would receive if the filter were superimposed on an object of the same colour, one can always see its colour, not half darkened, with the addition of appearing filtering the background for 50%.

When the proportions between radiation from the background and radiation from the filter change, the same colours are always seen, but with varying degrees of transparency.

In a variation of the model of Metelli operated by Gerbino [11] to include the effect of lighting, it seems that the radiation coming from the background (reduced by a factor of transparency) add an additive component, i.e. the radiation coming from the filter (its actual luminance), and both would lead to the respective colours: it is clear that the “additive component” is always less than the sum of the two and therefore can never correspond to a white. It only would appear white when it is opaque, i.e. when it is the only component, without the background): in the traditional view this would corresponds to the maximum reflectance (or maximum luminance).

This interpretation of Gerbino’s model is however restrictive, because the additive component (coming from the transparent object) is in turn a very complex function of the colours present in the configuration, and therefore the fact that it may correspond to white only if the object is opaque is not a necessary consequence. This is for now the only case in which a mathematical model of transparency, inadequately interpreted, seems to imply that a white object cannot be transparent, but this interpretation is rather simplistic.

Part three – Wittgenstein’s observations

Other relevant models of transparency, including Kubelka & Munk [12], do not exclude that white can be transparent. The exclusion is on the contrary stressed by W. on several occasions in his *Bemerkungen über die Farben* [Remarks on Colour]. The author's analysis concerns the meaning of the terms used in the language of colour, and he finds that many coloured objects, for instance windows, can be transparent, but there are no objects simultaneously white and transparent. In fact, a white glass is not a clear glass but a frosted glass, and only clear glass could be transparent. According to W. transparency is clear, cannot be confused with translucency. One might think that the term used by W. [1] (*Durchsichtigkeit*) actually means only one type of clear transparency, as generally happens in English. Indeed in English it seems that both terms translucency and transparency are commonly used with reference to two types of transparency: clear in the first case and diffusive in the second one. Moreover in both cases, the terms refer primarily to the physical mechanism which causes the relative perception, presence or absence of scattering in the transparent object; consequently when they are used with reference to the perception of colours they involve the same clear vs. diffuse distinction. In Italian the terms corresponding to translucency and translucent exist but they are quite rarely used, since the term transparency includes almost naturally cases of translucency (when we say that a veil is or appears transparent, certainly we do not mean a clear type of transparency).

W. does not use other terms that relate to transparency. On the contrary there are many words in German to express transparency, but they are only used in very specific areas [*Durchsichtigkeit*, *Durchscheinen*, *Durchschaubarkeit*, *Transparenz*].

However, unlike in W., the term *Durchsichtigkeit* appears to be used in German without problems in relation to the perceptual transparency, with the general meaning to see something behind and through an object [10,13]. Dealing with terms is useful as it allows a deeper investigation of the phenomenon transparency and helps to properly describe different impressions with different terms.

According to Beck [14], the perceptual transparency can be explained by the nature of subtractive colour mixtures: this means that the transparent object filters the radiation that passes through it in a spectrally selective way (like the green glass example by W.). According to this view a transparent white would not be possible, because white character should be determined by its spectral transmittance, but a complete transmittance makes the object colourless (glass). As one can see, this interpretation of Beck [14] is close to the position of W., but is not a mathematical model of transparency like that of Gerbino [11], and it is far from being scientifically reliable. In fact, according to da Pos [15] selective filtration can produce visually unexpected results, as our visual system works in an additive manner [16], and in fact this interpretation requires a prior experience to give effects of perceptual transparency. Moreover cases of phenomenal transparency are better (although not very well) explained by additive mixtures, in particular partitive, such as those proposed by Metelli [6], da Pos [15], D'Zmura *et al.* [17].

A recent model by Faul and Ekroll (scaling model [18]) is inspired by particular subtractive processes, but the set of parameters used in it greatly limits its interpretability and usability, and is not very different from the additive models though providing slightly better results in the reported experiments. Lastly it does not pronounce at all on the case of a transparent white object. In some models of subtractive transparency one can rely on the fact that the colour of the transparent object would never arrive to have a very high reflectance, such as to justify the perception of a white object. However, the anchoring theory of lightness perception [19-20], does not require a very high reflectance to see a white, as it appears white the surface that has the highest luminance in the visual field, even if it corresponds to a low reflectance. Consequently fall even the few reasons that could justify scientifically that white cannot appear transparent.

One can interpret W.'s point of view by analysing the reasoning procedure he suggests [I-29: "From the rule for the appearance of transparent coloured things that you have extracted from transparent green, red, etc., ascertain the appearance of transparent white! Why doesn't this work?"]. It seems he is suggesting a cognitive procedure consisting in deriving some rules about the visual appearance of colours of transparent objects from the analysis of specific terms, for instance deriving rules about transparency from the transparent red, the transparent green, and so on. Next step is to apply such rules to new cases and see whether they work or not. Lastly he concludes that what we learn from studying transparent green and red cannot be applied to white. Of course one can argue why white cannot be transparent as green and red are. And the reason is that the cases of green and red transparency analysed by W. do not include green and red translucency, which are maybe rare but actually existing (green and red veils).

If a surface takes the colour of the light which falls on it, it should, according to W. become whitish (decreasing saturation). It is the same argument of the filter: if a red filter makes objects in the back to appear reddish, how should be perceived objects behind a white filter? One should not be trapped in the language as W. does, because the characteristics of colours which he expresses are not all the possible ones, forgetting a large part of them, especially as regard to the understanding of what he calls 'concept'. He considers true that an object seen under a red light appears reddish, and that an object seen under a green light appears green: but this is not always true, both in our experience and still more in science. As an example, a yellow object (which appears yellow under white light) appears white under a yellow light.

To be a little critical, either he does not quote cases in which the statement is false though he knows it (but I discard for the moment this alternative), or this happens because he does not know it. Irrespective of the reasons why he does not know the truthfulness of the statement, explicit deductions contrary to what is scientifically ascertained are not trivial limits to his speculations.

He is notably wrong when stresses that only clear glasses and lights can be transparent [I-4, III-239]. W. never speaks of transparent veils, which not only were well known at his time, but can have all colours, white included. It is difficult to find a reason for this omission.

On the other side one can certainly agree with W. when he states that “the logic of colour concepts is much more complex than one might think” [III-106], but I would add that it is fruitless starting from the concepts without knowing how they are defined, i.e. which relationship they bear with empirical experience. Although W. sustains that defining a concept is of secondary interest, this vagueness can certainly be the reason of the difficulty in dealing with the logic aspects of colour concepts [I-12].

Conclusions

In conclusion, Wittgenstein's claim that white cannot be transparent is contradicted by the plain, white veils which are transparent, and very attractive. No scientific model of perceptual transparency excludes the possibility that white might be transparent, especially because this aspect, even if of considerable theoretical importance, is not usually considered.

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