

CHAPTER THREE

*The Primacy of the Abstract**

I did not bring a written paper as I preferred to leave it to the course of the discussion to determine in what direction I could best supplement it. Perhaps, however, it was quite as much a tacit hope that the discussion would provide me with an excuse to talk about a problem in which at the moment I am much interested but on which my ideas have not yet reached the clarity required for writing a formal paper. As I was listening I have indeed come to the conclusion that this is the most useful thing I can attempt to do and I am now taking my courage in both hands to present to you, as well as I can from a few notes,¹ some half-baked ideas about what I have called 'The Primacy of the Abstract'.²

I

What I shall try to explain under this paradoxical heading seems to me in some ways merely a final step in a long development, which would probably have been explicitly formulated some time ago had it not required the overcoming of a barrier built into the language which we have to employ. This is shown by the necessity in which I found myself of describing my subject by an apparent contradiction in terms. We simply have no other suitable term to describe what we call 'abstract' than this expression which implies that we deal with something 'abstracted' or derived from some other previously

* Reprinted from the 'Alpbach Symposium', *Beyond Reductionism*, ed. A. Koestler and J. R. Smythies, London, 1969, for which I had written up from my notes the essence of a talk I had given at Alpbach on 7 June 1968.

¹ The numbered paragraphs in the present written paper correspond to the headings of the notes from which I spoke. Beyond this I have followed only partly the transcript of the tape recording. Not everything as now written was contained or came out clearly in the oral presentation.

² I could, of course, instead have spoken of 'the primacy of the general', but this would not have had the shock effect which is the merit of the phrase chosen.

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existing mental entity or entities which in some respect are richer or 'more concrete'. The contention which I want to expound and defend here is that, on the contrary, all the conscious experience that we regard as relatively concrete and primary, in particular all sensations, perceptions and images, are the product of a superimposition of many 'classifications'³ of the events perceived according to their significance in many respects. These classifications are to us difficult or impossible to disentangle because they happen simultaneously, but are nevertheless the constituents of the richer experiences which are built up from these abstract elements.

My main concern in all this will not be to argue the truth of my contention but to ask what is its significance if true. I shall in a moment try to show that the phrase of the title merely brings under one heading several conceptions which have emerged independently in different fields. They will not be quoted as conclusive evidence for the truth of my thesis, but merely as a justification for examining the consequences that would follow if it were true. Without entering into a detailed account of the different theories in question, these references must remain very summary and incomplete. But I want to leave as much time as possible for showing in what way the conception suggested might provide a clue to a number of interesting questions, and have a liberating effect on one's thinking.

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First I want to explain more fully what I mean by the 'primacy' of the abstract. I do not mean by this primarily a genetic sequence, although an evolutionary movement from the perception of abstract patterns to that of particular objects is also involved. The primacy with which I am mainly concerned is a causal one, that is, it refers to what, in the explanation of mental phenomena, must come first and can be used to explain the other. I do not wish to deny that in our conscious experience, or introspectively, concrete particulars occupy the central place and the abstractions appear to be derived from them. But this subjective experience appears to me to be the source of the error with which I am concerned, the appearance which prevents us from recognizing that these concrete particulars are the

³ For a justification of this, and a few related terms I shall occasionally use, see my earlier book *The Sensory Order*, London and Chicago, 1952, in which, as it now seems to me, much of what I shall have to say was already implicitly contained.

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product of abstractions which the mind must possess in order that it should be able to experience particular sensations, perceptions, or images. If, indeed, all we are aware of are concrete particulars, this does not preclude our being aware of them only because the mind is capable of operating in accordance with abstract rules which we can discover in that mind, but which it must have possessed before we were able to perceive the particulars from which we believe the abstractions to be derived. What I contend, in short, is that the mind must be capable of performing abstract operations in order to be able to perceive particulars, and that this capacity appears long before we can speak of a conscious awareness of particulars. Subjectively, we live in a concrete world and may have the greatest difficulty in discovering even a few of the abstract relations which enable us to discriminate between different things and to respond to them differentially. But when we want to explain what makes us tick, we must start with the abstract relations governing the order which, as a whole, gives particulars their distinct place.

So far this may sound pretty obvious, but when we reflect on the implications, they would mean little less than that psychology and the theory of knowledge frequently start at the wrong end. From the assertion that the abstract presupposes the concrete rather than the concrete the abstract (in the sense that in the mind the abstract can exist without the concrete, but not the concrete without the abstract) a wholly erroneous approach results which treats as given what most requires explanation.

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Let me now remind you briefly of the chief developments in the various disciplines concerned, which seem to me instances of my general proposition. The chief support comes, of course, from ethology, and especially from the dummy experiments with fishes and birds that show that they respond in the same manner to a great variety of shapes which have only some very abstract features in common. It seems to follow that probably most animals recognize, not what we would regard as concrete particulars, or particular individuals, but abstract features long before they can identify particulars. This is indicated most clearly by the theoretical framework developed by ethology, which distinguishes between the 'innate releasing patterns' and the mechanism through which these

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evoke certain 'action patterns', where both concepts refer not to particular events, but to classes of combinations of stimuli and their effects in inducing a preparedness for one of a class of actions, which are both definable only in abstract terms.⁴

Similar insights have been gained by human sensory psychology in the course of its gradual emancipation from the conception of simple elementary sensations from which, in a mosaic fashion, the representations of the environment were supposed to be built up.⁵ From H. von Helmholtz's still insufficiently appreciated conception of 'unconscious inference' and the similar ideas of C. S. Peirce⁶ to F. Bartlett's interpretation of perceptions as 'inferential constructs', of which Koestler has reminded us, and culminating in the Gestalt school, which now proves to have emphasized only one aspect of a much wider phenomenon,⁷ they all stress in one way or another that our perception of the external world is made possible by the mind possessing an organizing capacity; and that what used to be called elementary qualities are its product rather than its material.⁸

Another important development in a similar direction is the increasing awareness that all our actions must be conceived of as being guided by rules of which we are not conscious but which in their joint influence enable us to exercise extremely complicated skills without having any idea of the particular sequence of movements involved. (This capacity is often inadequately described as 'intuitive knowledge'.) From Gilbert Ryle's now familiar distinction between the 'knowledge how' to do a thing and the 'knowledge that' it is so and so,⁹ through Michael Polanyi's analysis of skills (and the closely connected concept of 'physiognomy perception'),¹⁰ to R. S.

4 Cf., for example, W. H. Thorpe, *Learning and Instinct in Animals*, 2nd ed., London, 1963, p. 130.

5 See on what immediately follows my *The Sensory Order* quoted before.

6 C. S. Peirce, *Collected Papers*, vol. I, p. 38.

7 In a paper which I have come to know only since delivering this talk, M. Merleau-Ponty discusses under a heading very similar to that of this paper, the 'primacy of perception' over sensation. See his volume, *The Primacy of Perception*, ed. J. M. Edie, Evanston, Ill., 1964, pp. 12 ff.

8 Cf. further J. C. Gibson, *The Perception of the Visual World*, Boston, 1950, W. H. Thorpe, *op. cit.*, p. 129, and particularly Ivo Kohler, 'Experiments with Goggles', *Scientific American*, May 1962, who speaks of the 'general rules' by which the visual system learns to correct exceedingly complex and variable distortions produced by prismatic spectacles.

9 G. Ryle, 'Knowing how and knowing that', *Proc. Arist. Soc.* 1945-6, and *The Concept of Mind*, London, 1949.

10 M. Polanyi, *Personal Knowledge*, London, 1959.

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Peters's highly important discussion of the significance of non-articulated rules in determining action, there has been an increasing stress on mental factors which govern all our acting and thinking without being known to us, and which can be described only as abstract rules guiding us without our knowledge.

The field, however, in which it has come out most clearly that our mental activities are not guided solely or even chiefly by the particulars at which they are consciously directed, or of which the acting mind is aware, but by abstract rules which it cannot be said to know yet which nevertheless guide it, is modern linguistics. I do not know enough about it to discuss it at any length, but the chief point has indeed been brought out as long as 200 years ago by Adam Ferguson in one of my favourite passages of his great work which I cannot refrain from quoting:¹¹

The peasant, or the child, can reason and judge, and speak his language, with a discernment, a consistency, and a regard to analogy, which perplex the logician, the moralist, and the grammarian, when they would find the principles upon which the proceeding is grounded, or when they would bring to general rule, what is so familiar, and so well sustained in particular cases.

You all know how far this conception of the elaborate theory of the grammar of his language which the small child can observe without having any conscious idea of its existence has been carried by Noam Chomsky¹² and his school of transformational-generative grammar.

4

When I now turn to the substance of my thesis it will be expedient to begin by considering, not how we interpret the external world, but how this interpretation governs our actions. It is easier first to show how particular actions are determined by the superimposition of various instructions concerning the several attributes of the action

¹¹ Adam Ferguson, *An Essay on the History of Civil Society*, London, 1767, p. 50.

¹² N. Chomsky, *Syntactic Structures*, s'Gravenhage, 1957. I notice in R. H. Robins, *A Short History of Linguistics*, London, 1967, p. 126, that L. Hjelmslev in his early *Principes de grammaire générale*, Copenhagen, 1928, pp. 15, 268, demanded a universal *état abstrait* comprising the possibilities available to language and differently realized in *états concrets* for each particular one which I quote for the interesting use of 'abstract' and 'concrete' in this connection.

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to be taken, and only afterwards to consider in what sense the perception of events can also be regarded as a subsummation of particular stimuli, or groups of stimuli, as elements of an abstract class to which a response possessing certain characteristics is appropriate.

The most convenient starting point is the conception of a disposition (or 'set', or propensity, or state) which makes an organism inclined to respond to stimuli of a certain class, not by a particular response, but by a response of a certain kind. What I mean to show in this connection is that what I have called an abstraction is primarily such a disposition towards certain ranges of actions, that the various 'qualities' which we attribute to our sensations and perceptions are these dispositions which they evoke, and that both the specification of a particular experienced event, and the specification of a particular response to it, are the result of a superimposition of many such dispositions to kinds of actions, which result in the connection of particular stimuli with particular actions.

I need not enter here into the detail of the physiological processes involved through which, by raising the threshold of excitation of a great many other neurons, the stream of impulses issuing from one will put a great many others in a state of preparedness to act. The important point is that only very rarely if ever will a single signal sent out from the highest levels of the nervous system evoke an invariable action pattern, and that normally the particular sequence of movements of particular muscles will be the joint result of many superimposed dispositions. A disposition will thus, strictly speaking, not be directed towards a particular action, but towards an action possessing certain properties, and it will be the concurrent effect of many such dispositions which will determine the various attributes of a particular action. A disposition to act will be directed towards a particular pattern of movements only in the abstract sense of pattern, and the execution of the movement will take one of many different possible concrete forms adjusted to the situation taken into account by the joint effect of many other dispositions existing at the moment. The particular movements of, say, a lion jumping on the neck of his prey, will be one of a range of movements in the determination of which account will be taken not only of direction, distance and speed of movement of the prey, but also of the state of the ground (whether smooth or rough, hard or soft), whether it is covered or open territory, the state of fitness of the lion's various limbs – all being present as dispositions together with its disposition

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to jump. Every one of these dispositions will refer not to a particular action but to attributes of any action to be taken while the dispositions in question last. It will equally govern the lion's action if it decides to slink away instead of jumping.

The difference between such a determination of an action and the unique response of what we usually call a mechanism when we pull a trigger or press a button, is that each of the various signals ultimately determining the action of the organism at first activates merely a tendency towards one of a range of in some respect equivalent movements; and it will be the overlapping of many generic instructions (corresponding to different 'considerations') which will select a particular movement.

These several dispositions towards *kinds* of movements can be regarded as adaptations to typical features of the environment, and the 'recognition' of such features as the activation of the kind of disposition adapted to them. The perception of something as 'round', for example, would thus consist essentially in the arousal of a disposition towards a class of movements of the limbs or the whole body which have in common only that they consist of a succession of movements of the several muscles which in different scales, dimensions and directions lead to what we call a round movement. It will be these capacities to act in a kind of manner, or of imposing upon the movements certain general characteristics adapted to certain attributes of the environment, which operate as the classifiers identifying certain combinations of stimuli as being of the same kind. The action patterns of a very general character which the organism is capable of imposing upon its movements operate thus as moulds into which the various effects upon it of the external world are fitted.

What this amounts to is that all the 'knowledge' of the external world which such an organism possesses consists in the action patterns which the stimuli tend to evoke, or, with special reference to the human mind, that what we call knowledge is primarily a system of rules of action assisted and modified by rules indicating equivalences or differences or various combinations of stimuli. This, I believe, is the limited truth contained in behaviourism:¹³ that in

¹³ A truth, however, often much more clearly expressed by authors who were very far from being behaviourists: cf., for example, E. Cassirer, *Philosophie der symbolischen Formen II*, Berlin, 1925, p. 193: 'Nicht das blosse Betrachten, sondern das Tun bildet den Mittelpunkt, von dem für uns Menschen die geistige Organisation der Wirklichkeit ihren Ausgangspunkt nimmt.'

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the last resort all sensory experience, perceptions, images, concepts, etc., derive their particular qualitative properties from the rules of action which they put into operation, and that it is meaningless to speak of perceiving or thinking except as a function of an acting organism in which the differentiation of the stimuli manifests itself in the differences of the dispositions to act which they evoke.

The chief points I want to drive home here are that the primary characteristic of an organism is a capacity to govern its actions by rules which determine the properties of its particular movements; that in this sense its actions must be governed by abstract categories long before it experiences conscious mental processes, and that what we call mind is essentially a system of such rules conjointly determining particular actions. In the sphere of action what I have called 'the primacy of the abstract' would then merely mean that the dispositions for a kind of action possessing certain properties comes first and the particular action is determined by the superimposition of many such dispositions.

5

There is still one special point to which I must draw your attention in connection with these action patterns by which the organism responds to – and thereby, as I like to call it, 'classifies' – the various effects on it of events in the external world. This is the limited extent in which it can be said that these action patterns are built up by 'experience'. It seems to me that the organism first develops new potentialities for actions and that only afterwards does experience select and confirm those which are useful as adaptations to typical characteristics of its environment. There will thus be gradually developed by natural selection a repertory of action types adapted to standard features of the environment. Organisms become capable of ever greater varieties of actions, and learn to select among them, as a result of some assisting the preservation of the individual or the species, while other possible actions come to be similarly inhibited or confined to some special constellations of external conditions.

Perhaps I should add, in view of what we have discussed earlier, that nothing in this commits us to a choice between nativism and empiricism, although it makes it seem probable that most of the action patterns by which the organism responds will be innate. The important point is that the action patterns are not built up by the

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mind, but that it is by a selection among mechanisms producing different action patterns that the system of rules of action is built up on which rests what we regard as an interpretation of the external world by the mind.

You may already have noticed that what I have been arguing is in some way related to certain developments in the modern theory of knowledge, especially Karl Popper's argument against 'inductivism' – i.e. the argument that we cannot logically derive generalizations from particular experiences, but that the capacity to generalize comes first and the hypotheses are then tested and confirmed or refuted according to their effectiveness as guides to actions. As the organism plays with a great many action patterns of which some are confirmed and retained as conducive to the preservation of the species, corresponding structures of the nervous system producing appropriate dispositions will first appear experimentally and then either be retained or abandoned.

I cannot here more than just mention that this approach evidently also sheds important light on the significance of purely playful activities in the development both of animal and of human intelligence.

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While my chief contention is the primacy of the rules of action (or dispositions), which are abstract in the sense that they merely impose certain attributes on particular actions (which constitute the 'responses' by which the stimuli or combinations of stimuli are classified), I will now turn to the significance of this for the cognitive processes. I will put my main point first by stating that the formation of abstractions ought to be regarded not as actions of the human mind but rather as something which happens to the mind, or that alters that structure of relationships which we call the mind, and which consists of the system of abstract rules which govern its operation. In other words, we ought to regard what we call mind as a system of abstract rules of action (each 'rule' defining a class of actions) which determines each action by a combination of several such rules; while every appearance of a new rule (or abstraction) constitutes a change in that system, something which its own operations cannot produce but which is brought about by extraneous factors.

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This implies that the richness of the sensory world in which we live, and which defies exhaustive analysis by our mind, is not the starting point from which the mind derives abstractions, but the product of a great range of abstractions which the mind must possess in order to be capable of experiencing that richness of the particular. The difference between this approach and the still predominant one is perhaps best illustrated by an oft-quoted phrase of William James which is very characteristic of the idea that the primitive mind of a higher animal or a small child perceives concrete particulars but lacks abstract relations. James speaks of the 'blooming, buzzing confusion' of the baby's sensory experience of his environment. This presumably means that the baby can fully perceive such particulars as coloured spots, particular sounds, etc., but that for him these particulars are unordered. I am inclined to believe that, in the case of the baby as well as in that of higher animals, almost the exact opposite is true, namely that they experience a structured world in which the particulars are very indistinct. The baby and the animal certainly do not live in the same sensory world in which we live. But this is so, not because, though their 'sense data' are the same, they have not yet been able to derive from them as many abstractions as we have done, but because of the much thinner net of ordering relations which they possess – because the much smaller number of abstract classes under which they can subsume their impressions makes the qualities which their supposedly elementary sensations possess much less rich. Our experience is so much richer than theirs as a consequence of our mind being equipped, not with relations which are more abstract, but with a greater number of abstract relations not derived from given attributes of the elements. It rather confers these attributes on the elements.

7

Some people are likely to object to this analysis on the ground that the term 'abstract' is properly attributed only to results of conscious thought. I shall later return to this point and in fact question whether we can ever in the same sense be conscious of an abstraction in which we are conscious of the intuitive perceptions of particular events or of images. But before I turn to this question I want to examine a tacit assumption which seems to be uncritically accepted in most discussions of these problems.

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It is generally taken for granted that in some sense conscious experience constitutes the 'highest' level in the hierarchy of mental events, and that what is not conscious has remained 'sub-conscious' because it has not yet risen to that level. There can of course be no doubt that many neural processes through which stimuli evoke actions do not become conscious because they proceed on literally too low a level of the central nervous system. But this is no justification for assuming that all the neural events determining action to which no distinct conscious experience corresponds are in this sense sub-conscious. If my conception is correct that abstract rules of which we are not aware determine the sensory (and other) 'qualities' which we consciously experience, this would mean that of much that happens in our mind we are not aware, not because it proceeds at too low a level but because it proceeds at too high a level. It would seem more appropriate to call such processes not 'sub-conscious' but 'super-conscious', because they govern the conscious processes without appearing in them.¹⁴ This would mean that what we consciously experience is only a part, or the result, of processes of which we cannot be conscious, because it is only the multiple classification by the super-structure which assigns to a particular event that determined place in a comprehensive order which makes it a conscious event.

This brings me back to the question of whether we can ever be conscious of all the higher abstractions which govern our thinking. It is rather significant in this connection that we seem to be unable to use such abstractions without resort to concrete symbols which appear to have the capacity of evoking the abstract operations that the mind is capable of performing, but of which we cannot form an intuitive 'picture', and of which, in this sense, we are not conscious. It seems to me that if we ask whether we can ever strictly be conscious of an abstraction in the same sense in which we are conscious of something that we perceive with our senses, the answer is at least uncertain. Is what we call an abstraction perhaps something which had better be described as an operation of the mind and which it can be induced to perform by the perception of appropriate symbols, but which can never 'figure' in conscious experience? I would suggest that at least those abstractions of which it can in some sense

¹⁴ I did not mention in my oral exposition, and therefore will not enlarge here on, the obvious relation of all this to Kant's conception of the categories that govern our thinking -- which I took rather for granted.

be said that we are aware of them, and can communicate them, are a secondary phenomenon, late discoveries by our mind reflecting on itself, and to be distinguished from their primary significances as guides to our acting and thinking.

8

The point in all this which I find most difficult to bring out clearly is that the formation of a new abstraction seems *never* to be the outcome of a conscious process, not something at which the mind can deliberately aim, but always a discovery of something which *already* guides its operation. This is closely connected with the fact that the capacity for abstraction manifests itself already in the actions of organisms to which we surely have no reason to attribute anything like consciousness, and that our own actions certainly provide ample evidence of being governed by abstract rules of which we are not aware.

I may perhaps mention here my interest in two apparently wholly different problems, namely the problem of what makes the observed action of other persons intelligible to us, and the problem of what we mean by the expression 'sense of justice'.¹⁵ In this connection I was driven to the conclusions that both our capacity to recognize other people's actions as meaningful, and the capacity to judge actions of our own or of others as just or unjust, must be based on the possession of highly abstract rules governing our actions, although we are not aware of their existence and even less capable of articulating them in words. Recent developments in the theory of linguistics at last make explicit those rules to which older linguists used to refer as the *Sprachgefühl*¹⁶ – which is clearly a phenomenon of the same sort as the sense of justice (*Rechtsgefühl*). Once more the jurists, as they did in ancient Rome,¹⁷ could probably learn a great deal from the 'grammarians'. The point which the lawyers have yet to learn is that what is 'felt but not reasoned' is not, as the word 'feel' might suggest, a matter of emotion, but is determined by processes

15 Cf. chapters 3, 4 and 11 in my *Studies in Philosophy, Politics and Economics*, London and Chicago, 1967, and section 3 of my pamphlet, *The Confusion of Language in Political Thought*, reprinted as chapter 6 of this book.

16 Cf. H. Kainz, *Psychologie der Sprache*, vol. IV, Stuttgart, 1956, p. 343: 'Die Normen, die das Sprachverwenden steuern, das Richtige vom Falschen sondern, bilden in ihrer Gesamtheit das Sprachgefühl.'

17 Peter Stein, *Regulae Iuris*, Edinburgh, 1966.

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which, though not conscious, have much more in common with intellectual than with emotional processes.

There is still another problem of language on which I must briefly touch. It is probably because in the development of language concrete terms seem to precede abstract terms that it is generally believed that the concrete precedes the abstract. I suspect that even the terms 'concrete' and 'abstract' were introduced by some ancient Latin grammarian and then taken over by the logicians and philosophers. But even if the evolution of words should proceed from concrete to abstract terms, this would not disprove that mental development proceeds in the opposite direction. Once we realize that the capacity to act in accordance with very abstract rules is much older than language, and that man developing language was already guided by a great many abstract rules of action, the fact (if it is a fact) that language begins with names for relatively concrete things would mean no more than that in the development of language the sequence characteristic of the development of mind is reversed.

Even that may be true, however, only if we mean by language the words of which it is made up and not also the manner in which we handle the words. We do not know, of course, whether vocal signs for such abstract concepts as 'danger' or 'food' actually appeared earlier than names for particular things. But if they did not, this is probably due to the fact, already mentioned, that of such abstractions no conscious image can be formed but that they are represented directly by dispositions to certain kinds of actions, while words were developed largely to evoke images of absent things. However that may be, it does not seem to me to mean that if in language abstract terms appear relatively late, we can draw from this any conclusions concerning the development of the mental faculties which govern all action (including speaking).

To identify and name the regularities which govern our own actions may be a much more difficult task than to identify objects of the external world, even though the existence of the former be the condition which makes the latter possible. If, as I suggested, abstractions are something that the conscious mind cannot make but only discover in itself, or something the existence of which constitutes that mind, to become aware of their existence and to be able to give them names may indeed be possible only at a very late stage of intellectual development.

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Before I attempt briefly to sum up I should like at least to mention, although I cannot pursue this point at any length, that only the recognition of the primacy of the abstract in the production of mental phenomena can enable us to integrate our knowledge of mind with our knowledge of the physical world. Science can deal only with the abstract. The processes of classification and specification by superimposition of many classes, which would turn out to be the determinants of what we experience subjectively as events in our consciousness, appear then as processes of the same general kind as those with which we are familiar in the physical sciences. And although, as I have argued at length in other places,¹⁸ a complete reduction of the subjectively experienced mental qualities to exhaustively defined places in a network of physical relations is in principle impossible for us, because, as I would now like to put it, we can never become consciously aware of all the abstract relations which govern our mental processes, we can at least arrive at an understanding of what ranges of events lie within the power of those physical forces to produce – even if we cannot aspire to more than what I like to call a limited ‘explanation of the principles’ involved.

10

In the course of this sketch I have repeatedly used the phrase ‘specification by superimposition’, meaning that particular actions are selected from fields of in some respect equivalent action patterns for which the threshold of activation is lowered, by those being reinforced which also belong to families of action patterns which are equivalent in other respects. This phrase ‘specification by superimposition’ seems to me to be the best description of the mechanism for the operation of which I have claimed the ‘primacy of the abstract’, because each of the causal determinants decides only one of the attributes of the resulting action.

It is this determination of particular actions by various combinations of abstract propensities which makes it possible for a causally determined structure of actions to produce ever new actions it has never produced before, and therefore to produce altogether new

¹⁸ See: *The Sensory Order*, London and Chicago, 1952, chapter VII and *Studies in Philosophy, Politics and Economics*, London and Chicago, 1967, pp. 39 and 60–3.

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behaviour such as we do not expect from what we usually describe as a mechanism. Even a relatively limited repertory of abstract rules that can thus be combined into particular actions will be capable of 'creating' an almost infinite variety of particular actions.

I do not know how far Koestler would be prepared to accept this as a generalization of his account of creation by 'bisociation'. To me it seems to describe much the same process he had in mind in coining that term, except that under my scheme the new may be the result of combination of any number of separately existing features. However, I am concerned with the appearance of the new in a much wider – and more modest – sense than he was in *The Act of Creation*. I am concerned with the fact that almost every action of a complex organism guided by what we call mind is in some respect something new.

I know that we both have in this connection been vainly endeavouring to find a really appropriate name for that stratification or layering of the structures involved which we are all tempted to describe as 'hierarchies'. I have throughout disregarded the fact that the processes I have been considering occur not just on two but on many superimposed layers, that therefore, for instance, I ought to have talked not only of changes in the dispositions to act, but also of changes in the dispositions to change dispositions, and so on. We need a conception of tiers of networks with the highest tier as complex as the lower ones. What I have called abstraction is after all nothing but such a mechanism which designates a large class of events from which particular events are then selected according as they belong also to various other 'abstract' classes.