

Intuition and problem solving

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There is a time for scientific method and a time for intuition. Poincaré

SUMMARY. General practitioners use the hypothetico-deductive method of scientific reasoning to solve problems. In the first few minutes of their consultations physicians form initial hypotheses about their patients' problems. This process has childlike, imaginative qualities based on intuition. It is often outside consciousness and probably based on pattern recognition. It has been neglected from study and analysis because of these 'mystical' qualities. Yet it is the key to fast and efficient problem solving. If the process could be understood, its efficiency would be improved. This paper is an attempt to explore the nature of general practitioners' intuition.

Introduction

The scientific method

SCIENCE and its methodology are often thought to be logical and objective. The *New Columbia Encyclopaedia* demonstrates this thinking by dividing scientific methodology into two parts: first is an information-gathering process leading to the formation of a hypothesis, using inductive reasoning; second is analysis and development of the hypothesis by observation and experimentation, using deductive reasoning. If the hypothesis is 'proven' it becomes scientific law. Medical problem solving is taught to medical students using this process. The initial phase of observation corresponds to the history, physical examination, and basic investigations. The hypothesis formation and testing correspond with the differential diagnoses and further investigations.

This view of science as totally objective and logical

is incomplete because it relies on the myth of objective observation, leaving no room for the observer's prejudices. If this incomplete view of science were true, scientific and medical problem solving would be slow, inefficient, and unimaginative. Science evolves slowly by logic: it evolves with leaps and bounds by creativity and intuition.

Popper (1959) emphasizes the need for creativity and intuition in addition to logical analysis. He, too, divides scientific methodology into two parts. However, his first part is very different from the above. He calls it "the psychology of knowledge", because it is neither logical nor based solely on objective observation. It is based on a mixture of partial knowledge, intuition, and creativity, which is used to form a new idea or hypothesis. Popper says of this: "The act of conceiving or inventing a theory seems to me neither to call for logical analysis nor to be susceptible to it," and "There is no such thing as a logical method of having new ideas, or a logical reconstruction of this process."

Popper calls the second part of the scientific method the "logic of knowledge", because the new idea or hypothesis is tested using deductive reasoning. It is as essential as, and complementary to, the psychology of knowledge. Popper says: "I do not demand that every scientific statement must have in fact been tested before it is accepted. I only demand that every statement must be capable of being tested, or in other words I refuse to accept the view that there are statements in science which we have resignedly to accept as true merely because it does not seem possible for logical reasons to test them."

Popper's two-part division forms the hypothetico-deductive method of scientific reasoning. It is suitable for medical problem solving in general and general practice in particular (McWhinney, 1972; RCGP, 1972; RACGP, 1976). Observations have shown that experienced physicians of many disciplines solve problems in this way, in spite of their traditional teaching (Elstein *et al.*, 1972; Leaper *et al.*, 1973).

Before seeing a patient, physicians have ideas or

hypotheses about the kinds of problems the patient will present. This is based on previous experience with the patient or someone of similar age and background. Physicians rarely encounter patients about whom they have completely open minds; from the beginning the physician is focusing on certain diagnostic possibilities.

During the first few minutes of a consultation with a patient, the physician is observing, consciously and subconsciously, pieces of information (cues) which will enable him or her to form initial hypotheses about the patient's problems. General practitioners use "an extended range of information" based on verbal and non-verbal behaviour as well as previous experience of the patient and family (RCGP, 1972).

After an initial hypothesis is formed, a search is conducted to gather more information to define it. This process is dynamic so that hypotheses may be defined and redefined many times during a consultation. The search is aimed at getting further information (history, physical examination, investigations) until physicians are satisfied with their refined hypothesis, enabling them to start treatment. The latter is the final validation of the hypothesis.

This process may be compared with Popper's methodology. The formation of the initial hypothesis is "the psychology of knowledge" and its validation through the search, refined hypothesis, and treatment is "the logic of knowledge". The key to this method is the accuracy of the initial hypothesis; if this is false its validation will be unproductive and wasteful of time, energy, and resources. Problem solving will be more efficient if the initial hypothesis is correct. Busy general practitioners, seeing a patient every few minutes, need to be accurate formers of initial hypotheses. This is one of the fundamental skills of efficient medical problem solving. If it could be analysed and understood, it could be taught to trainees to their benefit.

Clinical intuition

The late Eric Berne became well known for his best-selling book *Games People Play* (1968). However, in his earlier writings he dealt with his observations and thinking about intuition. These have now been collected and published as a book, *Intuition and Ego States* (Berne, 1977). Even though his observations on intuition concerned his work as a psychiatrist, I feel that they offer useful insights into the intuitive process of initial hypothesis formation.

Berne (1977) described four methods of making judgements, which may be considered analogous to the initial hypothesis formation. They are not mutually exclusive, as most judgements are a mixture of all four processes.

The first method is to collect enough information to make a logical conscious decision. This is analogous to the classical scientific and medical problem solving described above. It probably exists alone for very few problems.

The second method is to make a judgement on a pre-conscious or pre-verbal level, based on pre-conscious sensory observations. The observations and judgements are then translated into verbal symbols (language) on a conscious level, which may be explained to an observer. However, something is lost in the translation because language is an inadequate tool to describe the whole process. Crombie (1972) has described the limitation of symbolic communication (language) as a method of transmitting knowledge. He said: "When human beings communicate with one another only a proportion of the total information is explicit in language symbols." This method is the basis of much general practice teaching. The experienced physician may form a hypothesis and, when asked, will describe the process by which it was reached. This is similar to the bird watcher explaining to a novice why a particular bird, visible only as a dot in the distance, was identified as a robin. It is easy to suspect that the reasons are being constructed after the conclusion.

Thirdly, Berne describes a subconscious process which may never be made conscious. The process is closed to analysis and cannot be explained. We have all made an initial hypothesis for which we have been unable to give an adequate explanation. Presumably this, too, is based on pre-conscious sensory information.

The fourth method of making judgements Berne calls "an unknown process".

In conclusion, Berne thought judgements were based on an intuitive process which used "knowledge based on experience and acquired by means of pre-verbal, unconscious or pre-conscious functions through sensory contact with the subject", and "without the intuitor being able to formulate to himself or others exactly how he came to his conclusions". This intuitive process is a useful framework for explaining how physicians make initial hypotheses in the early part of their consultations.

Berne's work on intuition led to his functionally useful view of the human mind as having three parts, which he called child, adult, and parent ego states. The child ego state contains wants, needs, feeling, and intuition. The adult ego state functions like a computer as it is able to think, analyse, and process information in a logical fashion. It also monitors information from the child and parent ego states. The parent ego state contains all the rules and 'shoulds' that we have learnt from parental figures. It may be nurturing to either self or others. At all times we function in one of these ego states.

The child ego state's creativity and intuition are important for problem solving. Berne amusingly called this part of the child ego state 'the little professor' (McCormick, 1977). It is present from an early age, and may be seen when a child works out a grown-up's true feelings and sees through his social façade. However, if intuition and creativity are not encouraged during

development the skills tend to become lost. We also tend to ignore them under pressure from other parts of our personality.

The initial hypothesis is based on incomplete information which is insufficient for logical analysis at that moment. This has practical implications because if physicians suppress their intuition and attempt early in the consultation to analyse information logically, they will make little progress. Physicians need to listen to their intuition, formulate an initial hypothesis, and only then begin its analysis.

Before examining the initial hypothesis the adult ego state has the function of translating the intuitive information into language or symbols for conscious analysis and possible transmission to others. Quality is lost in this process for the reasons described above.

Comparing Berne with Popper, the psychology of knowledge resides within the child ego state and the logic of knowledge with the adult ego state. Other writers, such as Rogers (1961) and Maslow (1971), have described creativity and intuition as childlike behaviours.

Wulff (1976) states that diagnoses are based on pattern recognition, probability, or knowledge of aetiology. The latter two are probably conscious processes, whereas much of pattern recognition is unconscious and probably the basis of intuition. Fabb (RACGP, 1976) has compared the functioning of the human mind with a computer. The mind has stored patterns or codes which are compared with incoming sensory information to see if there is a match. If a match takes place, the pattern is recognized and a diagnosis is made. Learning and experience increase the number of patterns or codes in our minds. To recognize a pattern it is unnecessary to have a complete match. A picture of a jigsaw puzzle may often be imagined when only one or two pieces are in place. The more experience with the puzzle the easier it becomes.

All sensory information, conscious and unconscious, is used in making and matching codes. The adult ego state concentrates on conscious verbal communication, which is the way we have been taught. In contrast the child ego state uses all sensory information, especially non-verbal. It picks out incongruencies between verbal and non-verbal information. This is a skill which needs to be encouraged and developed to improve problem solving.

Browne and Freeling (1976) have described a "sixth sense". Berne (1977) also alludes to this. The sixth sense, of how physicians are behaving and feeling toward their patients, gives important clues to their patients' behaviour. Awareness and use of this is a part of the intuitive process.

Previous knowledge about a patient or similar situation may be helpful in forming an initial hypothesis, although this information may also prejudice the intuitive process. For example, a child with recurrent abdominal pain may have appendicitis,

and the sixth cough in a morning of colds may be pneumonia. It is right to make a hypothesis on previous information provided physicians are aware of what they are doing and of its potential dangers.

Empathy has a powerful influence on the doctor/patient relationship, enhancing the effectiveness of the physician. Physicians may do this by reflecting to their patients their understanding of how their patients are feeling, thinking, and behaving. Much of this knowledge is gained by intuition.

Berne (1966) thought the initial few minutes (perhaps seconds) of a consultation are the most important because observations are taking place leading to the formation of the initial hypothesis. An incorrect hypothesis at this stage may prolong the consultation and organize the illness along patterns it will be difficult to reassemble. In the first few minutes it is imperative for physicians to listen and observe, free from other ego state pressures. It is the quality and intensity of contact at this point which is of importance.

Balint and Norell (1973) emphasized the need for the initial phase of the consultation to be unstructured and patient centred. Physicians will then be more likely to 'hear' what the patient is saying. This is the basis of the 'flash' technique, which I see as very similar to the intuitive process.

Barriers to intuition

Many factors interfere with the intuitive process; these are usually conflicts arising from other parts of the physicians' ego states. For example, if physicians are tired, hungry, and have several patients waiting to be seen, their child ego state's need for food, rest, or finishing will interfere with the intuitive process.

After forming an initial hypothesis the physician may react in different ways. He may ignore it because he believes it is wrong to act on 'guesses'. The parent ego state contains messages or injunctions, rather like tape recordings, which are switched on at appropriate (or inappropriate) moments. These injunctions are learned from parental figures. At times they may be useful; for example, the injunction "All postmenopausal bleeding is carcinoma of the uterus until proven otherwise" may act as a reminder at the end of a busy day. Many are harmful and interfere with problem solving. General practitioners still carry injunctions such as "Do not miss a cancer!", "You must find rare diseases", and "Send me interesting cases". These are left over from teaching hospital days and may still be a burden when they appear inappropriately. A function of vocational training is to help trainees discard those which are not useful. It is important for trainers to be conscious of what injunctions they are creating within their trainees, and whether these are useful.

In contrast, it is often tempting for busy physicians to act on a hypothesis without validating it. This is dangerous except when done consciously to use the

action as the validation of the hypothesis. For example, I have occasionally used anti-depressants on patients with suspected depression to alleviate their symptoms. Sometimes this has been successful. the other times I have had to re-evaluate the depression hypothesis. Most times physicians will try to validate their hypotheses to a degree they find acceptable. The amount of proof needed will vary with the hypothesis and its projected outcome. At one extreme, a carcinoma will need a high degree of proof before radical surgery or chemotherapy is begun, in comparison with vague symptoms (tiredness, headaches) when the physician may be content to say, "the probability of life-threatening illness is low and further investigations are not warranted".

If physicians are unable to validate a hypothesis after an acceptable search, they will need to give up their logical, adult ego state thinking and start again on a new hypothesis. This may be difficult as it needs flexible thinking. Sometimes a second opinion is needed to produce a new hypothesis.

Conclusion

Intuition has been described as one of the keys to problem solving. Its fast and pre-conscious nature makes it difficult to evaluate and understand. This has led to its mystification. The challenge is for physicians to demystify and begin analysing it. Methods for understanding the process of the first few minutes of the consultation need to be developed. If the process is understood it may be improved and taught to the benefit of general practitioners and their trainees. We may all learn to listen to our "little professors"!

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Addendum

Dr Style is now a family physician attached to the University of Massachusetts.

The design of hospitals

It seems to me that we make a fundamental error in the whole design of our hospitals in designing them around the bed as the unit rather than around services. Many patients in the hospital do not in fact need to be in bed at all during much of the day and yet there is nowhere else for them to be. If you take a census of the patients in an acute general hospital, you may be surprised to find how many are there purely for medical or social or geographical convenience rather than because they need continuous nursing and medical care. in the *Irish Times* of 26 August 1978 Dr David Nowlan reported a study of 400 patients admitted consecutively to the acute care ward of a major regional hospital. Sixty-four of the 400 patients were admitted only for special x-ray examination and their average stay was two and a half days, although the examination in question only took an hour or two. Of course there are acutely ill patients who need a high level of nursing but very many patients in hospital for investigation, and patients in the recovery phase of an illness, are in fact needed in the hospital only during the working weekday, perhaps 08.00 to 17.00 hours from Monday to Friday.

It is true that attempts are being made to face up to this problem by the development of day wards, five-day wards, and the development of hostel accommodation near the hospital. But what is really needed is a fundamental re-thinking of the whole design of our hospitals. Let us design them around the facilities and services. The 25 per cent (and that is a generous estimate) who need intensive care or high-level nursing care could be accommodated in wards as at present. But the remaining 75 per cent could be as well accommodated in hotels designed as part of the hospital complex and brought in to five-day wards during the working weekday as need arises. Many of the patients would not even need to be brought to the five-day wards; they need only be brought to special investigation departments during the short period of the investigation itself.

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