

Making Sense and the Means for Doing So

by

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Tools and machines do not merely signify man's imaginativeness and...creative reach, and they are certainly not important merely as instruments for the transformation of a malleable earth; they are pregnant symbols in themselves.

—Joseph Weizenbaum, *Computer Power and Human Reason*¹

This paper is a partial exploration and development of Michael Polanyi's concept of a heuristic field, a concept which should be indispensable to a theory of education. I shall argue that the concept of competence — i.e., the potentiality of an organism to deploy varied resources and complex skills flexibly in a creative act — is essential to the idea of discovery and creative utterance. Chomsky and Polanyi were, to some extent, allies, not only in their vigorous attack on behaviorism but in their interest in the problem of what it is which constitutes our capacity for articulate action.

It is not surprising that the shade of Karl Lashley and his heroic rats is never far away from this discussion. In the 1940s Lashley was challenging the views of conventional learning theorists on the basis of his experiments with severely brain damaged rats. These rats did not merely respond to stimuli but would show astonishing resourcefulness when faced with problems which they had learned to solve before their brains had been mutilated. Certainly the maze which they had to run was a narrow, cruel kind of heuristic field, but they brought to it that combination of ingenious flexibility and purposiveness which characterizes the competence of higher vertebrates.

Polanyi presents us with his concept of a heuristic field in an important passage towards the end of *Personal Knowledge*. In it one hears echoes of not only Lashley but of C.H. Waddington, Paul Weiss, and of other pioneers in systems thinking whom Polanyi mentions earlier. This is how he expresses his concept:

The lines of force in a heuristic field should stand for an access to an opportunity, and for the obligation and the resolve to make good this opportunity, in spite of its inherent uncertainties. . . . in order to express correctly this kinship of knowing and

living, fields must be interpreted throughout biology in accordance with their finalistic character, as fields of opportunity and of a striving directed towards this opportunity. . . . By contrast to a field of forces operating on an inanimate system, a field of biological striving stands defined by the fact that we attribute its operations to an active centre.²

Polanyi touches, here, on many specialist areas of discourse – on embryology and thermodynamics, on cognitive psychology and rhetoric. He lays stress both on “access to” a field of discovery, which is to do with grasping the present, and on “making good this opportunity,” which refers to an uncertain achievement in the future. Such ideas – “situatedness” and fitness for the occasion – are familiar to students of rhetoric. In the present paper, however, I shall be using mainly the language of skill learning, of exploration and heuristics, for here lies my own special interest and experience. So I shall say relatively little about articulate expression and the creative use of language itself. However, the two worlds of doing and speaking are parallel, separate but interdependent. They illuminate each other and depend upon each other, rather – I guess – as do the left and right sides of the human brains.

For an exploring human being, there are always two existential boundaries which correspond to the near and to the far limits of his field of discovery. Any experience of sudden novelty is likely to offer an illustration of this. Imagine someone, thrown, naked but surviving, on a desert island; or recollect – an analogous situation – your own first day at school. There is, ready to hand, all that the castaway brings with him, the particular, yet varied skills and attitudes with which he faces the new task. If he is capable of coping, he will be able to deploy these with considerable flexibility. *The loose assembly of skills and attitudes which a person brings to a field of opportunity is his competence.* In Polanyi's terms such competence can be thought of as the functional or proximal boundary of a field of discovery or creativity, and the person is its active center. The distal boundary of such a field – up the beach where the palm trees bend to the storm and where a hut *might* be built, where there *might* be coconuts – is *the frontier*. It is both real and problematic and we often speak of it in the subjunctive tense, with hope, apprehension and a wild surmise. The frontier is where the child or the castaway knows that his judgment, skills and resilience are likely to be stretched to the limit by new contingencies. Back at home, back on the ship, before the storm broke, all his competence seemed comfortably adequate for the tasks at hand, but now, with a dozen new challenges looming on the frontier just ahead, that same competence will be stretched almost to the breaking point. In addition to all the external problems, feelings are usually much in evidence at the frontier. The adrenalin flows more freely. So competence often involves making sense of the inner, physiological, environment as well as the outer one. Thus, when shipwreck threatens, a sharply focussed fear may be cultivated as being more appropriate than a more general terror. These examples are somewhat extreme but the same kind of inner and outer sense-making will be demanded by innumerable more homely contingencies. All fields of exploration, and especially those of youth, are delimited in this way, proximally by a person's competence, and distally – out yonder – by his or her frontier – the place of apprehension.³

Competence

Polanyi did not, as far as I know, use the word "competence" in the sense that I have used it above. He certainly approaches the idea in *Knowing and Being*, in that section which he entitled "Heuristics and Language Acquisition." It is here that he comes close to Chomsky and uses the latter's own words about the need for some "initial [concept] that is sufficiently rich to account for the acquisition of language." But Polanyi disagrees with Chomsky — as many of the readers of this paper might — about the need for postulating some deep structures in the brain meriting the name of *grammar*. What they more or less agree about concerns the nature of *competence for language*. Polanyi's key phrase, in which he emphasizes the element of play or looseness in the situation preceding any creative linguistic action, is as follows:

Prior to the internal or overt enunciation of the sentence, an aggregate of word units is partially activated or readied. This shows in the fact that words, destined for a sentence, may be found scrambled in a hasty utterance of it. I regard this as the period described by Poincare in which *the imagination loosens the potential elements for solving a problem*.⁴

Here we have both the integration of subsidiary units in a linear sequence and also that essential precondition for all creative acts — some degree of looseness or play. Both are indispensable to the exercise of competence.

Why not use Polanyi's terms "tacit knowing" or "tacit knowledge" for such competence? The reason for not doing so is that Polanyi gave to these terms a much wider meaning than that which we now require. There can be little doubt that he was at pains to protect the tacit terminology from becoming a portmanteau for mysterious and inexplicable entities and this is a danger which we still need to guard against. Nevertheless he did give "tacit knowledge" a very wide connotation. I take it to denote all the inherited and acquired information in an individual organism which can be brought to bear on an act of knowing. Both Piaget and Popper use a similarly extended, biologically rooted concept of knowledge.⁵ Polanyi's "tacit knowing," however, is sharply distinguished from Popper's because Polanyi includes the knower as the essential focus of the process and he only allows for objectivity and detachment (analysis of subsidiary elements) as being parenthetical within the larger process.

If, then competence is not equivalent to tacit knowledge, how are the two concepts related? We may think of a person's tacit knowing as resembling the root system of an ancient but living tree, a tree which is in reality you or me or a learning child. Polanyi preferred the participle "knowing" to "knowledge," as this emphasizes that we are conceptualizing a system rather than a collection of things. Most of the root system is deeply hidden, but it is not, in principle, inaccessible to scientific inquiry. Like the tree's roots, tacit knowing draws on the past and has a bearing on the future shape and health of the knowing organism. We may press the analogy a little further. If you look at the base of the tree, you will see that there are just a few main roots coming together at the trunk. These are relatively easy to examine and to damage and it is these main roots which are analogous to the mainchunks of competence which a person possesses. Each area of competence is made up of a loose cluster of skills

and subskills, of classified experience and inherited information. There is competence for feeding, for locomotion, for relating person to person, for musical and graphic experience, for language and for many other complex achievements. They overlap and interact and develop at different rates, but they are, in the main, sufficiently clear in their purposive complexity to merit a generic term. They are, nevertheless, part of the larger, focused totality of tacit knowing and are subject to its influence. In educational terms, especially when we are concerned with young children, these main areas of competence are the principal domains in which teachers and learners interact. It would not be an undue extension of Polanyi's terminology to say that the infant's competences (and most notably its competence for language) are those aspects of its total tacit knowledge which are most open to learning. (See the note under Figure 2.)

If we are to give the concept of competence a central place in educational theory, two other shades of meaning must be emphasized. Firstly, as has already been suggested, competence always involves a subtle element of play or looseness. The more subjectively "difficult" an achievement appears to be, the more important it becomes for teachers (or partners) to hold back pressure for its attainment. That is why teachers, among their other gifts, need to be adept at play and at skillfully transmuted the heavy into the light. Secondly a proper understanding of competence should make unnecessary much instrumental talk about "motivating" children. If they can they will want to; unless, as is too often the case, something gets in the way. As Polanyi says, "the thought of truth implies a desire for it," and even rats sometimes run mazes out of interest.⁶ I doubt if it is possible to define any particular competence in terms intrinsic to itself. The loose hierarchy of related skills and subskills and all the bits of information which are integrated in the exercise of particular competence only come together for some complex achievement, such as building a hut or engaging in speech. It is the same with tools: as with all the other gear of making and meaning, to understand them one must dwell in the achievements which they enable.

Tools

In his book *Computer Power and Human Reason*, Joseph Weizenbaum salutes Michael Polanyi and then goes on to show how people may easily, but need not, become servile to machines. In the passage quoted at the head of this paper he shows how tools and machines can be symbols, pregnant carriers of meaning and guides for action. It depends on us.

What, then, is a tool? It is an object that has first been chosen, then adapted to function within a skill. The competent user projects into it something personal that he already knows or does, something which it can do more powerfully or more precisely than he can. The blade of a stone hand ax embodies something of the sharpness of its maker's teeth and fingernails, but is more durable, the computer embodies something of his arithmetic, but is quicker. Men have always used tools and so do a few animals. Chimpanzees, for example, use stiff grasses for probing termites' nests and they also use sticks as weapons, i.e., as tools for use within a skill of aggressive intent. It is unfortunate that our linguistic watchdogs have not

kept as close an eye on the vocabulary of tools and technology as they have on some more abstract pronouncements. Increasingly the word "tool" is used when a word such as "skill" or "technique" would serve better. A recent headline, for example, was, "Study in prison: a tool for mental survival" when what was meant was *strategy* or *means* for survival.⁷ These distinctions are important because one condition for the cultural survival and further development of free men is that we should understand more clearly the nature of tools and of "technology" and their relation to ourselves and to science.⁸ The concept of tool is not always clear. One might, sometimes, say that a book is a tool if it forms part of a researcher's project; but, defined in a more public context, as within a reference library, the idea of a book as a tool begins to lose sharpness. If one pushes the use of the word "tool" in the contrary direction, towards the micro-skills of language an interesting set of meanings emerges. One can then come to regard words themselves as shaped "things," each differently fashioned of vibrating air, and collectively forming a tool kit (i.e. vocabulary) for use within the fine skills of language. To call words "tools" is a just permissible conceptual stretch, in my view, and it allows us to treat the use of a concept or the process of conceptualizing as a micro-skill – that of classifying and connoting. Both skills and concepts are directional, they impose limitations and yet they are open-ended towards the frontiers of creativity.

The important point here is that a tool should be definable within a specifiable skill. This means that a tool can always be thought about at least at two levels: (1) at the level of nature – what it is made of when found – and (2) at the level of culture, where it is incorporated into a skill and used or held in readiness for a range of human (or animal) purposes. This is perhaps obvious, but it leads on to further distinctions in the understanding of all cultural objects, including words and pictures – that they can be used with only little intent (toys), with precise intent (tools) or to cope with ambiguities and with multiple levels of meaning (symbols). It is these distinctions and relationships and particularly the dynamic, yet complex, meaning of "symbol" which will now concern us.

Toys, Tools and Symbols

Donald Winnicott has given us the basis for understanding the origin of, and the three different phases in which "cultural objects" can be used – namely as toys, tools, and symbols. Winnicott starts his analysis by discussing those well-loved bits of cloth, those tattered toys or those fetish-like bits of the world onto which an infant readily hooks. They calm the child for rest or steady it for action and in this, curiously, these things in their calming function, resemble both cigarettes and prayers. Winnicott gives them the general name of "transitional objects" and describes them as having a "me" "not me" quality.⁹ They are sometimes part of me – hair, for instance – and yet they are also transitional towards – they point towards – that shadowy world which lies beyond me and beyond the safe "space" which my mother and I have created. It was when Winnicott tried to become clear in his mind as to what was the status of these transitional

objects and where they should be conceptually located that he coined the phrase "potential space." I would define this space as the locus of play, whose outer edge is the frontier of discovery. The two concepts, *heuristic field* and *potential space* are strikingly similar but the latter generally refers to shared activity while the former may often imply a solitary search. For an infant the well-loved and tattered piece of cloth *is* what it is – the comforter. We, from a mature vantage point, can see that it points forward to much more – to future toys, to future tools and to future symbols and to the ranges of enquiry and reflection which these encompass. (See Figure 1)

The overlap between the three categories – toys, tools, and symbols – never entirely disappears even in maturity. Sometimes young adults – students at the secondary stage of education, for example – display a powerful fixation on transitional objects which is reminiscent of childhood and yet which also foreshadows the future. One fifteen year old boy whom I once taught – Edward – was, for a year or so, obsessed with knives. They were his toys but they were tools too. He could whittle with great skill, and he had to be discouraged from using his knife-throwing expertise in the vicinity of human targets. A Freudian will immediately recognize the symbolic, phallic reference of the knife. When thinking about symbols, however, it is a mistake for us to narrow their meanings down to "nothing but" interpretations. The knife and indeed the phallus which it often signifies are symbols of a much wider range of possibilities and potencies than sex. When Edward showed me a specialist catalogue for knife-lovers, this range was clear to see. Some of the knife associations undoubtedly had a touch of *machismo* and even of cruelty about them. Others pointed to hunting, to the backwoods, to tropical forests and to the high seas; but always there was a suggestion of an adult man, competent to adapt to a non-mechanical, "natural" world, free, yet facing tasks and problems.

Seen from the viewpoint of "things for use" transitional objects can be regarded as the juvenile source from which flows all the practical gear of a technical world; but from another perspective – things for meaning – they are the beginnings of all our imaginative and intuitive dreaming, of poetry and of religion. This is undoubtedly an area of powerful ambiguity; yet I am sure that David Winnicott has pointed a way through. My line of argument involves a bringing together of his idea of "potential space" and Polanyi's "heuristic field" and then locating within this common space the diverse things which men have devised in order to extend our power of knowing and meaning. One might describe the subject as "the phenomenology of tools": how can a stone become a play thing, then a tool, and then part of my exploring imagination? Such an enquiry is also about language because of the parallelism between fine manual skills, which themselves are most subtly programmed for sequential performance, and the super-skills of word use.

As soon as an infant (or a shipwrecked mariner) picks up a natural object and plays with it, that thing has entered a world of culture. Immediately the use/meaning paradox arises. However – and here I give a brief resume of the subsequent argument – these ambiguities can be resolved if we

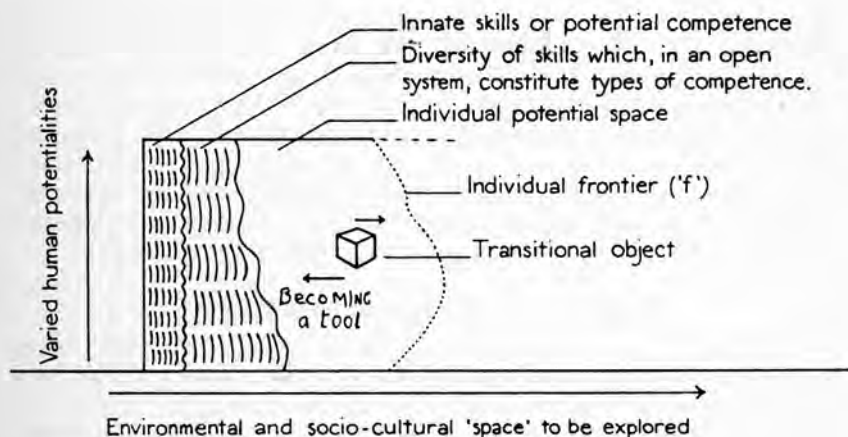


Figure 1: The Basis of Education

This diagram sums up the relationship between competence – the system of innate and acquired skills relevant to a task – and freedom. The horizontal boundaries represent social and environmental constraints, within which competence is exercised. The frontier is the existential limit to this space, at which a person explores and copes with problems and ambiguities. The transitional object is prototypical of all play-things, tools (skill things) and of those things, such as probes, hypotheses and symbols, which we explore with.

hold onto the idea that every person (or child) is potentially an explorer. Yet he cannot be exploring all the time. Sometimes he must rest, play, practice and reflect. Nevertheless, if a thing is only played with, it remains a toy or a gadget. (A gadget is a special kind of toy, a tool made with high level expertise, but played with by those who have no intention or competence to explore such expertise). We are focusing on childhood, a world of relatively slow transitions, and it should be apparent that toys become tools as play turns into skill. That is one important transition. If a tool is properly used, at increasing levels of skill, it becomes, through practice, an extension of the user – what Bruner calls “a prosthetic device” – a wooden leg, for example, or a radio telescope. There is, however, another transition. Toys and tools are not only for achievement and success. They point to the frontier, which is a place of relevant problems, of danger, of ambiguity and of possible failure. It is the function of symbols in regard to this frontier that must now be considered in more detail.

What We Explore With: Probe and Symbol

There are several elements of Polanyi's thought which seem indispensable for an understanding of how a learner's competence is gradually enhanced through education. One is the notion of heuristic fields, which we have located conceptually, with the learner's competence as a base line and his frontiers as a limit. There are also social and cultural limits but I have not discussed these. The teacher's task in regard to this space is both to protect it (hence our interest in freedom) and to enrich it with appropriate elements of structure – problem-posing and instructional apparatus, for example.

Another central interest of Polanyi's which has not been sufficiently used to illuminate the process of education is *the probe*. For him, as for Niels Bohr, the probe is the paradigmatic thing-that-we-explore-with. It helps us to understand the nature of any “actively held” theory or hypothesis.¹⁰ The probe summarizes the three phases of competence and creativity which we have been discussing: for it must be skilfully and firmly grasped by my hand, which reminds us of competence; it must be moveable within limits and with intent, which reminds us of play and freedom; and it touches, with its tip, on some problematic, out-there, aspect of reality.

I think that Polanyi failed to explore symbolism in the way it bears on discovery and groping. When he and Harry Prosch dealt with metaphors and with symbols in *Meaning*¹¹, they did not follow up the clues which were available in Polanyi's famous analysis of probes. By restricting their account of iconic symbols mainly to consideration of a flag and by concentrating on semantic processes, they left out those very attributes of symbols for which the probe paradigm was most useful – that one must make a symbol one's own, that one must play with it, use it, share it and, finally, that one must hold it in readiness to touch on ambiguities.

Every meaning-making artefact, whether it be a tool or a rite or a word or a hypothesis, can be used in the three ways of which the probe is a reminder and which are the three fundamental modalities of education.

1) An artefact can be used for maximizing competence; and the educational activity characteristic of this is practice. This is normally what one means by a tool.

2) It can be used "with the pressure off," with looseness and resilience prevailing; and the educational activity characteristic of this is play. This is a toy.

3) It can be used at the frontier where problems, ambiguity, and uncertainty are of the essence and where characteristic educational activities are grappling with serious problems and creative work. Here the artefact, instrument, word or rite becomes symbolic.

One of the characteristics of a symbol in active use is that it points to the future, with its ambiguity touching, not infallibly but sometimes, the reality of some higher order system. This anticipatory function is well illustrated by the probable etymology of the word "sym-bol." What, we might ask, was it that was "thrown together" to give meaning and what kind of meaning emerges from such an integration? It has been suggested that two broken bits of an object, say of a pot sherd, were sometimes used to establish the identity and potential friendship of two strangers who, each carrying a fragment, would meet and then match their broken pieces. So even in its origin the word "symbol" points to the integration of differences and to the emergence of some higher order entity – in this paradigm case – the reality of alliance and friendship.¹²

An important aspect of Polanyi's probe analogy is that it helps us to remember that when we are *groping* for truth we are on the look-out both for known patterns and for anomalies at the limits of such patterns. If you think of a probe in practical use (and the reader might well try this, blindfolded, in an unfamiliar garden) you will find that a pattern of expected information comes up the stick as well as occasional anomalies. You tap along the grass edge of the path – tap, tap, tap, tap, . . . then – nothing! There is a problem. The inference may be "perhaps a step down" or "perhaps a corner." But when you began tapping, did you not expect something like this? You started off with the definite expectation that you would eventually encounter problems and ambiguities. Nevertheless, as one pattern becomes more familiar, you assimilate it to what is already yours. Then comes the anomaly. The skilful prober eliminates looseness from his grip but he transfers it to the distal end of his wobbling antenna. The yes, yes, yes of the expected finding is familiar and becomes assimilated almost as part of "me"; the sudden gap or anomaly demands a change. It is definitely not part of "my pattern" and so it requires accommodation in my exploratory schema. All "discovery things," from probes to hypotheses, share this attribute of symbols, that they cope with known patterns and with the tension that precedes surprise, with what you expect to find and with what you do not.

Our "motivation" energy tends to gather around symbols. But the contrary is also true; symbols can be repellent. Jerome Bruner, discussing the negative side of this process, has given us the term "preemptive metaphor" to describe how it is that in such a transitional zone a boy or a girl may be blocked from learning because of a cluster of ideas which link up, associatively, with one central focus of fear and failure.¹³ I am sure that we need a similar but positive terminology for symbols which foreshadow success. It was when I used to think about the problems of frustrated, angry children that I used to find myself turning to the word "vista" to carry the idea of an opening or an encouraging pathway as it is vaguely perceived by someone on his or her own frontier. A young man who

seems to be the despair of his teachers, who has quarrelled with his parents, who has low self-esteem, suddenly finds "an outlet" in painting battle scenes. Yet it is not just an outlet for surplus energy, it points the way forward for him and for his teachers if they could see it. To think of these processes, however, in terms of outlets and self-expression is not enough. A vista leads somewhere and makes available new levels of reality which can be entered through the operation of some positive symbol. Where education is structured firmly around a stable family or around apprenticeship such a symbol may be a respected adult or – again to use Bruner's term – "a competence model." But in the contemporary world of youth, where breaking away from parents is an important part of development, such family symbols will often be rejected and others sought out.

In terms of our metaphor of the castaway or of the corresponding idea of potential space with the frontier ahead, *the symbol points to a vista*. It is the focus of an attractive part, or of the least alarming part, of my frontier. The preemptive metaphor, on the contrary, makes the frontier invisible. We need such terminology to provide education and psychology with concepts of similar scope and power to those which C.H. Waddington created for biology when he developed the terminology of *chreods*. By "chreod" he meant a fated or favored pathway through a morphogenetic field.¹⁴ Is not this what we should be doing, not so much *for* young learners as *with* them or helping them to find their favorable pathways? What they see will be symbolic, attractive, perhaps, or repellant, very real to them but almost certainly not a subject for cool and rational discussion with anyone.

The Creative Cycle

How are these concepts – toys, tools, and symbols – related? This question runs parallel to the crucial educational problem of how play, practice, and creative discovery merge into each other. Each relates to the others in a cyclical manner, but how? The philosophers of art and education are not yet agreed on an adequate conceptual system in which to pose this problem. On the other hand, a number of psychologists (George Kelly, Jerome Bruner, Liam Hudson, for example) have expressed the view that play *and* discipline, convergent *and* divergent thinking must work together. Kelly's personal construct theory describes the "creativity cycle . . . as one which starts with loosened construction and terminates with tightened and validated construction."¹⁵ That is a useful beginning and is in harmony with the ideas we started with.

In trying to think clearly about the relationship between play, practice, and discovery, I found myself in a *cul de sac*. The reason was that I had imposed a mistaken sequence on the three kinds of artefact with which we act in these roles. Toys, I thought, were most primitive; tools must develop out of toys and then symbols must develop somehow out of tools. And yet that never seemed to be right. The relationship was not linear and sequential but dialectical. Assimilation and practice implied a steady move towards efficiency, predictability, and control; whereas exploration and

the need for accommodating new experience *via* symbolism moved in the contrary direction – towards ambiguity, doubtful competence and, even, danger. So what we seem to require is a two-way, oscillating concept, more on the lines of Taoism's *Yin* and *Yang* and less like a linear progression. Play is there at the beginning, but it remains central – a spring-board for two complementary kinds of action. We can either move from it in the direction of increasing efficiency and control as we build up our competence *or* we can move towards uncertainty and challenge as we stretch our competence.

In Figure 2, I sum up these ideas, tidying them, no doubt more than is justified. It should not be assumed, for example, that overt play must always precede frontier activity. The suggestion is that rigorous activity draws not only on its skilful antecedents but also on randomness, that tension must not be maintained too long without the possibility of re-creation and openness to new information.

This is the way the cycle of creativity generally goes— play-practice-play, then play-exploration and back to play again. Toys are what we play with; symbols – and they may be pictures, poetic images, a work of music, a scientific hypothesis, a person or a ritual – these are what we explore new worlds and new meanings with. Yet we must always, in some degree, be existentially committed to them. The diagram is a modification of Figure 1. It suggests the oscillations which take place between play and these two distinct kinds of "seriousness." Play merges in one direction into controlled, instrumental practice; in the other, it runs into frontier activity – to exploring or to the sustaining of what is problematic, ambiguous and, perhaps, dangerous. It should be remembered that play, in the rather extended sense which we are using, is the phase of activity in which reflection and criticism are likely to be effective. The phases in which the arrows are pointing towards the left are those where relaxation and, sometimes, analysis of action will be appropriate; the movement of the arrows towards the right suggests phases of synthesis and commitment.

Throughout this paper and, indeed, throughout the writings of Michael Polanyi and of David Winnicott, on which it draws, there is an almost inevitable distortion. Philosophers of science and psychotherapists, no matter how humble they may be, tend to emphasize in their writings the roll of the Discoverer at the expense of the discovered, the Healer at the expense of the healed. It is the same with teachers who write about their art. There *is* in education a fundamental asymmetry between the teacher who knows more and the learner who knows less and yet, in a deep sense, each must be part of one larger system. The play space which envelopes the mother and the infant is, in this sense, a joint creation. So is all worthwhile learning at school and university. I may withdraw to the staff room and objectify what goes on between me and my "problematic pupils." This is but recreation, however, and my prior commitment must be to rougher ground. The work of educational creation, such as it is, goes on as a tumultuous two-way process. The play, the problems, and all the means for exploring will not be true if they are not increasingly *Ours*.¹⁷

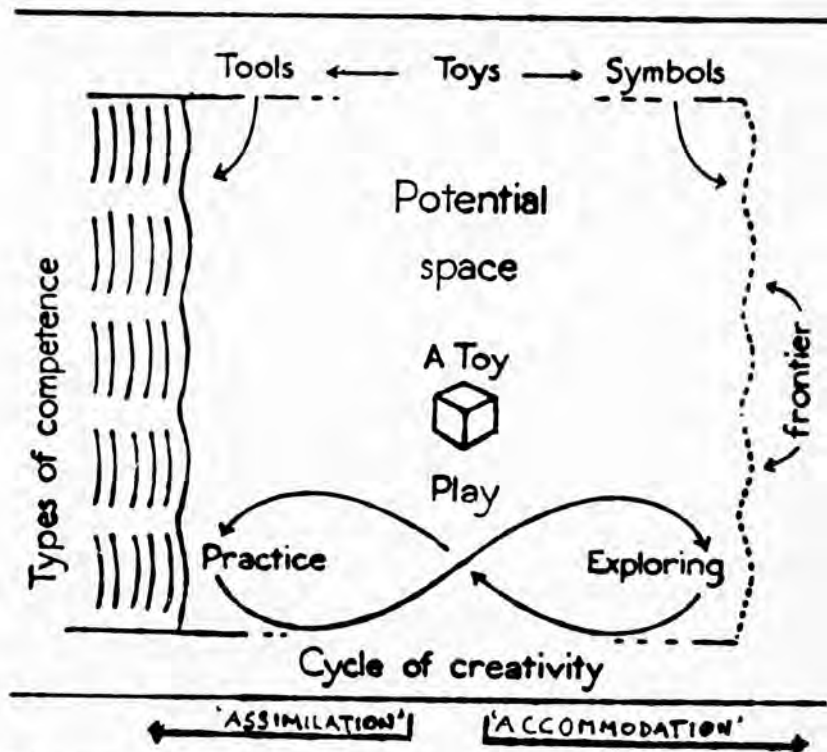


Figure 2 Play and Creativity

A learner's competence is suggested on the left – a collection of skills. The learner faces a field of relatively free action, bounded partly by his own frontier. This Potential Space (Winnicott) is where the learner plays, practices new aspects of skills and where he/she explores, on or near the frontier. Toys are what Coleridge calls "play-withs." In (see note 16) a similar vein, tools could be termed "skill-withs" and symbols, "explore withs." I have elsewhere (*Born Curious* pp. 96-101) suggested that we think of education in terms of four main modes of competence (five if one includes music). These can be diagrammatically represented by the five hatched bands on the left. The modes are: interpersonal, enactive, iconic, musical and language-like. The idea and, in part, the terminology is developed from Jerome Bruner's *Toward A Theory of Instruction*. (See note 13).

ENDNOTES

¹(San Francisco: W.H. Freeman, 1976), p. 18.

²(Chicago: Univ. of Chicago Press, 1958), pp. 403-4. Polanyi's italics.

³I explored some of these ideas in a preliminary way in *Born Curious* (London: John Wiley, 1976). The motivating aspect of competence was stressed, but I failed to link these concepts adequately with Polanyi's ideas about skills and tacit knowledge. I am grateful to Sam Watson, Jr., and others for pointing this out. The next section of the present paper attempts to bridge this gap.

⁴(Chicago: Univ. of Chicago Press, 1969), pp. 203-4. Italics mine. The title of the chapter is "Sense-giving and Sense-reading." Polanyi's reference to play in *Personal Knowledge*, p. 196, is concerned with problem solving. A contemporary and fundamental approach to the problem of play is given by Gregory Bateson in *Mind and Nature* (London: Wildwood House, 1979), pp. 123-25. He emphasizes the mutuality of play and suggests, but never systematically explains, play's purpose of supplying a ration of randomness in all learning.

⁵Jean Piaget, *Behaviour and Evolution* (London: Routledge & Kegan Paul, 1978), pp. 5-6; for example, see Karl Popper, *Objective Knowledge* (Oxford: The Univ. Press, 1972), p. 71.

⁶*Personal Knowledge*, p. 308.

⁷Article by John McVicar, *The Times Higher Education Supplement*, 22 Sept. 1978.

⁸This is one of the central themes of Manfred Stanley's *The Technological Conscience* (New York: Free Press, 1978). He argues that only by developing a more discriminating linguistic consciousness in regard to tools and "technics" will we be able to avoid a creeping subservience ("false consciousness") towards technology. He calls this cultural disease "technicism." This, in turn, relates to problems of closedness and openness in the curriculum.

⁹*Playing and Reality* (London: Tavistock, 1971), pp. 2-3, 96-103.

¹⁰Joseph Weizenbaum develops the same idea, also expressed in the quotation at the head of this chapter, that symbols are pregnant with possible meanings. He is discussing the nature of scientific theory. Though a theory, he acknowledges, is first of all a text in language, "it is also a symbolic construction in a deeper sense for the very terms which it employs are symbols. . . which grope for their denotation in the real world." *Computer Power and Human Reason*, p. 140. Niels Bohr's concept of probing was developed in his *Atomic Theory and the Description of Nature* (Cambridge: The Univ. Press, 1934).

¹¹(Chicago: The Univ. of Chicago Press, 1975), Ch. 4. If it were not for the fact that "epicyclic" is one of the most serious terms of disapproval among philosophers of science, one would be tempted to apply it to these loopy arrows which Polanyi and Prosch devised to keep their argument about symbols and metaphors at the level of language.

¹²Leopold Stein, "What is a Symbol to be?" *Journal of Analytical Psychology*, 2, No. 1 (January 1975).

¹³*Toward a Theory of Instruction* (New York: Norton, 1968), p. 134. In Ch. 7, "On Coping and Defending," Bruner gives a valuable introduction to the problem of educational "blocks."

¹⁴C.H. Waddington first proposed this term, spelled as "creode," in his *The Strategy of Genes* (London: Allen and Unwin, 1957), p. 32.

¹⁵George A. Kelly, *The Psychology of Personal Constructs* (New York: Norton, 1955), II, 528. D. Bannister and Fay Fransella, *Inquiring Man* (London: Penguin, 1971), and Liam Hudson, *Contrary Imagination* (London: Methuen, 1966), p. 119.

¹⁶*Anima Poetae*, 1814. Quoted in Kathleen Raine's *Samuel Taylor Coleridge* (London: Penguin, nd), p. 143.

¹⁷This paper overlaps a chapter entitled "Things for Use and Things for Meaning" in *New Themes for Education*, ed., M. Brahm (London: John Wiley, 1981).