

I.C.The Imagery Revival.SI.C.1. The Return of the Ostracized.

We have already had occasion to refer to the fact that, after its long eclipse during the period of Behaviorist dominance, the mental image has more recently returned to the mainstream of psychology. This change is, of course, bound up with the broader shift in the direction of the mainstream of experimental psychology away from the Behaviorist concern with "learning theory" and animal models, and towards a more general concern with investigating the 'cognitive' faculties of human subjects. Solso, in a recent textbook, lists eight major areas of research with which contemporary "Cognitive Psychologists" are concerned. These are: perception; attention; memory; imagery; language; developmental psychology; thinking and problem solving; and 'Artificial Intelligence' (1). The early stirrings of this interest in cognitive processes, with its non-Behavioristic willingness to talk about internal mental events and processes, can be traced back well into the 1950s, and seems to have received an important stimulus from Shannon's development of "information theory" (2), and from the advent of the electronic computer. These developments outside psychology held out the prospect of being able to talk in a meaningful way about the contents and activity of the mind without

having to build entirely on dubious introspective reports; mental processes, it seemed, could now be safely conceptualized in terms of the processing of 'information', without our having to worry about the mysteries of consciousness (3). Of course, outside the United States Behaviorism never achieved the same degree of influence which it enjoyed in its land of origin. Figures such as Bartlett, in Cambridge, and Piaget, in Geneva, had always carried out their researches and framed their theories in what would now be considered a 'cognitive' style, and they did not disdain to talk of images (4). Another psychologist who published several discussions of imagery during the 1920s and 30s was T.H. Pear of Manchester (5). McKellar's 1957 work *Imagination and Thinking* is probably best considered as a late product of this British tradition rather than as a harbinger of the return to favour of the image in the U.S.A., where the real psychological action was and is.

In fact, the mental image, the conscious content *par excellence*, does not seem to have come back into real favour in America until well into the 1960s, and the initial interest seems not to have come from 'pure' academic psychology. R.R. Holt's 1964 paper "Imagery: the Return of the Ostracised" (6*) both documented and probably helped to stimulate the nascent interest in imagery at that time. Holt claims that psychologists (i.e. American psychologists) were first forced to pay attention to imagery phenomena again by problems in applied psychology.

(This is somewhat ironic since one of the main factors in the original appeal of Behaviorism had been the promise that it would be able to form the scientific basis of a psychological 'technology' (7)). The practical problems involving imagery which Holt cites are the experiences of:

Radar operators who have to monitor a scope for long periods; long-distance truck drivers in night runs over turnpikes, but also other victims of "highway hypnosis"; jet pilots flying straight and level at high altitudes; operators of snowcats and other such vehicles of polar exploration, when surrounded by snowstorms - all of these persons have been troubled by the emergence into consciousness of vivid imagery, largely visual but often kinaesthetic or auditory, which they may take momentarily for reality. In such a situation, when serious accidents can occur on its account, practical people are not likely to be impressed by the argument that imagery is unworthy of study because it is "mentalistic" and virtually impossible to experiment on with animals. (8).

Holt warns that such "hallucinations" (although he objects to this term as "hyperbolic", as falsely implying that all such imagery experiences must be somehow abnormal or pathological (9)) are also likely to afflict the astronauts of the American space program. He also mentions interest aroused by reports from survivors of Nazi concentration camps of the vivid images and hallucinations which they often experienced during their sufferings (10). It was these sorts of effects, he says, which inspired the research on 'sensory deprivation' in which he himself was involved, and which, as is well known, often produced reports of a great deal of very strong imagery. The very first experiment of this type seems to have been that published in 1954 by Bexton, Heron & Scott, which does

indeed seem to have been inspired by the problems of radar operators, pilots and the like {11}. It is notable that these pioneering workers clearly did not anticipate that imagery would be produced by their sensory deprivation procedure, and they found their subjects' references to these powerful effects "rather puzzling at first". They did not really understand these imagery reports until one of the experimenters had experienced the procedure and its effects for himself {12}.

Other factors pointed to by Holt as stimulating psychological interest in imagery include: the discovery of hallucinogenic drugs such as LSD; developments in electroencephalography leading to the suggestion that people's power to image is correlated with their typical alpha-wave pattern; the discovery of REM sleep and the consequent interest in dreaming; and Penfield's reports of the vivid memory images reported by patients having certain parts of their brains electrically stimulated whilst undergoing neurosurgery with only local anaesthetic {13}.

Holt's paper is mainly concerned with the influence of problems and discoveries outside academic psychology on its attitudes towards imagery. Within experimental psychology proper, 1960 itself seems to have been a key year in the return to favour of the image. In this year Donald Hebb, then president of the American Psychological Association, gave an address to that body which consisted of a retrospective on the American "psychological

revolution" {14*} of Behaviorism, and heralded a "second phase" of revolution:

In the psychological revolution, the second phase is just now getting under way. The first banished thought, imagery, volition, attention, and other such seditious notions. The sedition of one period, however, may be the good sense of another. These notions relate to a vital problem in the understanding of man, and it is the task of the second phase to bring them back, brainwashed as necessary. In other words: my thesis in this address is that an outstanding contribution to psychology was made in the establishment of a thoroughgoing behavioristic mode of thinking. But this has been achieved, too frequently, only by excluding the chief problem of human behavior. The second contribution must be to establish an equally thoroughgoing behavioristics of the thought processes. {15}.

We need not worry whether Hebb's vision of the future of psychology came to pass quite as he expected; certainly psychology was changing. The work which probably did more than any other to bring on this change, Miller, Galanter & Pribram's *Plans and the Structure of Behavior*, was also published in 1960. Its importance lies largely in the fact that it was a self-consciously pioneering attempt by psychologists to systematically apply concepts drawn from computer programing and 'Artificial Intelligence' research to real psychological problems. As such it was highly influential. It is of particular interest to us because it uses the "image" as a central explanatory concept. Admittedly the term is used in a rather idiosyncratic sense {16*}. Rather than our being able to summon up any number of specific images of remembered or imagined scenes, for Miller, Galanter & Pribram we each

have only ~~one~~ Image which

is all the accumulated, organized knowledge that the organism has about itself and its world. The Image consists of a great deal more than imagery, of course. (...) It includes everything the organism has learned - his values as well as his facts - organised by whatever concepts, images or relations he has been able to master. {17}.

Despite this rather specialized and idiosyncratic usage of the word, Miller, Galanter & Pribram probably did quite a lot to make "image" a respectable, 'scientific' psychological term again. Certainly they did much to make mental processes in general respectable.

Two other events relevant to the return of imagery occurred in 1960. First of all, O.H. Mowrer, a psychologist coming out of a strict Behavioristic tradition, published two books {18} which, although they set out an essentially Behavioristic theory, openly employ mental images (in the ordinary sense) as vital explanatory concepts. Mowrer seems to have wanted to explain behaviour entirely in terms of 'classical' Pavlovian conditioning. He argues that purposeful behaviour can only be accounted for in these terms if we allow that the behaviour can become conditioned not only to a present goal object or situation as stimulus (for after all, this will normally not be present when the goal seeking behaviour begins), but also to a mental image of the goal {19}. He also argues that the covert mediating responses postulated by Osgood's {20} neo-behavioristic theory of word meaning are not enough to fix reference unless they are supplemented by mental images {21}. Mowrer

claims {22} that these works mark the beginning of the modern revival of interest in imagery; although I suspect he actually rather exaggerates their influence {23*}.

The last of our significant events of 1960 was the discovery by George Sperling of the phenomenon which later became known as "iconic memory" {24*}. In Sperling's experiments subjects were very briefly (for 50 milliseconds) shown a rectangular array of letters. There might be nine letters set out in three rows of three. The subjects were asked which letters they had seen and in general could only correctly report about four or five of them. Sperling then gave his subjects the task of reporting, on a signal, only one particular row of such an array. If they heard a high pitched tone they were to report the top row, a low pitched tone would indicate the bottom row, and an intermediate tone the middle row. However, these signals were given not before or during the visual display, but immediately after it. Nevertheless, in this version of the experiment the subjects were generally to accurately report all of the letters of the designated row. The inference is that a purely visual, uninterpreted impression of the stimulus array, from which letters can be 'read off', must persist in the mind for a short time after the actual array has gone. This gives enough time to read any entire row of three letters, but not enough to read more than four or five overall. Before this work, under the influence of Behaviorism, human memory was generally treated by psychologists as purely verbal. Sperling's

experiment, and others like it, seemed to show that purely visual memories must exist, if only briefly, and Haber (25) testifies that this work was another significant factor in the revival of interest in imagery. I should point out, however, that "iconic memory", being strictly of a very short duration, almost certainly has little or nothing to do with the normal mental imagery which we can recall or make up more or less at will. In fact certain psychologists who once took a great interest in the "icon", notably Neisser and Haber, are now inclined to doubt whether it has any real psychological function under normal visual circumstances (26). Some authors argue that it is no more than a retinal persistence phenomenon (27), although we should note that others continue to regard it as an important stage of 'visual processing' (28).

In the late 1950s another American psychologist, S.J. Segal, also began some significant work on imagery (29*). Her studies were in fact an attempt to replicate and extend a famous experiment of the introspectionist era, which was carried out in Titchener's laboratory by C.W. Perky and published in 1910. Perky's experiment is significant because, despite its period and setting, it does not really depend on dubious introspective techniques but rather it seems to establish a significant point about imagery on a fairly objective basis. In essence what Perky did was to ask her subjects to fixate a mark in the centre of a screen and to form a series of simple mental images there - images of a tomato, a book, a banana, an orange, a

leaf and a lemon {30}. Whilst the subjects were trying to form each image a faint coloured patch of the appropriate colour and shape was back projected on the screen at which they were looking. These colour patches were deliberately very faint, but their intensity was gradually increased until they were above the normal thresholds of vision (although they were also given a soft focus and made to gently wobble). The interesting result was that in no case (except a couple of instances where the handling of the apparatus was faulty {31*}) did the subjects (who ranged from trained introspectors to young, naïve teenagers) realize that they were experiencing real percepts. They took their experiences to be entirely the products of their imagination. The projected colour patches did seem to be affecting the subjects' imagery - some were surprised to find themselves 'imagining' an upright banana rather than the horizontal one which they had been trying for, one was surprised to end up 'imagining' an elm leaf after trying for a maple - and purely imaginary elements were also present - one subject could 'see' the veins in the leaf, another imagined the tomato as painted on a can and could read the title on the book - but none of them realized that the projections were there. "It follows," says Perky, "that the image of imagination must have much in common with the perception of everyday life" {32}. Segal notes that the conclusion that even trained introspectors could not distinguish images of imagination from true perceptual images was extremely unwelcome to Titchener and Wundt {33}, and that in fact Perky's results reproduce some earlier,

less systematic findings of Külpe {34}. Perky herself notes that when "students in the psychological department, and some psychologically competent visitors" were shown the projections (without being asked to form images) they "could hardly credit" that the experimental subjects had not recognized their objective nature, and some refused outright to believe it {35}. Titchener himself, it would seem, was one of the latter, and arranged subsequent studies which quite failed to replicate Perky's results {36}.

When Segal first tried to replicate the 'Perky effect'

using the suspicious, pragmatic students who populated our campuses in the late 1950's and early 1960's, who had not been "turned on" and were embarrassed at the instruction to describe their inner experiences {37}.

she did not meet with much success. The subjects generally realized what was going on after three or four presentations. Later, however, she was able to produce better replications by taking steps to relax her subjects, either through giving them a placebo 'relaxant' {38}, or simply by having them lie down {39*}.

In subsequent work, later in the decade, Segal began to try a series of variations of the basic Perky experiment {40}. She tried projecting a faint stimulus picture which was different from what the subjects had been told to image. Although it proved difficult to get reliably verifiable results on this, it often seemed that the

subjects were incorporating the projected figure, or parts or aspects of it, into their image in some way. For instance, several subjects who were asked to imagine a city skyline whilst a faint picture of a tomato was projected at them reported having an image of the city against a red sunset. When asked to imagine a glass of Coca-Cola and 'shown' a white china cup of coffee they were liable to imagine the 'Coke' in a paper cup rather than in a glass {41*}.

In other experiments, subjects were asked to image, as before, and sometimes a faint picture would be projected but at other times nothing would be. The subjects were then asked to say retrospectively during which images a real stimulus had been present. When they had not previously known that such stimuli might be present they performed poorly on this retrospective task. Unsurprisingly, when they knew in advance that a faint picture would be projected during certain of their image forming tasks they were much better at spotting the presence of such stimuli. However, even in this informed condition they were not nearly so good at seeing the stimulus as when they did not have to form images at the same time. Segal concluded that the very fact that they were forming an image, no matter what of, was interfering with their perceptual abilities. In later experiments she was able to show that this interference: when subjects were asked to form visual images these were found to interfere much more with the detection of faint visual stimuli than they did with the

detection of similarly faint auditory stimuli, and vice versa {42}. Likewise, olfactory, kinaesthetic, gustatory and tactile imagery interfered far less with the detection of a visual stimulus than did visual imagery {43}. 'Selective interference' results like these seem to provide good objective evidence for the existence and functional relevance of imagery. They also suggest that the mechanisms of imagery and of sensory perception are largely overlapping.

Despite the above related events, imagery still remained on the periphery of experimental psychology during the early 1960s. It was still ontologically and theoretically suspect, methodologically intractable, and of no great obvious relevance to central psychological issues as then perceived. Later in the decade, however, things were to change decisively. Imagery variables which could be operationally defined were found to have very strong and thoroughly reproducible effects on human memory performance, and the study of memory was right at the heart of the developing Cognitive Psychology movement. After this imagery could no longer be ignored. According to Bugelski there was practically no interest amongst psychologists in the mnemonic effects of imagery before about 1965, whereas after that year they began to show a "somewhat more than modest interest" {44} in the topic. The recognition of the effects of imagery on memory seems to have had to overcome barriers above and beyond the general Behavioristic iconophobia. For one thing, the scientific study of memory

had grown out of the nineteenth century German work of Hermann Ebbinghaus, and Ebbinghaus, in order to control out what he saw as extraneous associative effects, had founded his studies upon the memorization of meaningless nonsense syllables {45}. According to Paivio {46} this technique continued to dominate the study of memory until well into the 1950s. Meaningfulness was avoided as completely as possible in the materials to be memorized in order to avoid possible idiosyncratic and uncontrolled effects of association. On top of this, imagery mnemonics, in so far as they were known at all, tended to be associated with the scientifically disreputable world of the conjurer and the stage mnemonist, a world of illusion, deceit and trickery with which a postulant science like psychology could ill afford to be associated {47}.

The first important discussion by contemporary psychologists of mnemonic techniques occurs in chapter 10 of the book of Miller, Galanter & Pribram to which we have already referred. They discuss the so called "one is a bun" technique, in which the numbers from one to ten are associated through rhyme with some appropriate concrete noun ("one is a bun, two is a shoe, three is a tree," etc.). Once this list has been learned any numbered list of ten concrete objects can be learned very easily and thoroughly by forming a mental image involving both the object to be remembered and the object associated by rhyme with the number. Thus, for example, if number 3 on the list is "picture" the subject might form an image of a picture

