Towards a Fuller Assessment of Cognitive Models of Task-Based Learning: Investigating Task-Generated Cognitive Demands and Processes

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This commentary discusses some methodological innovations and challenges in testing two cognitive models of task-based instruction and learning: Robinson’s Cognition Hypothesis (2001) and Skehan’s Trade-Off Hypothesis (1998). My focus, in view of these models’ key constructs, is the extent to which current methodological approaches are adequate to address the theoretical questions posed. I argue that there is a need for more extensive use of methods that can provide independent evidence of construct validity for the independent variables and causal processes invoked by the frameworks. By exploring some innovative task-based research and drawing on examples from other fields, I offer suggestions for improving our practices in future research.

INTRODUCTION

The field of instructed second language acquisition (SLA) has seen an increasing interest in the construct of task as a pedagogical tool, and a large part of the empirical research has been inspired by two cognitive-interactionist models for task-based language teaching (TBLT) and learning: Robinson’s (2001, 2011) Cognition Hypothesis (CH) and Skehan’s (1998, 2009) Trade-Off Hypothesis (TOH). The primary concern of both frameworks is to explain how task characteristics can affect SLA processes and outcomes, with the ultimate goal of informing task-based syllabus design. Considering the growing popularity of TBLT among educators worldwide, empirical studies testing the models have potentially important implications not only for theory-building but also for pedagogical practice. As such, it is crucial to ensure that appropriate methods are used in assessing their explanatory adequacy.

The aim of this commentary is to identify and discuss methodological challenges in investigating the theoretical questions posed by the CH and TOH, and to explore how these challenges may be addressed in future research. I argue that, in order to fully capture and evaluate the key constructs and predictions
of the models, researchers need to turn their attention to the explanatory (or independent) variables and the causal processes posited. This move would supplement and balance the currently dominant focus on the outcome (or dependent) variables. Building on some innovative task-based studies and research from other fields, I offer suggestions for investigating one of the central explanatory variables of the proposals and the processes it is argued to generate.

WHAT NEEDS TO BE MEASURED: KEY CONSTRUCTS IN THE CH AND TOH

As a starting point, it is useful to review some of the key constructs involved in the TOH and CH. A principal independent variable in both models is cognitive task demands, which Skehan (1998) terms as cognitive complexity and Robinson (2001) refers to as task complexity. Skehan (2009) posits that task factors may impose more or less pressure at the conceptualization and/or formulation stages of the speech production process, and the linguistic outcomes of task performance are influenced by the extent to which these stages can handle the cognitive demands imposed by the task on working memory or attentional limitations. Drawing on a multiple-resources account of attention, Robinson (2011) claims that making tasks more cognitively complex will not only have predictable impact on speech production processes but also allocation of attentional and memory resources to input, and retention of that input. In both models, a key dependent variable is quality of linguistic performance defined in terms of indices of complexity, accuracy, and fluency (CAF). Now I turn to the question of what evidence needs to be obtained to test the CH and TOH.

THE ADEQUACY OF CURRENT PRACTICES IN TESTING THE MODELS

The adequate assessment of any theoretical model requires that each and every construct is measured clearly and independently (Norris and Ortega 2003). Applying this to the TOH and CH, it follows that researchers need to supply specific and separate evidence for all proposed factors, from the independent variables including cognitive task complexity, through the explanatory processes of speech production and attentional allocation, to the dependent variables of CAF measures. Let us consider the extent to which current research practices evident in the literature meet these criteria.

To begin with the positives, recently much progress has been achieved in understanding and exploring methods that are suitable for tapping the dependent variables of interest, for example, CAF measures (Housen and Kuiken 2009). By comparison, the measurement of the independent factors and the causal processes posited appears to be more problematic. As Norris (2010)
points out, the most common method to test the TOH and CH involves designing a task and then manipulating it in terms of task complexity, that is, creating a simple and complex task version along a dimension, which is believed to affect the cognitive demands imposed by it. Next, researchers typically measure learner performance using linguistic outcome measures such as CAF under both the simple and complex conditions. If a significant difference in the predicted direction is found between the two complexity conditions on the linguistic measures, this is usually taken as evidence in favour of the TOH and/or CH.

This conclusion, however, is based on evidence insufficient to confirm or refute the models, because one step in the reasoning is more often than not skipped. Namely, for any operationalization of task complexity, researchers must seek and furnish independent evidence that the task complexity manipulations have indeed led to the desired changes in cognitive demands, and that any changes in cognitive demands have in fact triggered the causal processes predicted (Norris 2010). Specifically, it needs to be shown rather than assumed that the task version designed to be more complex is indeed more cognitively demanding. Likewise, independent evidence needs to be gathered for the causal processes that are predicted to take place instead of inferring based on linguistic performance data whether they have occurred.

But if researchers must measure explanatory constructs in investigating task-based models, the question is: What are some possible ways of measuring the cognitive load induced by task manipulations and of investigating the processes that ensue due to any changes in cognitive demands? I turn to methods that appear promising in tackling these challenges.

HOW TO PROVIDE INDEPENDENT EVIDENCE FOR TASK-GENERATED COGNITIVE DEMANDS

While the issue of separate measurement of cognitive task demands has received little consideration in instructed SLA research, applied cognitive scientists have identified several ways to obtain independent evidence of the cognitive load or mental effort required to perform cognitive activities [see e.g. Sweller et al. (2011) for a review]. Four such methods also appear to be useful for investigating the CH and TOH, namely, subjective self-ratings, subjective time estimations, secondary task methodology, and psychophysiological techniques. The use of rating scales is motivated by the assumption that people can assign a numerical value to the perceived mental effort expended during cognitive activities. This technique has been employed in a small number of task complexity studies, all of which have adopted or adapted a scale originally introduced by Robinson (2001). Subjective time estimation involves asking participants to estimate the length of time they have taken to perform a given task. A recent meta-analysis (Block et al. 2010) evaluating
this method confirmed that, when participants are asked to assess task duration retrospectively, the estimated time increases as a result of higher processing demands. Baralt (2010), the first to utilize this method in an L2 study of task complexity, found that, as expected, tasks designed to be more complex were perceived to take longer. These results received partial confirmation in a recent study by Malicka and Levkina (2012). Dual task methodology entails performing a task simultaneously with the primary task. Secondary tasks typically include simple activities that require sustained attention. The principle underlying the technique is that performance on the secondary task, assessed in terms of reaction time and accuracy, mirrors the level of cognitive load generated by the primary task. This approach has not yet been applied in task complexity research, even though it has been used in SLA research for other purposes (DeKeyser 1997). Finally, physiological methods include measuring heart activity, employing neuro-imaging techniques, and recording eye activity. These methods presume that fluctuations in cognitive load will be reflected in physiological functioning.

At this stage of L2 research, a combination of these approaches is probably the best way to gauge the cognitive load imposed by task demands. It is worth pointing out, however, that any results in terms of these indices will inevitably be influenced by individual differences. None of these techniques generate pure or objective measures of task complexity. Rather, they capture how task characteristics and learner factors together contribute to the extent of cognitive effort experienced by learners (Bachmann 2002). Using Robinson’s terminology, they encapsulate aspects of task difficulty, that is, the degree of difficulty learners experience depending on their affective and cognitive attributes. However, this does not subtract from the fact that these methods appear useful for obtaining independent measurement of cognitive load or effort, which is a key explanatory variable in the CH and TOH.

POSSIBLE WAYS OF EXPLORING TASK-GENERATED COGNITIVE PROCESSES

Finally, I would like to explore ways of addressing another principal challenge that task-based researchers face in testing the CH and TOH; that is, obtaining evidence for the causal processes invoked. Several of the explanatory processes referred to in the frameworks involve conscious operations (e.g. conceptualization and noticing). Therefore, introspective methods seem to offer a useful means of gaining access to aspects of these processes. Among the introspective techniques, probably the stimulated recall procedure (Gass and Mackey 2000) lends itself best to tapping conscious operations, since both the CH and TOH are primarily concerned with explaining the impact of task manipulations on production-related processes and outcomes. As part of stimulated recalls, learners could be asked to stop videotapes of their performances when they remember experiencing difficulty and could be prompted to describe the
source of that difficulty. Researchers could also elicit comments in relation to observable performance phenomena such as pausing behaviour. In computer-mediated contexts, stimulated recall comments could also be triangulated by recordings of eye movements. Eye-tracking methodology is gaining ground in L2 task-related research (e.g., Smith 2010) and as a method to investigate noticing (e.g. Godfroid et al. 2010), but it has not yet been employed to assess the predictions of the CH or TOH.

CONCLUSION

I would like to conclude with a few suggestions. In future task complexity research, it would be desirable if researchers began with investigating whether their manipulations do indeed result in the anticipated changes in task demands. This could be done within a single study that also seeks evidence on outcomes, or it might be done in separate studies that exclusively address the validity of task complexity manipulations and investigate the processes they trigger. As part of this process, various data sources that examine task-generated cognitive load and explanatory processes could be triangulated. Clearly, in the initial stages, the usefulness of these data sources also needs to be assessed. Such careful triangulation and cross-validation may eventually allow researchers to investigate theoretical cornerstones of the CH and TOH which have been largely empirically untapped, including Skehan’s (2009) distinction of pressures at the conceptualization versus formulation stages or Robinson’s (2001) distinction between resource-dispersing and resource-directing increases in task-generated cognitive complexity.

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