

How does the methodology of obtaining and justifying scientific knowledge inform medical practice?

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Scientific knowledge is obtained from results of the construction of scientific theories, which are derived from facts observed from nature that are tested in experiments.¹ Such observations are made by humans with their perceptual faculties. These are our five senses: sight, touch, hearing, smell and taste.² Because scientific knowledge is ultimately based on the observations made, the way these observations are obtained, that is through our perception, becomes important.

Perception can present problems because it is not infallible. I will focus on sight for now because most observations in science are made through sight. Sight is the capturing of photons of light by the retina, which are then converted into nerve impulses that are passed to the brain, which produces the images we see. This means that what we see depends on the objects our eyes are resting upon. Two people looking at the same object will see the same image (under normal circumstances). However, humans do a lot more than just see an image of the object in front of them. We will take that image and analyse and interpret it, and it is the interpretation of what we see which renders perception problematic. How the image is interpreted will be dependent on the person seeing the image, and the specific characteristics of that person. Characteristics may include cultural and educational background and experience. For example, if we were to show people a pair of earphones, most people in developed countries will know what they are and what they are used for, and link that object to music and iPods which are part of their daily lives. However, if we were to show the same pair of earphones to people living in the Third World, who do not have such access to electrical devices, then they would not associate it with music and iPods; they may think it was a special type of string to tie things with, or whatever their imagination takes them to be.

This presents a problem in medical practice. I will use diagnosis as an example. Diagnosis is the identification of disease in a patient by the doctor through a combination of knowledge of the patient's medical history, symptoms, physical examination, and investigations. It is evident that the patient's symptoms and signs manifested by a physical examination both need to be perceived by the doctor. As they are based on perception, it is possible for these to be interpreted differently by people with different backgrounds and different experience. For example, a patient may present with an abnormal gait and loss of dorsiflexion of the right foot. A neurologist who has extensive experience with neuropathies may be

confident in diagnosing this patient with foot drop, which is a lesion of the deep fibular nerve, because she is experienced in this field and knows what signs she is looking for. However, if the same patient was presented to a medical student with little experience in neurological disorders, although he is seeing the same abnormal gait, he may not make the connection between the abnormal gait to a loss of dorsiflexion or it may take him a much longer time to notice there is a lack of dorsiflexion of the right foot. It is evident that the knowledge and experience possessed by the doctor and student may render differences in their interpretations of what they are seeing in the same patient. It follows from that, that the interpretation of one's perceptions requires the appropriate knowledge and the ability to apply this to the observation.² Without the appropriate knowledge, perceptions may be less than useful.

With perception and the information obtained from it, comes the question of whether these beliefs are justified. There are two approaches to answering this question. The traditional approach is that knowledge has to be a "justified true belief"²; that is, for something to be knowledge, one has to believe it is true, and one has to have justification for it. The non-traditional approach is similar in the sense that in both, the justification of knowledge must guarantee that something is not true due to luck alone. However, the two approaches differ in what can be regarded as proper justification. Justification in the traditional definition is belief in something when taking something to be true and it is rational judging from one's own point of view. One must have evidence of experiencing something to believe that something is true. Experiences are of things perceived through our five senses, introspective experiences, memories and intuitions. Because these form part of our mental state, justification is internal according to traditional knowledge. This kind of justification may present problems in medicine, which will be described further on.

On the other hand, justification according to the non-traditional approach holds that it is not based solely on experiences which are the evidence, but also on the reliability of the origin of these experiences. The origin of these experiences, cognitive processes and perceptual faculties must be reliable enough for them to have a high probability of giving rise to true beliefs for them to be sufficient justification. Because the reliability of these experiences is not internal, it follows that justification in this approach is external, even though the experiences themselves are internal.²

In my opinion, justification should be determined by evidence from reliable processes rather than any evidence in possession. What is important in terms of knowledge and beliefs is the pursuit of truth; and one's own experiences or mental states are not always concordant with the truth. Memory is an example of this kind of evidence. Memories are not always reliable and it is possible to have memories of an event for instance that did

not actually occur. For instance, my earliest memory is playing with a doll on a bed in the house we were living in at the time. But I am not sure if this is because it actually happened or because I have seen photos of the house and the doll. Therefore, I cannot believe that I once played with a doll on a bed in that house is true, based solely on my memory of it.

The internalist approach to justification could present problems in medical practice. The type of evidence I will focus on here is introspective experience. Firstly, introspection is the ability to know one's mental state; for instance, we know if we are happy, tired, or in pain. Also, it is difficult for someone to have an introspective experience, for example a headache, when they in fact do not have a headache. Therefore it is less likely for introspective experiences to be fallible than perceptual experiences. However, that is not to say that all introspection is reliable. We are all familiar with the placebo effect, which is the phenomenon of perceived or actual improvement in a medical condition associated with receiving an inert substance. Due to this, if we were to trial a new drug, introspective experiences alone cannot provide sufficient justification for the efficacy of any one treatment. The reliability of introspection is questionable because one's introspective experience is variable depending on many factors. For instance, the placebo effect is variable in its magnitude among different people at different times, because it depends on a person's perception of the treatment and their expectations. It therefore makes the evaluation of new treatments more difficult. To overcome this problem, clinical trials often have a control group who receive a placebo, and are double-blinded.

I stated earlier that with knowledge comes justification. It is important to consider the structure of the two; whether beliefs are built upon each other or if they are more like a network of truths interlinking one another. One way of understanding the structure of justification is that there is a foundation of beliefs that do not require justification from beliefs, which can provide justification for other beliefs. This is called foundationalism²; and the 'foundation' of beliefs which other beliefs rest upon is called basic beliefs. What makes them 'basic' is that its justification does not come from other beliefs but rather because it cannot be falsified or corrected by anyone else. For example, beliefs about one's own perceptions or introspective experiences could be considered as basic because if a person believed they were thirsty it would be difficult for another person to prove that that person was not thirsty. Beliefs external to one's own perceptions or mental states would not be basic because they can be falsified; for instance a belief about an apple being sweet would not be basic, but a belief about the apple tasting sweet to you would be basic. If one was an evidentialist, one would allow the basic belief of the experience of the apple tasting sweet alone be justification for the non-basic belief that the apple is sweet. That is one way in which beliefs are stacked upon one another: One reason for foundationalism is the regress argument.² This is when a belief is justified by another belief, which is justified by another; which is justified by yet another; unless this chain of beliefs terminates at a basic belief, there will either be an infinite number of beliefs in this chain or the chain will loop back onto itself onto the first belief. The regress argument states that either possibility is unsatisfactory therefore, basic beliefs must exist.

Another approach to the structure of justification is that the beliefs a person holds are an interconnecting web in which the justification of one belief depends on the justification of surrounding beliefs. Therefore there are no basic beliefs because all justification would stem from beliefs. This is called 'coherentism' because beliefs must be coherent with other beliefs.² For a coherentist, the belief that the apple is sweet would be justified by the belief that the apple tastes sweet, which is justified by the belief that your taste perceptions were reliable, which would be justified by the belief that you have a good record of your taste perceptions being reliable in the past. These beliefs would all be in the epistemic vicinity of the belief that the apple being sweet.

In terms of the sciences, I believe that justification is coherent. Science is not one theory but a set of theories, and no theory sits alone. For instance, the germ theory of medicine is a theory which postulates that micro-organisms are the causes of disease. In order for this theory to be justified, it must not contradict other existent theories such as those of evolution, genetics, and reproduction. Therefore, theories in science must relate to other theories. Applied to medical practice, coherentism can be compared to treating a patient by recognising that all aspects of their well-being relate to each other and affect a person's health (for example, the Te Whare Tapa Whā model of health).

In describing the methods of obtaining scientific knowledge, I have shown some problems with perception and introspection, mainly that both are not infallible. This has the potential to lead to diagnosis of patients using these two methods being problematic, because the obtaining of knowledge must come with the ability to apply this knowledge appropriately. Following the obtaining of knowledge is the justification of it; I described the two approaches to justification of knowledge and I have shown my opinion that justification should be external by the example of the placebo effect. Lastly, two ways of understanding how justification is structured was described: foundationalism and coherentism. In terms of scientific knowledge, I believe that justification is coherent.

As for the medical practitioner, this knowledge encourages us to continually educate ourselves so we are adequately equipped to interpret the things we perceive, to recognise that introspective experiences can be unreliable, and to treat patients from a holistic point of view.

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