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Young Children's spelling representations and spelling strategies

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ABSTRACT

While traditional models of spelling describe the skills and knowledge required for development, the underlying cognitive processes that drive spelling success are often overlooked. Ninety-six English-speaking children, aged 5-to-7 years, completed two tasks which provided a direct measure of their spelling recognition and spelling production, respectively. Using a combination of performance measures and self-explanations, we assessed the relationship between children's performance on both the recognition and procedural tasks. Two separate hierarchical cluster analyses identified distinct profiles based on children's spelling recognition and spelling production, respectively. While these different profiles appeared related, log-linear analysis confirmed that the relations between recognition and production profiles were strongly moderated by children's spelling experience. Overall, the findings provide further support for application of the Representational Redescription (RR) and Overlapping Waves (OW) models in relation to young children's spelling acquisition within an English orthography.

1. Introduction

Spelling is a complex process that requires children to understand and apply rules of phonology and morphology (while recognising their exceptions) to build up orthographic representations of words. A number of theories have sought to provide domain specific explanations of spelling. Early theories of spelling development traditionally comprise stage-like formulations focussing on either the co-occurrence with reading (Frith, 1980) or spelling skill alone (Bear, Invernizzi, Templeton, & Johnston, 2000; Nunes, Bindman, & Bryant, 1997). Alternative approaches propose greater flexibility in how children acquire spelling knowledge, such as phase theory (Ehri, 1999, 2000) or item-based formulations (Share, 1995; 1999) which state that children can simultaneously coordinate phonological, orthographic, and morphological skills from quite early in their spelling development (Daffern, Mackenzie, & Hemmings, 2015).

While previous theories have provided some understanding about the knowledge involved in successful spelling and the approximate order in which knowledge is acquired (Critten & Pine, 2009), less is known about the underlying cognitive processes that actually drive spelling development. The cognitive mechanisms underlying the development of spelling knowledge, or the nature of spelling representations, are often overlooked and the extent to which implicit/explicit representations drive spelling production requires further consideration (Critten & Pine, 2009; Steffler, 2001). One solution is to consider the application of more general cognitive models of development, including the Representational-Redescription model (Karmiloff-Smith, 1992) and the Overlapping Waves model (Siegler, 1996), to define the cognitive basis of spelling development. The present study sought to bring together both cognitive models for the first time to help explore the relationship between the representations and mechanisms required for early spelling acquisition.

1.1. The Representational Redescription model

Despite suggestions around the implicit and explicit features of spelling knowledge (Gombert, 1992; Steffler, 2001), the nature of children's explanations and spelling performance at the implicit and explicit level remains underspecified. The Representational Redescription (RR) model of cognitive development (Karmiloff-Smith, 1992) describes learning as a process through a multi-representational system whereby implicit level representations of knowledge are redescribed into a series of more explicit representations (Levels E1, E2, E3). In the current study, we define the term 'representations' in relation to children's underlying knowledge and understanding of spelling units as indicated in their own verbal justifications and self-explanations. In line with the RR

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model, at the implicit level information is encoded in a procedural data-driven format and this knowledge cannot be *consciously* accessed or *verbalised* so procedural skills are devoid of conscious understanding. However, children may still achieve some degree of *behavioural mastery* or task success despite having no accessible or verbalisable knowledge of their successful procedures. Through sufficient practice, behavioural mastery of procedures occurs and knowledge is redescribed into more accessible explicit formats (E1). Explicit representations therefore signify later and more advanced development as knowledge can be consciously accessed, verbalised and generalised across situations. However, explicit level 1 (E1) procedures often produce a decrease in task success as contrary to evidence in the environment, abstracted theories may be over-applied leading to errors and causing to a U-shaped performance curve. Gradually at Explicit Level 2 (E2) these over-application errors start to decrease as greater acknowledgement of environmental information alongside the internalised theories enables a realisation that there are exceptions to the theories. Finally at Explicit Level 3 (E3) knowledge is now fully explicit not only leading to task success but the ability to apply this knowledge within and across domains in a flexible and creative way.

Very few studies have considered the application of the RR model in relation to spelling (Critten, Pine, & Messer, 2013; Critten, Pine, & Steffler, 2007; Lorandi & Karmiloff-Smith, 2012). In one initial study, Critten et al. (2007) sought to understand how early representations underlie the phonological to morphological development of spelling. Using a spelling recognition task, five-to-seven year-olds were given 15 sets of three alternative spellings of a target word, (e.g., *lost*, *losed*, *losted*) and asked to identify which was the correct target word; to explain why their choice was correct, and why the other alternatives were spelled incorrectly. Children's knowledge and understanding was categorised as a predominant level of representation (RR levels: Implicit, E1A, E1B, E2, E3) based on their orthographic choices and their verbal explanations. Children's early explicit knowledge was denoted by theories that had been abstracted in relation to phonology (level E1A) and morphology (level E1B) and the over-application of these theories often resulting in phonological (e.g., choosing *kissd* instead of *kissed*) or morphological errors (e.g., choosing *losted* instead of *lost*). In contrast, children at Level E2 achieved higher recognition scores than those at level E1 and demonstrated both phonological and morphological knowledge for each explanation. Finally those few children categorised as Level E3, demonstrated excellent recognition skills and fully explicit verbal explanations for the choices made. While this study made a promising start in conceptualising early spelling representations using the framework of the RR model, no concrete evidence of implicit representations was found, and only knowledge of spelling recognition was explored.

In a subsequent study, and to address these earlier concerns, Critten et al. (2013) tested slightly younger children (4-to-6 years) compared to the previous study (5-to-7 year-olds') and also incorporated an additional measure of explicit spelling production. Children's self-explanations on the recognition and production tasks were systematically compared. The first key finding was evidence of implicit representations where some children were able to achieve behavioural mastery, defined here as at least 70% accuracy in either the recognition or production of spelling items, despite being unable to explain the orthographic choices they made. On this basis, Critten et al. (2013) suggest that behavioural mastery in spelling is underpinned by the acquisition of implicit representations reflective of early visual/logographic processes being present prior to the emergence of explicit representations that incorporate phonological information. The second key finding was that while the majority of children showed consistent performance across both the recognition and production spelling tasks, one group showed inconsistency by displaying more explicit knowledge in either the recognition or production task but not on both tasks together. While this finding offers an exciting glimpse into the possibility of identifying different groups of children based on their spelling knowledge and procedural skill, there is an important limitation. The production task prompted children to rely on just one particular spelling production strategy which was based on the correct or incorrect use of onset/rime (equivalent to analogy). The use of this specific and unconventional production task is an important limitation because it remains unclear whether these reported implicit and explicit levels of representations are in fact associated with other phonological or rule-based production strategies found in past studies (Farrington-Flint, 2015; Farrington-Flint, Stash, & Stiller, 2008; Sheriston, Critten & Jones, 2016). Therefore, the relationship between spelling recognition and spelling production, in terms of the extent to which implicit/explicit representations might guide or constrain spelling production, requires further investigation in the present study.

There are two additional issues addressed in the current work that extends the findings of past studies. First, in both studies (Critten et al. 2007, 2013), analyses were conducted upon children's predominant type of representation (i.e. the level of understanding displayed most often) rather than considering intra-individual variation within each child's recognition scores across individual trials. Second, there was no real consideration of the role that age and prior spelling experience played in the level of explicit knowledge that children displayed. While Critten et al. (2013) suggest that implicit representations were associated with younger children neither studies actually explored year group effects on the early acquisition of spelling representations. These limitations, alongside a closer examination of the connections between spelling recognition and spelling production abilities, are therefore addressed in the current work.

1.2. Overlapping Waves model

The Overlapping Waves (OW) model of cognitive development (Siegler, 1996), rather than focussing on knowledge representations, describes how children apply new knowledge in relation to their explicit strategy choice. This model explores variation and adaptive change in children's domain-specific problem-solving strategies and proposes that children will use a variety of strategies to solve a problem, often choosing from a co-existing repertoire of procedures depending on the nature of the problem they are attempting to solve. Similar to the RR model of representation, some or all of these procedures and corresponding ways of thinking, may exist in parallel. The attributes of these strategies can occur, change and diminish at any time during development allowing children to shift from one strategy to another depending on which is deemed most appropriate at the time (Fazio & Siegler, 2013; Siegler, 1996). The frequency of strategies may also change, with children replacing simple strategies with those more advanced showing variability and adaptive choice.

A novel feature of this study is a direct test of the theoretical principles of both the RR model and OW model in relation to children's spelling development. While the RR model helps us to understand the state of spelling knowledge and how this changes, the OW model helps us to understand how knowledge can be applied in a variety of different ways to solve any given task. Therefore, an advantage of exploring spelling using both the RR and OW cognitive models is while the former concerns the acquisition and development of implicit/explicit knowledge, the latter considers how this knowledge is applied to solve problems and complete spelling tasks. This is not to say the two models are mutually exclusive as there is clearly an interplay between knowledge development and application in both contexts but there is a slightly different (if