The Psychology of Errors

Paul A. Bartolo

One of the lasting contributions to psychology by Sigmund Freud and Jean Piaget has been their focus on human errors as keys to the workings of the mind.

Freud dedicated two of his first lectures of *A general introduction to psychoanalysis* (1935) to "The Psychology of Errors". He considered slips of the tongue, misreading and the forgetting of resolutions as related to unconscious mental processes. Hence the expression "a Freudian slip". Similarly Piaget did not follow the developers of intelligence tests who focused on those tasks which most children could solve at progressive ages, but turned his attention instead to those tasks which most children at any given age invariably failed to solve. He based his theory of stages in children's intellectual development on their errors in dealing with problems that required a level of thinking beyond their particular level of development (see e.g. Piaget, 1954).

Whatever our view of them,there is no doubt that mistakes are a very common feature of our lives. We generally adopt the common attitude to them that helps us defend ourselves from feeling incompetent or discouraged in our endeavours, expressed in the sayings of *Humanum est errare* - (to err is human) - or *Bl-iżbalji titgħallem* - (we learn through mistakes).

While the first Latin maxim is merely a defence approach, the latter Maltese saying points to a different approach that could be very useful if adopted from the psychological point of view. The psychological approach can help us to understand the workings of our mind or that of others and thus serve as a solid foundation for improving our own or others' understanding and coping better with our problems.

For instance, a young man who from a distance mistakes another person for his lover, can regard his mistake as an indication of the degree of his involvement with his girl friend. Similarly a student who fails to solve a problem correctly, may discover at what point his reasoning, i.e. his mental functioning, did not match the real issues and thereby be able to adjust his internal processing to better match the real factors in the problem. These same mistakes can be of great value to the counsellor or teacher who is trying to help his client or pupil to come to terms with his problem.

The teacher should in fact be fascinated by the mistakes of his pupils. It is through mistakes that he can best come in clear contact with the workings of the mind of his pupils whose thinking he is trying to help improve.

Mistakes and errors

One might assume that there are no 'accidental' mistakes - or to put it differently that every mistake can be explained as a conscious or unconscious process in one's mind. On the other hand it is fruitful for educators to distinguish between two types of mistakes. A learner sometimes commits a *random mistake* or a mistake that is the result of some kind of failure in his mental functioning. For instance, one who has the understanding and ability to add single digit figures may occasionally make a mistake in one of his additions.

In contrast to this, a learner may make a *systematic* mistake, which for our purpose may be termed an error, that is the result of a failure to understand the principles involved in the solution of a particular problem. For instance, in the subtraction of double digit figures a boy or girl may sytematically subtract the smaller number from the bigger one without taking account of which should in fact be subtracted from which. Note that in this case the child is actually applying the elementary mathematical rule that only the smaller amount can be subtracted from the larger to give a positive result; but he is not yet aware of the more advanced principle that allows a negative result or that requires borrowing from the next higher unit.

These insights have been extended to all areas of psychology including the psychology of language. The type of errors children make in acquiring language are clear evidence that they process internally the language they hear according to the systems they develop in their brains. For instance, it is now common knowledge that when a child says "Father *buyed* it for me" instead of *bought,* or *Il-barmili* instead of *Il-bramel,* he is not making a random mistake but rather a systematic error of applying his recently discovered language rules (of how to form a past tense verb in English or the plural form of a noun in Maltese) to express the desired meaning (cf. Corder, 1967; Deutsch (ed.), 1981.

Errors indicate developmental stages

The discovery of such systematic errors is also being used to determine more adequately the essential underlying factors of children's intellectual development. Taking their cue from Piaget's work, cognitive developmental psychologists have been devising tasks that reveal the rules children construct or are able to construct at different ages to deal with school and other problems.

One such interesting task, first used by Piaget, is that of predicting which side of a balance beam will go down when various combinations of weights are placed at various distances from the fulcrum. Siegler (1976) found that children at ages 3 or 4 make a very global evaluation of each side, often based on salient perceptual characteristics of the weights; at the age of $4^1/_2$ to 6, they carefully add the number of weights on each side, and pick the one with the greater number; at ages 7 or 8, if the number of weights on each side is equal, children will predict that the weight which is at a greater distance from the fulcrum will go down. At age 9 or 10, children succeed in working out some kind of compensation between weight and distance on both sides. Case (1978 and in press), through experimental testing and instruction, has found that children's ability to take account of more and more dimensions of a problem at various stages of their middle childhood ($4^1/_2$ to 10 years) is related to their developing short-term-storage-space (STSS) (i.e. mental capacity to process various units of information simultaneously in one's mind) which seems to go on expanding until the age of around 15. Thus, at the four substages of their dimensional development in middle childhood, children are able to evaluate *simultaneously* the global features of the balance beam problem, then to quantify and compare wieghts, then to take account of and later also to evaluate the relation between quantified distance from the fulcrum as well as quantified wieght.

In contrast to Piaget, who was primarily concerned with discovering *structural* stages in intellectual development, Case has focussed on the *functional* aspects of the theory. He has subsequently come up with a new applied theory of intellectual development that seeks to establish criteria for the optimisation of the educational environment for children's intellectual development.

Through the analysis of children's errors in dealing with tasks within or outside the school curriculum, it is gradually becoming possible to determine their particular demands on the STSS of students and at which level of difficulty these tasks may be understood and worked out by the various students. We will thus be able to avoid frustrating our students with unnecessary failures while at the same time optimising the use of their capacity.

Even without the technical measuring of children's STSS, the above developmental theory suggests that there is a 'natural' sequence in which children learn to deal with the various tasks they come across. Therefore, if we can reveal such specific sequences we will be able to more effectively promote our students' transition from any given stage to the next higher level of understanding of a task. Evidence of such effectiveness is already available, for instance, in reading (e.g. Dewsbury *et al.* 1983).

Both in discovering such developmental criteria as well as in assessing the developmental stage of a child in dealing with any particular problem, error analysis is an essential tool. Educators should be trained to appreciate the psychology of errors, as some teachers already do spontaneously, to modify their instruction and tune in to the intellectual functioning of the individual student.

References

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Whichever type of questionnaire is used this should enable the researcher to collect data not only on the teaching methods but also on classroom and curricular organisation, discipline, testing, marking and so on (e.g. Bennett, 1976). In developing the questionnaire the researcher should ensure that the questions are not ambiguous (that is, that the instrument is reliable), through successive piloting in the field (Kerlinger, 1964), and even with knowledgeable individuals. Piloting could also reveal questions which should have been asked but were initially overlooked. Pre-coded answers would make the instrument more "efficient" in the sense that one knows beforehand what type of answers are to be expected, and pre-