Perils of perception in radiant radiology

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Perils of perception in radiology

by Prof. Dr. J. F. Schouten

Our own world is an inner-world of perception. We gain information of the outer world through our senses by observing. By thinking, our brain then processes the incoming information, finally leading to some action upon that outer world. The ensuing results are observed, and through this feedback, our perceptual cycle is completed tens of thousands of times a day in all our manifold activities. From babyhood onwards our ever repeating observations, considerations and actions build up our world of perception, our fair and reliable image of an increasingly familiar outer world. By continuous learning the trial and error of the initial tentative jerk and the odd response develops into a pattern of adequate recognition, efficient thinking and appropriate action and reaction.

Yet, this remarkable feature of the living being is, by definition, restricted to a world which has become familiar by the cumulative reminiscence of success and failure. This is a man, or any animal for that matter, is all but lost when confronted with an unfamiliar world in which observations "make no sense" nor actions evoke the "natural" response. Brainwashing is a pernicious example of abusing this limitation of man's perceptual powers. In normal life the deviations from the normal pattern are less drastic and we are able to acquire new skills.

In the medical profession, for instance, one learns to recognize symptoms, be it in the behaviour of the patient or in the interpretation of an X-ray picture, an auscultation, an electrocardiogram or an electroencephalogram. One learns to make a diagnosis from subtle differences, unobservable by the layman, to take appropriate action and even make a fair guess at the prognosis.

The two visual worlds

The main subject of this paper is to dwell upon man's visual world and to illustrate how completely different the radiologist's visual world is from the visual world of the man in the street.

Let us start by remarking that the eye, as a sensory organ, reports something to the brain and that the brain interprets this message. This remark is far from trivial, in particular as regards the eye. The eye reports that a person has a front but no back. The brain interprets this as evidence of a complete person, "knowing" that if the person turns around his back will appear.

The eye reports a hole in a background, the contour of which corresponds exactly to that of the person or object in the foreground. The brain "assumes" the background to be present completely. The eye reports that a person becomes smaller and smaller. The brain, "knowing" that people are not in the habit of dwindling in size, interprets this message in terms of the increasing distance of the person viewed. The most remarkable feature of this automatic translation from viewing angle into distance, developed from infancy onwards, is that it operates in the normal direction of viewing only. Whenever we look around, we are amused by the apparent smallness of the people and the objects on the ground.

What really happens, though, is that in this unaccustomed direction of viewing the brain fails to make the usual translation and accepts the eye's report that these people and these objects are small. So, in the world of visual perception, looking 40 fathoms down is quite different indeed from looking 240 feet ahead! Let us now analyse the two visual worlds.

The visual world of the man in the street

It is a world:
- of opaque objects,
- which we see by the reflection of light at their surface, both in brightness and in colour,
- which obtain depth by having a sunny side and a shady side;
- in which objects screen their background and thus step into the foreground,
- in which objects have a visible front and an invisible back,
- in which perspective and apparent size suggest distance,
- in which, at close quarters, the accommodation and the convergence of the eyes suggest nearness.

The visual world of the radiologist

The magic X-ray permits the radiologist to look right through an object, except for the absorption caused by heavy elements located anywhere along each ray. Hence it is a world:
- of transparent objects,
- which he sees by the transmission of light throughout the object in terms of a two-dimensional colourless pattern caused by the shadow-casting of the three-dimensional array of heavy elements in the object,
- which obtain no depth in offering neither a sunny nor a shady side;
- It is a world:
- in which objects do not screen their background and thus fail to step into the foreground,
- in which objects have an equally visible front, back and inside,
- in which perspective and apparent size are all but missing and thus barely provide a clue to distance,
- in which, under normal projection, there is no focussing in a particular plane.

Perils of Perception in a Hospital

Man is both a consumer and a producer. As a consumer he has many human needs such as eating, clothing, housing, education, medical care and recreation. All these amnesties have to be provided by man as a producer or as a servant. But to man as a producer we have to grant the additional human right to employ the best of his individual capabilities in the best possible way. It is a curious and even tragic fact that we are still poor at satisfying both needs. All too often the jobs required to fulfill man's need as a consumer contain elements of sheer slavery. And the medical profession too provides a notorious example.

If the patient had a personal staff of nurses and doctors he might receive all personal care necessary for his individual well-being and recovery. But for nurses and doctors this arrangement would amount to a modern form of slavery, i.e., having to perform repetitive work below their intrinsic human capabilities and ambitions, as well as being to cope with peak loads at particular times with long stretches of idleness in between.

On the one hand a patient may sometimes need care faster than a nurse can run. On the other hand doctors and nurses need a type of work in which they can employ their individual skills to the fullest possible extent, without more than a fair share of boring repetitive work that is below their capabilities. It is an old saying of Norbert Wiener, the pioneer of cybernetics, that it is degrading to the human being continuously to perform work which can be done just as well or better by a machine. These considerations are the root of the tremendous effort being made to let the burden of dull monotonous work and the immediate warning facilities be taken over from the hospital staff by automatic instruments and systems.

To return to our perceptual cycle, many of the observations can be taken over by measuring instruments, many of the elementary processes of the brain can be taken over by a computer and quite a few actions can be taken over by a machine. Not in order to make the patient a mere attachment to a computerized system, nor to make the hospital staff mere components of that system. One may call it a matter of hospital efficiency provided such efficiency is considered in terms of the best personal care, both for patient and for hospital staff.

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