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Discussion

What lesson for dyslexia from Down's syndrome? Comments on Cossu, Rossini, and Marshall (1993)

John Morton*, Uta Frith
MRC Cognitive Development Unit, 4 Taviton Street, London WC1H 0BT, UK

Cossu, Rossini, and Marshall (1993) have made a spirited attempt to clear the terminology currently obscuring the debate on the relation between phonological awareness and reading acquisition. They conclude that the teaching of phonological awareness (PA) skills is a pointless exercise. This conclusion may be correct, but we find ourselves still uncertain of the nature of PA, and regret that the confusion between competence/performance and the confusion between cognition/behaviour in the preceding literature has been carried forward in the paper by Cossu et al. (henceforth CRM).

To review the problem: CRM usefully identify four views on the relation between phonological awareness and the acquisition of literacy in the normal child:

(a) PA is a consequence of learning to read (Morais, Cary, Alegria, & Bertelson, 1979).

(b) PA is a causal factor in learning to read (Bradley & Bryant, 1983).

(c) An interactionalist view, such that being instructed to read in alphabetic systems develops segmental awareness which, in turn, is crucial for mastering the rules of grapheme–phoneme conversion (Morais, Alegria, & Content, 1987).

(d) There is no causal relationship between PA and learning to read, merely an association (Liberman, Shankweiler, Liberman, Fowler, & Fisher, 1977).

The position of CRM in this controversy is illuminated by their claim that "if in

*Corresponding author.

some abnormal group, reading is acquired in the absence of ability to perform explicit segmental analysis tasks, that would seem *prima facie* evidence that no necessary causal connection holds between the two skills" (p. 130).[1] The notion of causal connection between diverse skills is an interesting one. The problem is, in the context of reading acquisition, as elsewhere, that skill is indexed by performance. In consequence we end up with the traditional conflation of ability and performance that predates cognition. Of course, CRM are aware of this distinction and try to avoid the criticism that Down's syndrome children "merely failed to understand the task demands" (p. 134). Their argument is that phonological awareness tests are "conscious skills" and that "with respect to conscious skills, failure to understand the task *is* failure to be able to perform the task" (p. 134, their italics). However, we would claim that failure to perform the task is not to be equated with absence of phonological processes causally relevant to reading acquisition.

CRM's argument runs as follows: if it is the case that reading acquisition depends on phonological awareness, then you will not find reading acquisition without phonological awareness. They take a group of Down's syndrome children (mean age 11.4; mean IQ 44), matched with controls (mean age 7.3) on ability to read aloud regular and irregular words and in the pronunciation of words and non-words.[2] This step is meant to establish that the two groups are equivalent in relation to the aspects of reading acquisition that are important in the current debate.[3] They then tested the two groups on a variety of metalinguistic tasks: phoneme counting, phoneme deletion, oral spelling and blending of a string of letter sounds. This step is designed to enquire whether the groups are equivalent in the skill of phoneme awareness. On all four tasks the Down's syndrome group performed appallingly. What is odd is that CRM remark that this failure is not surprising, since normal children of the mental age of the Down's syndrome group (around 5) would also fail. The way CRM put it, however, maintains the focus on the tasks: "gross failure on phonological awareness tasks has not prevented. . . (the Down's syndrome group). . . from acquiring reading (as a transcoding skill)" (p. 134), and they conclude "all causal hypotheses relating PA to the acquisition of reading (or vice versa)[4] are false if the connection is taken as a necessary one" (p. 134).

[1]The term *prima facie* is an odd one to find in a scientific context, where, in our experience, a second glance always repays itself.

[2]We are surprised that they did not make more of the fact that the Down's syndrome children were 10% worse at reading irregular words and 10% better at reading non-words, and so might be supposed to be readers who relied even more than the controls on the phonological system (Frith's, 1985, alphabetic stage).

[3]Presumably, the groups differed in their ability to understand the words, or to read continuous prose, but such differences would not affect the rest of the arguments put forward in the paper nor would they be relevant to the debate that the paper addresses.

[4]Note that on CRM's own line of argument, the vice versa would require a group which passes the PA tests but is without mature graphemic transcoding skills.

At one stage, they emphasize, wisely, the restricted nature of their own claims. "We simply wish it to be accepted that *not all* children depend on phonological awareness in order to learn to read" (p. 135, their italics). In other words, some children (i.e. all normal children?) do depend on phonological awareness. In their final paragraph, however, they make the stronger claim:

> Metalinguistic games seem to draw upon a whole range of (possibly important) cognitive skills, but not skills that are of crucial importance to reading *per se*. (p. 136, their italics)

This conclusion seems to be driven by CRM's reading of the intervention literature: they claim there is no empirical evidence that teaching phonological awareness facilitates learning to read. Whether or not this is the case, such a claim should not be seen as gaining support from the rest of CRM's arguments or from their experiment. Their experiment only bears on particular extreme claims of a necessary and sufficient causal relationship between performance on tests of phonological awareness and reading skills – a claim made neither by Morais et al. (1987) nor by Bryant and Bradley (1985).

The four positions outlined by CRM have been illustrated in Fig. 1. In these

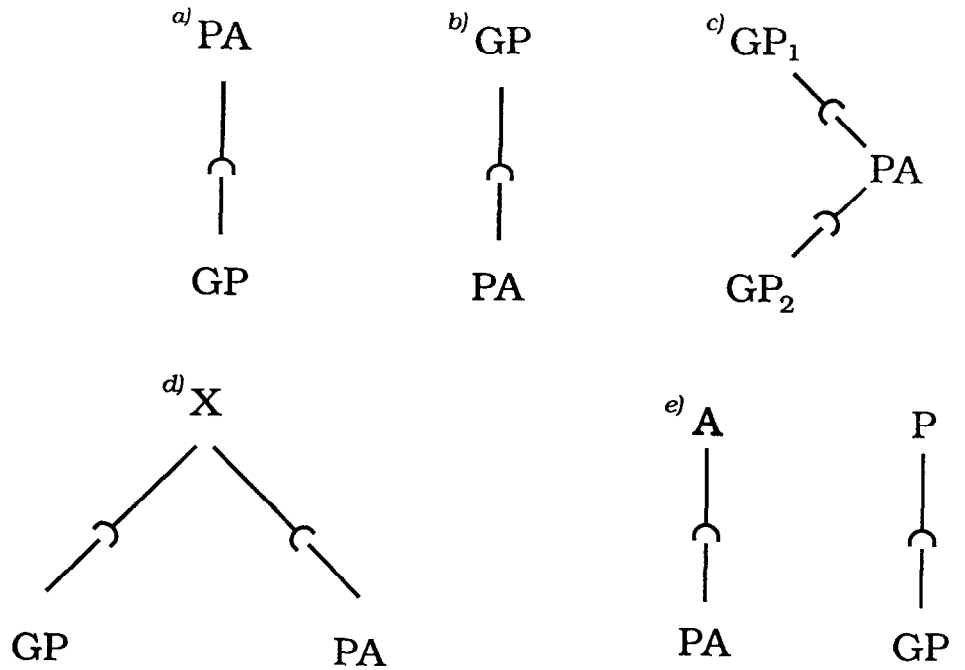

Figure 1. *Formulations of alternative claims of the relationship between phonological awareness (PA) and the acquisition of a grapheme–phoneme correspondence system (GP). (a) PA is required for GP; (b) GP is required for PA; (c) the interactionalist view, where GP_2 is more elaborated than GP_1; (d) the common source view; (e) the view of Cossu et al. (1993). (The horseshoe symbol is borrowed from Morton's (1986) developmental contingency modelling notation.)*

diagrams we have taken the crucial element in reading acquisition (for the purposes of the present discussion) to be the development of a grapheme–phoneme correspondence system (GP).[5] In contrast to these positions, CRM suppose that GP and PA have separate prerequisites. This fifth position is effectively the preformist one, which had its strongest expression in Marshall (1989). We have shown prerequisites P′ and A′ for these two structures, but if we base the diagram on Marshall's (1984, 1989) preformist stance, then there will be no cognitive prerequisites for GP, at any rate.

Essentially, the position that CRM are putting forward is that any supposed relationship between GP and PA arises simply because of maturational factors. Such factors, while linked, perhaps, at the biological level, would be independent at the cognitive level. Such a position implies that reading acquisition needs only a minimal input from the environment, much as language is supposed to.

The problem with all five theories is that they do not differentiate systematically between behaviour on the tasks and the cognitive processes and structures which underlie task performance. Everyone distinguishes between performance on non-word reading tasks and the structures required to support such performance, namely, knowledge of the alphabetic system. But a similar step needs to be taken if we are to understand performance on phoneme awareness tasks. For short, we call the cognitive processes or structures that make such performance possible iPA (implicit phoneme awareness). In line with the usual performance/competence distinction, it would then be possible for an individual to possess the structure iPA (competence), without being able to succeed on the PA tasks (performance).

To illustrate the argument, we present in Fig. 2 one of many possible models. The first point is that PA performance requires two cognitive prerequisites. We have already defined one of these to be iPA; this particular model represents that, in line with Morais et al., GP has to be developed before the full range of

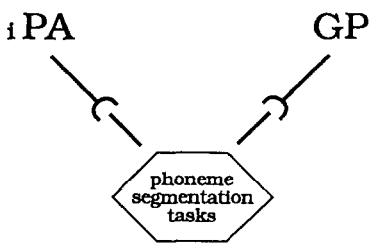

Figure 2. *Model of the cognitive prerequisites for phoneme segmentation skills. If either iPA or GP is missing then normal task performance will not be possible.*

[5]We would like to make it clear that reference to GP should not be interpreted in terms of a one-to-one conversion of single graphemic elements to single phonological ones but rather in terms of any system that converts a graphemic code to a phonological code at any sublexical unit size.

phoneme segmentation tasks can be performed, including those used by CRM but not including "understanding rhyme" (Morais et al. 1987, p. 425). The model implies that without GP or without iPA an individual will be unable to perform phoneme segmentation tasks fluently.

By postulating deeper, underlying structures we are not just reifying components of the task we are attempting to deconstruct. Rather, the presence of any postulated cognitive element must be independently indexed. There will always be more than one prerequisite that one can think of for any element. In order to maintain explanatory and predictive power, independent marker tasks, in domains other than that currently under examination, should be proposed for the presence or absence of each such prerequisite. In the case of iPA we suggest that understanding of rhyme may be such a task. In the theory, expanded in Fig. 3, rhyme understanding, unlike the phoneme segmentation tasks, would be possible without GP. GP, on the other hand, is well indexed by performance on non-word reading tasks which could be carried out in the complete absence of iPA.

Given the separation between iPA and GP, there is a problem uncovered in Fig. 3. How do we account for the normally high correlation between the various tasks? The natural way of dealing with this is to examine the prerequisites for the cognitive elements GP and iPA. We propose that both iPA and GP have at least two prerequisites, with one component underlying them both. In Fig. 4, this component is labelled as P, and would correspond to some underlying phonological structure or process. The real nature and function of P remains unknown, but its effect in alphabetic cultures is to make representations at the level of the phoneme available to be mapped to graphemic codes[6] and to be manipulated in phoneme segmentation tasks. In this model, environmental input, as provided by rhyming games, could play a role in the development of P. Of course, those games would not be equivalent to "understanding rhymes" nor could they be members of the set of phoneme segmentation tasks shown in Fig. 4 as contingently

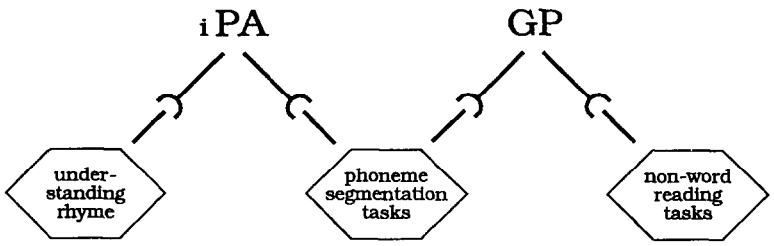

Figure 3. *An expansion of Fig. 2, showing that the cognitive prerequisites for phoneme segmentation skills are required for other tasks.*

[6]Note that such a requirement would be as necessary if the GP system were to be represented as a connectionist network, as CRM hint for Down's syndrome children.

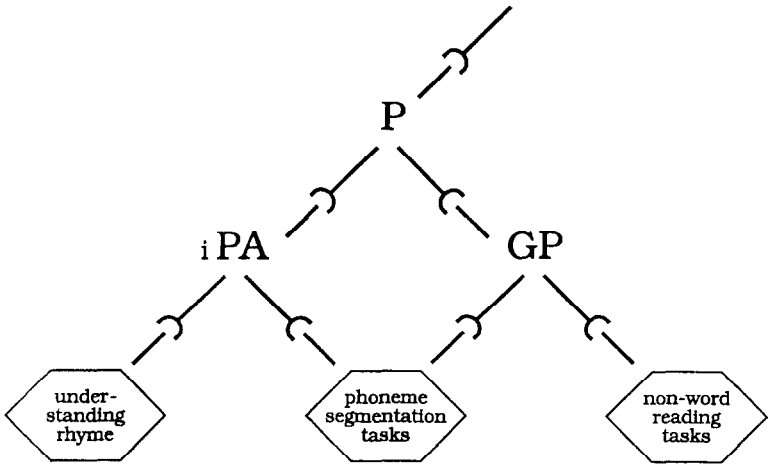

Figure 4. *An extension of the model, indicating that both the grapheme–phoneme (GP) system and implicit phoneme awareness depend upon a common underlying phonological process, P. In turn, P could depend upon or be affected by environmental input, E.*

dependent on P.[7] The effect of rhyme exercises on reading acquisition thus returns to being an empirical issue, rather than being a logical requirement from the CRM experiment. The CRM experiment, then, has no necessary pedagogical implications. Indeed, as Maclean, Bryant, and Bradley (1987) have shown, knowledge of nursery rhymes at age 3 was specifically related to reading over a year later. This relationship held after variables such as intelligence and the socio-economic class of the parents had been taken into account. There was no relation between this marker test and later arithmetic ability, as one would expect from the model in Fig. 4. If we assume that Down's syndrome children have an intact P and that the teaching/learning context is satisfactory, then they would develop a normal GP system. In contrast, we suppose that the Down's syndrome children lack some process which underlies metalinguistic ability. This formulation allows that both groups of children acquire the GP system in the same way. It may be the case that Down's syndrome children acquire their GP system in a different way from normal children, as CRM imply, but, under the current formulation this is not required from the CRM data.

Fitting in dyslexia

In addition to P, the development of iPA also requires the existence of a metarepresentational ability. For the purposes of discussion we assume that this is

[7]While no tasks are shown as being immediately contingent on P, the tasks shown as contingent on iPA or GP are also contingent on P since contingency is transitive.

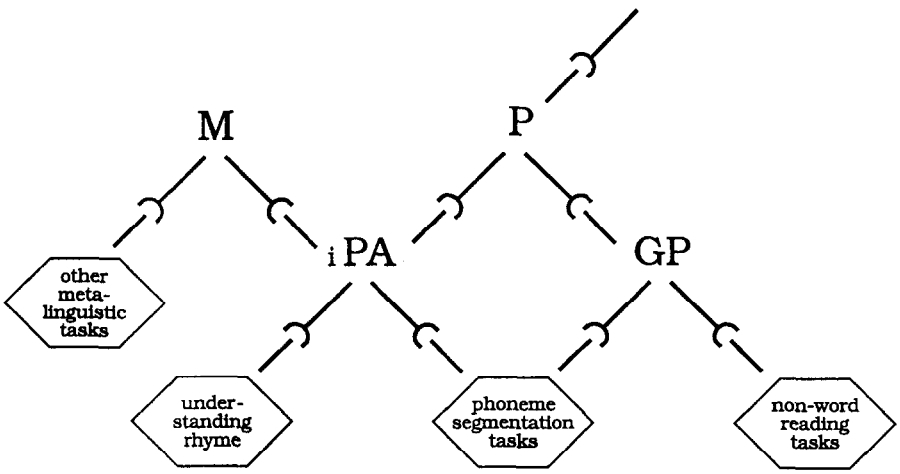

Figure 5. *A more complete model including the factor M, which underlies metarepresentational skills. We propose that this is absent for Down's syndrome children. Dyslexic children, in contrast, lack P.*

a general ability. In Fig. 5 we have used the label M for the process underlying all metalinguistic abilities (most of which are implicit). The presence of such a process would not only be detected by success on phoneme segmentation tasks (in the presence of P) but also by success on other metalinguistic tasks.

From Fig. 5 it can be seen that failure in phoneme segmentation tasks would result from lack of development of iPA. This could be due to an absence of P (which would also cause a lack of GP) or from absence of M. We assume that this is the case for the Down's syndrome children and predict that they fail both on iPA-dependent tasks and on other metalinguistic tasks.

Although CRM do not discuss dyslexia in any of its forms, we can represent some of the facts conveniently. The basic deficit is taken to be the process P (Morton & Frith, in press). The consequence of this, from Fig. 4, would be the lack of either of the developmentally dependent processes iPA and GP. As a consequence, dyslexics find it difficult to read non-words (Rack, Snowling, & Olson, 1992) and "show an impairment when the task demands the access and analysis of phonological features" (Ellis, 1991, p. 81). The model predicts that they would do well on other, non-phonemic, metalinguistic tasks.

Conclusion

Cossu et al. (1993) have performed a valuable service in demonstrating that fluent decoding of printed words can be learned in the absence of any ability to do phonological awareness tests. Reading non-words is a marker test for certain

underlying cognitive abilities which, in the normal population, can manifest themselves in phoneme segmentation tasks, but the latter also require other abilities which are missing in the Down's population. In spite of the best efforts of CRM, the issue of whether metalinguistic games have pedagogic utility remains an empirical one.

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