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Galileo perceptionist

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Abstract. The present paper focuses on Galileo's conception of perception. I take as my starting point the interpretation of the Galilean text by Piccolino and Wade (2008, *Perception* **37** 1312 – 1340): Galileo's eye: a new vision of the senses in the work of Galileo Galilei. Three points are discussed: the criticism of naive realism, the theoretical role of perceptual laws, and the distinction between different qualities of experience. The conclusions support an alternative interpretation which underscores the crucial role of phenomenology of perception in Galileo's epistemology.

Keywords: Galileo Galilei, perception, phenomenology of perception, naive realism, perceptual laws, qualities of experience.

1 Introduction

In recent years, several authors have discussed Galileo's conception of perception (Drake 1977; Bozzi 1990, 1995; Piccolino 2007; Wade 2007; Foschi and Leone 2009) and some of them (Piccolino and Wade 2008a, 2008b, 2009) maintain that Galileo's work has paved the way for modern sensory neuroscience. This general thesis is supported by an extensive discussion, with many references. However, according to me, the interpretation of the Galilean text by Piccolino and Wade underestimates the epistemological value Galileo himself placed upon the phenomenal data of perceptual experience. In the present note I make reference to this interpretation and discuss mainly three points: the criticism of naive realism, the theoretical role of perceptual laws, and distinction between different qualities of experience. The aim is to support an alternative interpretation which underscores the crucial role of phenomenology of perception in Galileo's epistemology.

2 Criticism of naive realism

As is well known, Galileo's method is based on immediate perceptual experience, frequently (see Baroncini 1992) called 'sensata esperienza' (translated as 'sensible experience' or 'sensory experience'), which is the essential Aristotelian instrument against the blindly dogmatic theorisation of the Aristotelians. According to Galileo:

> "Among the safe ways to pursue truth is the putting of experience ahead of any reasoning, we being sure that any fallacy must reside in the latter at least covertly, for it is not possible that sensible experience is contrary to truth. This also is a precept highly esteemed by Aristotle which he placed far in front of the value of all authority in the world." (Galileo 1640b, page 249; English translation in Drake 1980, page 109)

However, an *aporia* can easily be recognised in that: 'sensible experiences' can often be disproved. For instance, his very Copernican conception of the solar system is the opposite of what it appears: the Sun moves, the Earth is still. Piccolino and Wade (2008a) emphasise Galileo's diffidence about the appearance of data and resolve the *aporia* by invoking conscious and unconscious interpretation.

> "The senses are potentially deceptive for Galileo, but, in spite of their limits, they are nonetheless a fundamental path for acquiring knowledge of the world. To see something was for Galileo not simply to look at it and to register its instant impression. On the contrary, it was a complex operation in which the immediate appearance had to be

> interpreted in a conscious (and, to some extent, also unconscious) way with reference to our previous sensory experience. Galileo's recurring expression signifying the importance of such critical reflection for extracting useful information from potentially deceptive sensory appearances is 'eyes of mind'." (Piccolino and Wade 2008a, page 1328)

Thus, according to Piccolino and Wade (2008a), truth would then be established by Galileo through immediate appearance and conscious and unconscious interpretation:

> "Experiments are important and they must be based on senses, but, in this context, 'senses' must be intended as an educated capacity of seeing and critically interpreting the nature of phenomena, based on a strong interplay between reasoning ('discorso') and observation." (Piccolino and Wade 2008a, page 1334)

Logically speaking, if one of the terms of a conjunction (appearance) is false and one (interpretation) is true, the conjunction is necessarily false. Indeed, Galileo says this—as quoted by Piccolino and Wade themselves:

> "How then could we say that the moon is mountainous? We do not know it simply with the sense, but by coupling and joining the [logical] discourse with the observation and the sensible appearances, by arguing in such way (OG XI, page 183)." (Piccolino and Wade 2008a, page 1329)

However, in the English translation there is a slight but significant difference. Galileo writes: "Lo sappiamo non col semplice senso, ma coll'accoppiare e congiungere il discorso coll'osservationi et apparenze sensate"(Galileo 1611b, page 183). He uses *observations* in the plural (it is singular in the English translation) because it is the different perspectives and conditions of observation (each of which determines a reliable and true appearance, but relatively true) which together determine the truth on the observable.

Indeed, Galileo can have full confidence in appearance, as he himself recalls in a note on Sizzi's *Dianoia Astronomica, Optica, Physica*:

> "That vision is not deceived in modest distances perhaps experience alone could have taught us, when, getting nearer the objects, we learn that they are indeed what they appeared." (Galileo 161a, page 248)

Galileo's position seems then rather consistent with a sort of critical realism, in which there is full confidence in appearances, but only if considered in relation to the particular perspectives and conditions of observation. The truth about the observables cannot in any case be obtained through a conscious or unconscious interpretation, because, logically speaking, interpretation could never autonomously establish when observation is fallacious or when it is not. Indeed, another observation is always required to establish it, but it must come from the logical argumentation that joins the truths related to the different observations.

3 Theoretical role of perceptual laws

Galileo often gets to the truth of physics and astronomy via deductive reasoning, based not only on appearance (and on geometry, on optics, etc) but also on perceptual laws. One of the many examples can be found in the letter to Prince Leopoldo dei Medici, in which Galileo discusses the cause of the 'whiteness' of the moon:

> "Having once and then twice observed the said candour, urged by the natural desire of understanding the causes of the effects of nature ..., I awaited with curiosity the time of the next total eclipse of the Moon, convinced that if it shone with such a light by itself, it would show itself much more brilliantly in the depth of a dark night than in the twilight of dusk; in such a way that the unparalleled splendour of the Moon, bestowed on it by the Sun, appears to us more beautiful and huge in the dark of night than at noon, but also than at twilight. The eclipse came, and remaining the Moon so dark that it was totally inconspicuous, I was made certain that its candour was not its own, and necessarily must have been bestowed on it *ab extra*." (Galileo 1640a, page 508)

Unable to directly control the physical conditions, Galileo deduces the physical truth assuming as true the premise of the law of visual contrast. As Piccolino and Wade themselves record:

> "the information provided by the senses is necessary for confirming the conclusions of mathematical reasoning and thus stands as the basis for any knowledge of the physical world science may reach." (Piccolino and Wade 2008a, page 1334)

In this way, Galileo recognises an epistemologically autonomous legitimate level of the observables. By this admission he not only accepts the truth of a perceptual law as a necessary term to logically support a physical theory, but also legitimises a domain—phenomenology of perception—with its own laws *iuxta propria principia*. Like mathematical truths, true even if nobody thinks of them (Bolzano 1837), the laws of phenomenology of perception (simultaneous contrast), within an anti-psychologistic framework (Husserl 1900; Stumpf 1907), are also true and they are studied regardless of the inner activity of the perceiver.

4 Distinction of qualities of experience

> "Now I say that whenever I conceive any material or corporeal substance, I immediately feel the need to think of it as bounded, and as having this or that shape; as being large or small in relation to other things, and in some specific place at any given time; as being in motion or at rest; as touching or not touching some other body; and as being one in number, or few, or many. From these conditions I cannot separate such a substance by any stretch of my imagination. But that it must be white or red, bitter or sweet, noisy or silent, and of sweet or foul odour, my mind does not feel compelled to bring in as necessary accompaniments. Without the senses as our guides, reason or imagination unaided would probably never arrive at qualities like these. Hence I think that tastes, odors, colors, and so on are no more than mere names so far as the object in which we place them is concerned, and that they reside only in the consciousness. Hence, if the living creature were removed, all these qualities would be wiped away and annihilated. But since we have imposed upon them special names, distinct from those of the other and real qualities mentioned previously, we wish to believe that they really exist as actually different from those.
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> I may be able to make my notion clearer by means of some examples. I move my hand first over a marble statue and then over a living man. As to the effect flowing from my hand, this is the same with regard to both objects and my hand; it consists of the primary phenomena of motion and touch, for which we have no further names. But the live body which receives these operations feels different sensations according to the different places touched. When touched upon the soles of the feet, for example, or under the knee or armpit, it feels in addition to the common sensation of touch a sensation on which we have imposed a special name, 'tickling'. This sensation belongs to us and not to the hand. Anyone would make a serious error if he said that the hand, in addition to the properties of moving and touching, possessed another faculty of 'tickling' as if tickling were a phenomenon that resided in the hand that tickled. A piece of paper or a feather drawn lightly over any part of our bodies performs intrinsically the same operation of moving and touching, but by touching the eye, the nose, or the lower lip it excites in us an almost intolerable titillation, even though elsewhere it is scarcely felt. This titillation belongs entirely to us and not to the feather; if the live and sensitive body were removed it would remain no more than a mere word. I believe that no more solid an existence belongs to many qualities which we have come to attribute to physical bodies—tastes, odors, colors, and many more." (Galileo 1638, pages 347 – 348; English translation in Drake 1957, pages 274 – 275)

According to an authoritative interpretation of the famous excerpt from *Il Saggiatore* (The Assayer) on the distinction of the qualities of experience (Drake 1978), which Boyle (1666) will later name as primary and secondary, Galileo not only makes a qualitative distinction on the data coming from the phenomenal experience, but also establishes the subjectivity of the secondary qualities, with an ontological value (Burtt 1932).

According to Piccolino and Wade:

> "Galileo's general reflections on the senses exerted an important influence on the debate concerning the cognitive relation with reality." (Piccolino and Wade 2008a; page 1336)

If this is valid for the post-Galilean debate, the ontological option cannot be defined with any certainty from Galileo's works. An alternative interpretation on the contrary claims a methodological distinction. According to Husserl (1959):

> "we must note something of the highest importance that occured even as early as Galileo: the surreptitious substitution of the mathematically substructed world of idealities for the only real world, the one that is actually given through perception, that is ever experienced and experienceable—our every day life-world." (Husserl 1959; English translation in Carr 1970, pages 48 – 49).

For all his historical inaccuracies (Cassirer 1906 – 1907), Husserl nevertheless "provides the key for a profound and radical understanding of Galileo's work" (Koyré quoted by Gurwitsch 1978, page 74). According to Husserl (1959), Galileo gets to the mathematisation of nature by assuming the primacy of spatiality as a model for quantification. In so doing Galileo does not refer to the pre-categorical phenomenological extension, but to extension as a quantifiable quality. He does not achieve mensurability of the quality of immediate experience, but provides mensurability of the quality of experience by applying the model of quantifiability of extension. In other words, he imposes onto experiential qualities the schema of quantification, thus determining quality discrimination. Now, while for Galileo this operation was to have a positive value—a methodological value for the mensurability of nature—in the scientific tradition it came to acquire a negative value: it excluded the qualities that cannot be scientifically studied. And so, the primitive form of methodological reductionism has thus become ontological dualism. Therefore, according to this reading (see also Geymonat 1957; Bozzi 1995; Sinico 2012), Galileo's operation is methodological: he excludes the immediate experiential data, which are not practically useful to physical knowledge, to measurement. He excludes them not because they are not cognitively legitimate, but because they are not cognitively mathematisable.

Not by chance, a shrewd physicist like Köhler (1938), starting from the Galilean revolution, ended up saying:

> "Whenever a characteristic of human perception or of human thought is proved to disturb the objectivity of science, its influence will, of course, have to be checked. But does it follow that all qualities of the human, ie, the phenomenal, world must be disregarded when the physicists construct their system of objective reality? ... There is no ultimate source for the physicist's concepts other than the phenomenal world." (Köhler 1938, pages 373 – 374)

5 Conclusion

If these three arguments are valid, it follows that Galileo considers phenomenology the basis of his epistemology. After all, it would be contradictory to assign a crucial epistemological role (giving well-founded assumptions and allowing the empirical verification of theories) to immediate perceptual experience and then declare it unreliable. Galileo:

> "Like a true scientist, you make a very reasonable demand, for this is usual and necessary in those sciences which apply mathematical demonstrations to physical conclusion as may be seen among writers on optics, astronomers, mechanics, musicians, and others who confirm their principles with sensory experiences that are the foundations of all the resulting structures." (Galileo 1638, page 212; English translation in Drake 1974, page 169).

The present note agrees with Piccolino and Wade (2008a) on an important point: Galileo laid the foundations of modern science and neuroscience, and not only from a methodological viewpoint. In as much as neuroscience is oriented to explain the

functioning of a system, first it must start from the laws of phenomenology of perception to construct inferentially functionalist models. If neuroscience started from an intellectualised and abstract physical world in order to verify its hypothetical brain models with an empirical world loaded with theory, the result would be a short circuit (Sinico 2010). Second, to the extent that a theory of neuroscience cannot be an isolated hypothesis (Duhem 1914; Gillies 1993), the laws of phenomenology of perception are always a necessary assumption logically connected to the hypothesis to be tested.

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