INTRODUCTION

Why do we have sense-organs? We have ears, intricate structures composed of membranes, bones, channels, etc., a nose with two nostrils and a mucous membrane which covers a nasal cavity. We have taste buds, a range of tactile sensors under our skin, not to mention the eyes. Why?

The simple answer is that we have sense-organs because they enable us to perceive. A sense-organ, as Aristotle would say, is an *organon*, a tool or instrument of perception. But to understand why the sense-organ is instrumental in perception we must understand something about perception. Just as we must understand something about gardening before we can appreciate the usefulness of a rake, so we must understand something about sense-perception before we can see the point of having a sense-organ. An explanation of the sense-organs must therefore start with an understanding of what sense-perception is. Once we understand what sense-perception is, we can explain how the sense-organs help bring about sense-perception as we have understood it.

In modern science it can be taken for granted that the explanation of perception will refer to physical processes.[1] For example, vision is said to be the process whereby the eyes 'feed the brain with information coded into neural activity – chains of electrical impulses – which by their code and the patterns of brain activity, represent objects'.[2] Vision is understood as a physical process in a physical system: reference is made to 'light energy', 'electrical impulses' and 'the brain'. Particular stages in the process of vision are located in particular parts of the body. The conversion of light energy into electrical

[1] By 'perception' I shall throughout this study mean 'sense-perception'.
[2] Gregory (1966) 7.

impulses is something that happens in the eye, whereas the decoding of the electrical impulses is something that happens in the brain. The eye is a sense-organ of vision in this way: the eye is a part of the body in which the physical process which defines vision takes place.

The question why we have sense-organs thus shows up a particular view of how perception is to be explained. An explanation such as Gregory's explanation of the eye goes hand in hand with understanding perception to be a physical process. The assumption here is that if we are to have more knowledge about perception then that knowledge is to come from a greater understanding of the physical processes involved in perception, that is to say a greater understanding of which part of the body does what and when. Perception as a physical process is something that we can observe and measure in the sense-organs. It is here already assumed that if there is perception then there are parts of the body which realise that process. If we call these parts 'sense-organs' then we can see why we must have sense-organs if we are to have perception.

If this is the assumption behind scientific explanations of sense-perception and its organs today, then what are we to make of a philosopher who held that perception is not a physical[3] process but who (nevertheless, as we might say) held that sense-organs are necessary for perception? According to some interpreters, Aristotle is just such a philosopher. If they are right, Aristotle must have had other ways of explaining the presence of the sense-organs than modern scientists. Aristotle cannot have held, like modern scientists, that we have sense-organs because (i) perception is a physical process, (ii) a physical process must be realised in some parts of the body, that is in sense-organs. For perception is not, as it is

[3] That is, not 'physical' in the modern sense. As a first approximation, read 'material' in Aristotle for 'physical' in a modern context. Explaining the difference between 'φυσικός' in Aristotle and 'physical' in a modern context in itself gets one far into Aristotle's theory. As a first intimation of the difference the following may serve: whereas 'physical' and 'φυσικός' both contrast with 'immaterial', 'φυσικός' in Aristotle never means *just* 'material', cf. pp. 7–10, below.

for modern scientists, a physical process. Why, then, *would* Aristotle have held that the sense-organs are necessary for perception? The present study tries to give an answer.

The view that for Aristotle there are or need be no material processes (κινήσεις) in perception goes back to the ancient commentators.[4] More recently, Friedrich Solmsen noted that in Aristotle's theory 'it is doubtful whether the movement or the actualisation occurring when the eye sees or the ear hears has any physical or physiological aspects'.[5] Solmsen's comment has been most prominently developed by Myles Burnyeat. Burnyeat argues that in 'Aristotle's theory of perception there is no physiological process which is related to the perception of a colour or a sound as matter to form'.[6] Perception for Aristotle is not a physiological or material process but a cognitive change. In perception the perceiver changes only insofar as he or she becomes aware of a sense-object of which she was previously unaware. Saying that there is no material process which is related to the perception of a colour as matter to form means that the cognitive change which defines the perception of the colour is not necessarily realised in some material change. Contrast the case of building a house. Here the changes that the materials, the bricks, timber, etc., undergo whilst the house is being built are necessary material changes if there is going be a house. You cannot build a house without changing some materials. On Burnyeat's interpretation of Aristotle, there need be no similar material changes that happen in the perceiver when he or she perceives.

The main rival to Burnyeat's interpretation is the view that Aristotle was a precursor of modern functionalism.[7] The debate between defenders of the two interpretations has

[4] On the history of this interpretation, cf. Sorabji (1991).
[5] Solmsen (1961), as quoted by Burnyeat (1993) 263.
[6] Burnyeat (1993) 263. Note again that by saying that there is no physiological or physical aspect of seeing or hearing we should take Solmsen to mean that there is no *material* change in the eye or the ear. As we shall see, this need not mean that Aristotle thinks there is no material basis of perception.
[7] Cf. Burnyeat (1992).

produced a number of insights into Aristotle's views on the relationship between the soul and the body. The debate is also largely responsible for the renewed interest in Aristotle amongst modern philosophers of mind.[8] The issues involved in the debate provide an excellent introduction to the study of Aristotle's sense-organs. And, as I hope to show in the Conclusion, the study of the sense-organs can in return instruct us on a number of these issues. Let me start therefore by briefly sketching the basis of a functionalist interpretation.[9]

Functionalism understands mental states as analogous to computer or machine states. Machine states are functional states. That is to say, they are defined in terms of their relations to a causal input and a causal output. Compare the case of a cash machine. You insert your card in the slot, enter your code, and the machine issues some money. Whilst waiting for the money to come out, the machine displays the text 'processing your request'. You can define this state of the machine as the state brought about by inserting the card (causal input) which causes the machine to issue the money (causal output).[10] Similarly, functionalism suggests, we can define mental states in terms of their causal input and output. For example, we can define 'seeing red' as the state, say, that an animal is in when its visual centre is affected by the light reflected from pillar boxes, traffic lights, blood, etc. (causal input) and which causes the animal to believe that or to say that or to behave as if there is a red object in front of it (causal output). Defining mental states in terms of their causal input and output allows functionalists to say something about the relationship between mental states and physical states which neither reductionists nor dualists can say: a mental state can, as a functional state, be realised by a number of different physical states. The

[8] Cf. Ostenfeld (1986) ch. 5; Burnyeat (1992) 16.
[9] Since the drafts of Burnyeat (1992) and Nussbaum and Putnam (1992) first appeared, a range of more sophisticated functionalist interpretations has appeared. I cannot hope to do justice to these within the scope of this study. But I hope that by focusing on the multiple realisability claim I have addressed a claim that is central to any functionalist interpretation.
[10] Cf. Block (1980) 173–5.

functions of a machine can be realised in all sorts of gadgetry. Similarly, a mental state can be realised by any number of physical states. A mental state cannot therefore be defined as identical with any particular type of physical state. For example, pain is not identical with the firing of one's C-fibres, even though firing of one's C-fibres may be *one* of the physical states that realise a feeling of pain. Functionalists may here agree with identity theorists that each token, each occurrence, of feeling pain is identical with a *token* of some type of physical state, for example my feeling pain at this moment is identical with my C-fibres firing at this moment. But functionalists will disagree with those identity theorists who claim that a type of mental state can be identified with any one *type* of physical state, for example that feeling pain is always identical with the firing of one's C-fibres. They will disagree with this claim because mental states as functional states are in principle 'multiply realisable' or 'compositionally plastic', that is they can in principle be realised by any number of different types of physical state. In this sense mental states cannot be reduced to physical states.

Avoiding reductionism, however, does not mean agreeing with dualism. Dualists may argue that mental states are not identical with physical states because mental states have properties that cannot be properties of physical states. Descartes, for example, held that awareness defined mental states and could not be shared by physical states. Mental states were therefore different from physical states. The dualist will say not only that no types of mental and physical states are identical but also that no token of a mental state is identical with any token of a physical state. No instance of, say, feeling pain is identical with any physical state. Dualists and functionalists therefore agree to reject type-type identity but disagree about token-token identity: functionalists accept it, dualists do not.

Functionalism seems therefore to steer a middle course between reductionism and dualism. Modern philosophers have tried to find such a middle course because they want to avoid problems in both positions. On the one hand, they want to avoid the problems that dualists have in explaining the inter-

action between the mental and the physical. On the other hand, they want to avoid the problems that reductionists face in accounting for features that are considered characteristic of 'the mental', features such as subjectivity, intentionality and privacy.[11]

So if functionalism did offer a 'third way' that avoided both sorts of problem, then that was clearly welcome. If Aristotle could be seen as a functionalist *avant la lettre*, then that too was clearly welcome.[12] Thus Putnam wrote that he 'was pleasantly surprised to find that my view was substantially the same as Aristotle's, although stated a bit more precisely with the aid of the vocabulary of contemporary scientific methodology and cybernetics'.[13] But was Putnam's surprise justified? Was Aristotle really a proto-functionalist? The discussion that followed focused on one point in particular: to what extent, if any, Aristotle believed (A) that mental processes are realised by material processes. For the specific functionalist claim (B) that the same mental states according to Aristotle can be realised by many different types of material process would of course only be relevant if mental states are realised by material processes in the first place.

In defence of A, Nussbaum related Aristotle's philosophy of mind to his general hylomorphism.[14] Hylomorphism is the theory that natural beings are composites of form and matter. Natural beings are in this respect similar to artefacts. A

[11] The irreducibility of intentional states to computational states was one reason why Putnam gave up his earlier functionalism, cf. his (1988) 73–4; Nussbaum and Putnam (1992) 48–9.

[12] Cf. the acute comments by Wardy (1990) 260–1 on this use of Aristotle:

> at least in this instance [sc. Aristotle's anti-reductionism] Aristotle speaks the truth directly to us, conveying a message that is not essentially antique, or couched in a philosophical language that we can no longer speak. This approach is seductive ideologically, as it were: ancient and modern thinkers become mutually supportive, the Greek icon lending a sort of authority to his supposed philosophical descendants, while the moderns conversely ensure that Aristotle continues to play an active role in contemporary discourse.

[13] Putnam (1975) xiv.

[14] Nussbaum and Putnam (1992).

bronze sphere, for example, is a composite of some matter, the bronze, and a spherical shape or form. Similarly, a human being, for example, is made up of blood, bone, tissue, etc., materials that have a certain form, namely the structure and organisation characteristic of a human being. So both artefacts and natural beings are essentially composites of form and matter. They are essentially composites in the sense that the form is always realised in some matter. The form does not come without some matter.

In living beings the form is the soul and the matter the body. It follows, so the functionalists argue, that the states of the soul are realised by states of the body. If the states of the soul change, so should the states of the body. We should expect, then, on general hylomorphic grounds that perception as a change of state of the soul is realised by a change of state of the body. This would give us claim A.

However, Nussbaum and Putnam pressed the analogy between living beings and artefacts even further towards functionalism, towards claim B. They argued that just as a sphere can be made out of different materials, so the soul and its states can be realised in different materials. The sphere, for example, can be made of plastic or wood or bronze. Seeing, similarly, can be realised not just by changes in a human eye, but by changes in different material structures such as the eye of a frog, a bird, etc. This seems to give us B, the thesis that mental states for Aristotle are multiply realisable. So the functionalists argue that Aristotle's understanding of living beings as hylomorphic wholes by analogy with artefacts supports both the claim A, that the changes in the soul are realised by material changes, and the specifically functionalist claim, B, that the changes in the soul could be realised in different sorts of material change.

Let me briefly try to characterise the explanatory procedure of Aristotle's psychology and then ask whether it supports the functionalist interpretation. Aristotle introduces *De Anima* by suggesting that the study of the soul or psychology (ἡ περὶ τῆς ψυχῆς ἱστορία) is part of the study of nature in general.

Indeed, one of the reasons for studying the soul is that it contributes greatly to our understanding of nature.[15] The reason for this is that the soul is like a principle (ἀρχή) of animals.[16] One thing that is meant by a 'principle' is 'what you need to understand *first* if you are going to explain other things'. *Physica* tells us that animals are prime instances of natural beings, beings that exist by nature.[17] So if you have understood the principle of animals, you can start to explain other things about some paradigms of nature. That is why studying the soul as the principle of animals will contribute to our understanding of nature.

In his psychology, Aristotle borrows the explanatory procedure from his physics. Physics, as he understands it, explains things by reference to 'the four causes' (ἀρχαί/αἰτίαι).[18] They are: (i) form (εἶδος), (ii) matter (ὕλη), (iii) moving cause (ἡ ἀρχὴ ὅθεν) and (iv) goal (τέλος) or final cause (τὸ οὗ ἕνεκα).[19] For example, if you ask 'Why is this a frog?' I can answer you in different ways, pointing to different explanatory and causal factors.[20] I can say that this is a frog because: (i) it has a certain shape, arrangement and structure characteristic of a frog (formal cause); (ii) it is made of flesh and bones and skin without which there would not be a frog (material cause); (iii) its parents, and in particular its father, created it (moving cause); and (iv) it is able to do certain things characteristic of a frog, for example leap and croak (final cause).

When Aristotle says that living beings are to be explained in the manner of physics he means that they are to be explained by reference to all of the four causes. Living beings are ex-

[15] *De an.* I.1 402a4–6.
[16] *De an.* I.1 402a6–7: ἔστι γὰρ οἷον ἀρχὴ τῶν ζώων.
[17] *Ph.* II.1 192b9–12; cf. *De an.* II.1 412a13.
[18] *Ph.* II.7 198a22–3: 'Since there are four causes, it is the job of the φυσικός to know about all of them. If he leads back the 'why' question to them all he will give a "physical" account (ἀποδώσει φυσικῶς).'
[19] *Ph.* II.3.
[20] 'αἰτία' covers both cause and explanation in Aristotle. The moving cause is what comes closest to what we would call a 'cause' or a 'Humean cause'; cf. Sorabji (1980) 40.

plained in terms of the four causes by being analysed in terms of soul and body. In *De Anima* II.4 Aristotle says that the soul is the cause and principle (αἰτία καὶ ἀρχή) of the living beings in three senses: as the cause of motion, as the cause of being or substance (οὐσία) – and here Aristotle is thinking of the formal cause – and, as the final cause, that for the sake of which living beings live.[21] The body, in contrast, provides the material cause. Living beings are thus explained φυσικῶς by being explained as composites of a soul, which is a cause in the first three of the four required senses, and a body, which is a cause in the fourth sense.[22]

The changes that the soul gives rise to and suffers cannot be analysed in isolation from the body, for the soul is a cause of living beings that are essentially composites of form and matter. Physics studies 'destructible things that change'.[23] Physics studies these things *qua* changing and that means that the accounts that physics gives have to mention matter, for matter is a principle of change. Ὕλη is what underlies any sort of change.[24] Without matter there would be no change.[25] Hence physics tries not just to give a formal account of its subject matter. It tries to give an account that shows the formal features as instantiated in matter. Physics here differs from mathematics, since mathematics studies the formal features of changeable objects in abstraction from the matter of these objects and so in abstraction from their changeability. *De Anima* I.1 thus contrasts the φυσικός who is concerned with 'everything that is a function or affection of such and such a body and such and such matter'[26] with the μαθηματικός who treats properties of bodies that are not separable from bodies as if they were separate from bodies, for example he treats the

[21] *De an.* II.4 415b9–12; cf. *Metaph.* V.1 1013a16–17: 'cause' (αἰτία) is said in as many senses as principle (ἀρχή).
[22] The soul thus provides an example of how the final, formal and efficient causes often coincide; cf. *Ph.* II.7 198a24–6.
[23] *Ph.* II.7 198a31.
[24] Cf. *GC* I.4 320a2–3.
[25] *Metaph.* XII.2.
[26] *De an.* I.1 403b11–12.

geometrical shape of a body in abstraction from the body whose shape it is. Explaining a living being φυσικῶς means accounting for its functions and affections as enmattered and not treating them as functions and affections in abstraction from the matter in which they are realised.[27]

As an example of this physical mode of explanation, Aristotle in *De Anima* I.1 mentions the explanation of anger. Anger, he says, when defined in the physical mode is 'a certain change of a body of such and such a kind or of a part or of a potentiality of it as a result of this and for the sake of this'.[28] The explanation mentions, first, the material cause of anger. This is the boiling of the blood around the heart. But the explanation mentions also the reason for or principle of (λόγος) anger, namely, a desire for retaliation. Here, giving the λόγος provides the formal explanation of anger.

The explanation of anger follows the example of 'snub' in *Physica* II.2. 'Snub' is defined as 'concave nose', where 'concave' gives the form and 'nose' the matter in which the form is realised. A physical explanation is like 'concave nose'. By mentioning both the form and the matter, the explanation reflects the fact that the *explanandum*, what is to be explained, is an enmattered form or λόγος.

The important question as concerns the functionalist debate is whether the claim that the affections of the soul are λόγοι ἔνυλοι, and should be defined as such, implies that each mental change is realised in a material change. When I see red, for example, is there then necessarily a material change of some sort in my eye? The example of anger seems to imply that mental changes are realised by such material changes. For it was said to be necessary that the desire for retaliation be realised in a particular sort of matter such as boiling of the blood around the heart.[29] And the passage seems to imply that similar material changes are necessary in the case of all

[27] *Ibid.* 403a25: δῆλον ὅτι τὰ πάθη λόγοι ἔνυλοί εἰσιν.
[28] *Ibid.* 403a26–27: τὸ ὀργίζεσθαι κίνησίς τις τοῦ τοιουδὶ σώματος ἢ μέρους ἢ δυνάμεως ὑπὸ τοῦδε ἕνεκα τοῦδε.
[29] *De an.* I.1 403b2–3: ὁ μὲν γὰρ λόγος εἶδος τοῦ πράγματος, ἀνάγκη δ' εἶναι τοῦτον ἐν ὕλῃ τοιᾳδί, εἰ ἔσται.