Information Gap Tasks: Their Multiple Roles and Contributions to Interaction Research Methodology[1]

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This article describes how information gap tasks can be designed as instruments for data collection and analysis and as treatments in interaction research. It shows how to develop such tasks and presents data on their role in drawing learners' attention to L2 forms that are difficult to notice through classroom discussion alone. Because the tasks presented here are closed-ended, precision-oriented, and require the exchange of uniquely held information, they promote modified interaction among participants and orient students' attention to form, function, and meaning. These processes can be observed by the researcher during task implementation. Thus, the tasks reduce researcher dependence on externally applied treatments and analytical instruments not integral to the interaction itself. To illustrate this methodology in use, the article reports on a study in which six pairs of intermediate level English L2 learners carried out three types of information gap tasks in their classrooms. They first read passages on familiar topics, whose sentences contained L2 forms that were low in salience, difficult to master, but developmentally appropriate. To complete the tasks, learners were required to identify, recall, and compare the forms, their functions, and meanings. Data revealed close relationships among learners' attentional processes, their recall of form, function, and meaning, and the interactional processes that supported their efforts.

Information Gap Tasks as Research Instruments

Information gap tasks were introduced to the research context through Long (1980), to address questions on input and interaction in second language acquisition (SLA). Since that time, they have also come to serve as reliable instruments for gathering data on a variety of instructional interventions and learning processes as they arise during both learner-learner and learner-native speaker (NS) interaction. Their origins

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can be traced to the classroom, in activities that ask learners to find differences between individually-held pictures, to order sentences into stories, or to restore portions of incomplete maps and charts (e.g., Brumfit & Johnson 1979; Ur 1981, 1988). As they carry out these activities, the learners engage in functional, meaning-focused L2 use and gain access to input for their learning.

Among the most productive tasks for SLA are those in which interaction must lead to a specific goal or outcome and reaching it requires a verbal exchange of information (e.g., Ellis 2003; Pica, Kanagy, & Falodun 1993). These tasks set up conditions for participants to modify their interaction through the negotiation of meaning (Long 1980; Varonis & Gass 1985). As participants repeat and rephrase their utterances to make sure their information is accurate and understood, they also draw attention to the form in which their utterances are encoded. This can be seen in Excerpt 1, as two English language learners exchanged information about their individually-held pictures to reassemble a picture story hidden from their view. Suno followed-up by questioning Yaka's information, repeating *she*, but using *is*, rather than Yaka's original verb, *called*. Yaka incorporated *is* into his response and recoded *called* to *is calling*. The conversation then moved toward task completion.

Excerpt 1

Yaka: so I just have one more two picture. One of them she called someone
Suno: she is?
Yaka: she is calling someone
(Pica, Lincoln-Porter, Paninos, & Linnell 1996: 74)

Information gap tasks have been the focus of comparison studies on learners' negotiation, collaboration, and encoding of form, function, and meaning on different tasks and classroom groupings (e.g., Doughty & Pica 1986; Swain 1998; Swain & Lapkin 2000). In addition, they have more commonly served as instruments for data collection in studies on classroom turn taking, teacher vs. student control of interactions, and group and pair participation patterns (e.g., Doughty & Pica 1986; Pica & Doughty 1985a, 1985b). Data from these studies have revealed that the information distribution and design of such tasks plays a more influential role than interlocutor variables in these classroom processes. Information gap tasks have also been used to collect descriptive and frequency data on learner-NS generation of input, output, and feedback (e.g., Mackey 1999; Mackey, Oliver, & Leeman 2003; Oliver 2000), and to address questions on input comprehension and comprehensibility (e.g., Gass & Varonis 1985; Pica 1991; Pica, Young, & Doughty 1987).

As suggested by this overview, information gap tasks have been used in research primarily as a source of data on input, interaction, and interlanguage, or as a context for applying a treatment, such as feedback. Seldom, however, have information gap tasks themselves served as research treatments, despite evidence of their role in activating SLA processes, as was illustrated in Excerpt 1. To date, the work of Loschky and Bley-Vroman (1993) remains one of the most influential publications on treatment tasks. By following their guidelines, a task can be designed so that its successful outcome depends on the comprehension and expression of information encoded with a specific linguistic form that learners are developmentally ready to acquire but are having difficulty doing so. An information gap task, designed as an interview, would establish contexts for questions. The task could then be used cross sectionally to collect data on question development, or repeated over time, to track sequences in question formation or shed light on attentional and interactional processes for question development.

Based on an approach toward form usefulness, information gap tasks might also be designed to accommodate learners' needs to attend to characteristics that make specific linguistic forms difficult to learn. Among these are low perceptibility, infrequency of occurrence, or the limited transparency of the forms with the functions or meanings the forms encode (Harley 1993; Long 1996). This perspective is somewhat consistent with that of "focus on form," advanced by Long (1991), and continued by Long & Robinson (1998).

The versatility and robustness of information gap tasks for SLA research continues to grow. Increasingly, information gap tasks are used to focus learners' attention on form, function, and meaning, and to study their attentional processes and responses to feedback on these forms (e.g., Iwashita 2003; Leeman 2003; Mackey 1999). As evident from these studies, information gap tasks are excellent resources for addressing theoretical questions on SLA. Their pedagogical origins make them especially favorable to classroom research, especially those related to broad, theoretical issues about learning processes and outcomes (e.g., Doughty & Williams 1998).

Information Tasks in Classroom Perspectives

Controlled Conditions

Despite their origins in classroom practice, information gap tasks, when used in research, have been implemented primarily under conditions more typical of a controlled environment rather than a classroom setting. These have included monitored sessions outside the classroom (e.g., Long 1985; Pica et al. 1996; Pica et al. 1987); special researcher visits

to actual classrooms (e.g., Pica 1991); and breaks during regular class meetings (Doughty & Pica 1986). Some studies have gathered data by implementing tasks in authentic classrooms, but as an extra-curricular activity, added on to the regular classroom agenda (see Williams & Evans 1998). Data have also been collected during individual, small group, or interview sessions, controlled by the researcher, often on a short-term basis. Such practices guarantee uniform delivery of task treatments, across multiple participants, with consistent timing in task implementation. These approaches have shed light on the processes and outcomes of what is often referred to as "instructed SLA." (e.g., DeKeyser 2003; Doughty 2003)

The following sections describe three types of information gap tasks developed to serve two purposes: as research treatments that activate learners' interaction and attention toward forms whose relation to function and meaning are difficult to acquire and as research tools for the collection and analysis of data on aforementioned processes. The discussion about the three types of information gap tasks is followed by an overview of a study with the overarching research question: What does learners' interaction on tasks whose completion depends on forms with low salience, reveal about their attention to these forms? Data from the study are then presented to address the research questions and to show how the tasks served as a research method.

Task Design

Selection of Forms that Encode Function and Meaning

In keeping with guidelines set forth by Loschky and Bley-Vroman (1993), the tasks should be designed so that the information gap requires a specific form which is essential for, or at least useful to, task completion. For example, if learners needed to obtain directions to a location and had to exchange information to do so, the content to fill their information gap would be phrases encoded with prepositions of place.

It is also necessary to choose forms that the learners are developmentally ready to begin learning or are on their way to mastering, but doing so with little progress. The principles of Harley (1993) and Long (1996), noted above, provide a framework for form selection. In keeping with their principles, good candidates would be forms that are difficult for learners to perceive in their input or are lacking in transparency in their function or meaning. For a locations task, these could include pronouns, articles, and determiners for reference to place names, and modal verbs for suggesting direct and alternative routes.

Creating Conditions for Modified Interaction and Attention

Three types of information gap tasks appear to be especially well suited to serve as research treatments and instruments in creating conditions for SLA. As such, the Jigsaw (e.g., Doughty & Pica 1986; Swain & Lapkin 2000), Spot the Difference (e.g., Long 1980, 1981), and Grammar Communication tasks (e.g., Fotos & Ellis 1991; Loschky & Bley-Vroman 1993) have been shown to promote interaction and attentional processes among learners. These tasks were therefore used as a basis for those that are shown below.

The tasks shown below share a similar organizational structure and goal requirement, as learners proceed through the same steps to reach the goals of task reconstruction and text comparison. This consistency extends both within and across the task types, as their implementation creates conditions for learners, working in pairs, to modify their interaction and attend to form, function, and meaning. The relationship between task steps and attention and interactional processes is displayed in Table 1.

Table 1
Attentional and Interactional Processes across Task Step

Task Step	Step 1. Read original passage	Step 2. Read Version A or B of original passage	Step 3. Choose between sentences/ among phrases in Versions A and B. Justify choices	Step 4. Recall choices from Step 3 and insert in close version of original passage	Step 5. Compare choices with original passage/ identify differences
Attentional Processes	NA	NA	Notice forms with low salience as they encode function, meaning Notice differences between forms as they encode function, meaning Become aware of form, function, meaning relationships	Recall form from working memory Notice the gap between forms chosen and forms in original passage with respect to accuracy, appropriateness	Notice the gap between needed and unneeded forms
Interactional Processes	<<<<<Modified Interaction, Negative Feedback>>>>>				

As shown in Table 1, the learners proceed through the following steps, each located on a separate page with instructions not to turn back. (1) They read a passage based on any of the following sources: a previously read text, a prior discussion, a meaningful experience from an earlier session. (2) They each read a slightly different version of the passage without revealing their respective versions to each other. Each of the sentences in the two versions has a phrase in which a form with low salience from the original passage appears identically, in a different order, or with a slightly different encoding. (3) They choose between the phrases or between the sentences that contain the phrases and justify their choices. (4) Without looking back at their choices or the passages they have read, they work together to write their choices in a single cloze version of the original passage. (5) They re-read the original passage, compare it with their cloze version, identify any discrepancies, and pose explanations for them. Learners' participation in all five steps can activate their attentional processes for SLA. However, their participation in Steps 3-5 is especially well suited to providing spoken and written data in which these processes can be identified.

Many of these attentional processes were introduced to the field of SLA by Gass (1997); Leow (1997); Robinson (1995); Schmidt (1993); and Tomlin & Villa (1994); through the construct of noticing, a process which has been sustained, expanded, and further defined through their research and writing to date. Tomlin and Villa (1994) proposed a model of attention that included components of alertness, orientation, and detection as they pertained to the learner's access to SLA data. Alertness referred to learners' readiness to select incoming data for further processing. Their orientation directed them to particular parts of the data, and detection, referred to by others as noticing (e.g., Robinson 1995), registered the data in short-term memory, thereby making it available for higher levels of processing, such as hypothesis formation and testing (Tomlin & Villa 1994: 193).

This view of noticing was expanded by Robinson (1995), who situated noticing in the process of awareness, through which learners encoded and retrieved L2 data for use during task related interaction (301). Leow (1997) also addressed noticing in this way, defining it as the learner's awareness of new forms as they encoded L2 data. According to these researchers, then, noticing plays a crucial role in holding on to L2 data in the short term and making the data available for further processing over the long term, while awareness reflects a deeper understanding of form, function, and meaning of L2 data.

These perspectives on noticing and awareness are shared by Gass (1997) and Schmidt (1993, 2001), who also look to noticing in forming a link between the processing of incoming L2 data and its conversion first into input and later into intake. By extension, noticing enables learners to recognize input deviations from L2 norms or input differences with their

current interlanguage repertoire. These occurrences, which constitute noticing the gap, (See also Schmidt & Frota 1986) can lead learners to restructure their current interlanguage system. Gass further proposes apperception as an initial step that precedes noticing. Before learners notice the gap between the L2 data and their knowledge and production capability, they must first perceive and then relate the L2 data to their existing knowledge.

The importance placed on noticing and awareness has guided the design of the current tasks as well as analysis of the interaction data from their implementation. The different ways in which the tasks can draw learners' attention to the forms that encode word, phrase, and sentence function and meaning have led to further distinctions among noticing an individual form, noticing a difference between forms, noticing a discrepancy between a deviant form and its L2 counterpart, and noticing the relationship between a form and its function or meaning.

Thus, in Task Step 3, the need to locate, compare, and then choose between phrases and sentences sets up conditions for noticing a form as an item unto itself as well as for noticing differences among the forms that encode function and meaning in the phrases and sentences. These experiences are consistent with the views on noticing described above. Learners might mention a form during their reading of the task passages and their choosing between passage sentences and phrases as a way to alert each other that they have identified the form, as an early step toward task completion.

Learners' noticing of form has been signaled in various ways, for example, by underlining the target form in a passage (Izumi & Bigelow 2000), including the form in a text reconstruction activity (Izumi 2002), and referring to the target form in a learning journal (McDonough 2005) or during think-aloud verbal reports (Rosa & O'Neill 1999). However, because the current tasks require the learners' interaction, they provide an opportunity to study the learners' noticing of form and form differences through their own verbalizations. The tasks also allow for the possibility that learners will notice the gap in the accuracy and appropriateness of the sentences they choose and those they reject. The ability of language learners to notice this gap has been investigated in the literature on recasts and includes the learners' ability to correctly identify the source of error prompting the recasts (Mackey, Gass, & McDonough 2000) and their accuracy in immediate recall of recasts (Philp 2003). As a result of the tasks' emphasis on interaction, as the learners deliberate over and justify their choices, they might also modify their interaction to explain and clarify their arguments and use negative feedback, such as correction and recasting, for what they believe are each other's incorrect choices. Such verbal behavior encourages further noticing of the perceptual features of a particular form and builds awareness of its relation to function and meaning that contributes to the internalization process. This notic-

ing of form function or meaning is related to Rosa and O'Neill's (1999) awareness at the level of understanding, defined as the learners' articulation of rules governing a targeted structure during think-aloud verbal reports. Thus, as the learners notice the gap between correct and incorrect form uses and indicate awareness of form in relation to function and meaning, they demonstrate further processing of the form and a readiness for its recall in the next task step.

In Step 4, as the learners recall and write their choices in a single cloze version of the original passage, they are given opportunities for modified interaction and negative feedback, since mutual comprehension and agreement are necessary. With respect to attention, this phase of the task encourages the learners to recall or retrieve their earlier choices, an experience that researchers have claimed reveals further evidence for the different kinds of noticing, noted above. This is reminiscent of Robinson (2003), who determines what is noticed in terms of what the learner is able to verbally report.

Step 5, with its emphasis on comparison and explanation, provides a context for conditions such as those of Step 3. However, the conditions are contingent on the degree of consistency between the learners' earlier decisions about the phrases and sentences in Steps 3 and 4 and the text of the original passage. If they are able to achieve a complete match, there is no need for them to do much more than acknowledge this step and conclude the task. Should discrepancies exist, the need to identify and explain them could activate interactional processes as well as attentional ones, particularly those relating to their noticing the gap.

The four sample tasks below are based on a review of the film, *Philadelphia* (Renshaw 1994). Figure 1 shows a brief passage from a longer text to be given to learners following film viewing and discussion. The passage contains numerous contexts for low salience noun and verb forms, their functions, and meanings. There is seldom a need to enrich such meaningful passages with low salience forms, as contexts for them are abundant. However, the passages can be modified occasionally to streamline sentence complexity, reduce paragraph length or eliminate allusions to experiences and concepts unfamiliar to learners and teachers.

Task directions begin with a purpose statement. For the first sample

Figure 1
Passage Excerpt based on Renshaw's (1994) review of *Philadelphia* (Demme 1993)

"Philadelphia" opens strongly with an effective collection of city scenes. We see Andrew as a typical workaholic attorney, already living with HIV as part of his life. HIV from the outset is simply one element in Andrew's life, but not the defining element. Joe Miller is equally well-established, both at work and at home. Nevertheless, he recognizes the social similarities between being a black man and being a person with AIDS.

task, Spot the Difference, the statement tells the learners that they will become more accurate and precise in their speaking and writing in areas, such as organizing, reporting, reviewing, and editing information.

Figure 1a displays the slightly different versions given to the learners. Sentence 1 is the same as it appeared in the original passage. Differences begin with Sentence 2, as highlighted. Figure 1a illustrates the version for articles and determiners. (Please see Appendix A for models of the same passage modified for pronouns and connectors as well as for verb and modal morphology.) Differences are highlighted for each passage. There are no truly ungrammatical phrases used in either version, i.e., formations such as *a books* or *wented*, but rather formations inconsistent with passage meaning or with the original passage the learners read.

The cloze version of Figure 1a is shown in Figure 1b.

Figure 1a
Spot the Difference Passage Versions for Articles and Determiners[2]

Version to Student A	Version to Student B
"Philadelphia" opens strongly with an effective collection of city scenes. 2. We see Andrew as a typical workaholic attorney, already living with HIV as part of his life. 3. HIV from the outset is simply one element in Andrew's life, but not a defining element. 4. Joe Miller is equally well-established, both at work and at this home. 5. Nevertheless, he recognizes social similarities between being a black man and being a person with AIDS.	"Philadelphia" opens strongly with an effective collection of city scenes. 2. We see Andrew as one typical workaholic attorney, already living with HIV as part of his life. 3. HIV from the outset is simply one element in Andrew's life, but not the defining element. 4. Joe Miller is equally well-established, both at work and at home. 5. Nevertheless, he recognizes the social similarities between being a black man and being a person with AIDS.

Figure 1b
Spot the Difference Passage Versions for Articles and Determiners

"Philadelphia" opens strongly with an effective collection of city scenes. 2. We see Andrew as _____, already living with HIV as part of his life. 3. HIV from the outset is simply one element in Andrew's life, but not _____. 4. Joe Miller is equally well-established, both at work and at _____. 5. Nevertheless, he recognizes _____ between being a black man and being a person with AIDS.

Figure 1c displays the original Figure 1 passage again, with lines under the words and phrases whose articles and determiners had made the original passage more accurate and precise. A list of numbers follows

[2] Differences are highlighted in the passages above for the sake of illustration. However, these forms were not highlighted or in any way marked in the versions given to students.

for learners to write down any differences that they find between these underlined items and their cloze answers.

Figure 1c
Original Passage with Articles and Determiner Phrases Underlined

"Philadelphia" opens strongly with an effective collection of city scenes. 2. We see Andrew as a typical workaholic attorney, already living with HIV as part of his life. 3. HIV from the outset is simply one element in Andrew's life, but not the defining element. 4. Joe Miller is equally well-established, both at work and at home. 5. Nevertheless, he recognizes the social similarities between being a black man and being a person with AIDS.

Both the Jigsaw and Grammar Communication tasks ask learners to follow a set of directions very similar to those of Spot the Difference. Learners must choose between phrases that contain the forms they need to learn, justify their choices, recall them in a cloze activity, then compare their cloze version with the original passage and explain any differences that they find. To maintain authenticity, the purpose statement given for the Jigsaw task tells the learners that the task will help them organize information; for the Grammar Communication task, they are told that they will be helped to report information accurately.

Versions A and B of a sample of Jigsaw and Grammar Communication task are shown in Appendix B. In the Jigsaw task, the learners are asked to carry out the choosing step in two parts. First they are to choose the order of individual sentences as they appeared in the original passage, and then to choose between their sentences, much as they did for Spot the Difference. These two components of choosing are designed to activate slightly different attentional processes. When choosing sentence order, the learner's noticing of forms and form differences and gaps is incidental to the choice; in choosing between different sentences, such noticing is implicit, but nonetheless more directly related to the choice. As in Spot the Difference, the sentences for each version differ slightly in their articles and determiners. In the Grammar Communication task, learners again follow directions that are nearly identical with those of Spot the Difference. They choose among phrases that contain specific forms or features and apply them to their cloze reconstruction of the review passage.

Developing Tools for Data Collection

In designing the tasks as research instruments on interaction in SLA, care must be given to ensure that a large amount of data can be collected and that the data will be a valid representation of learners' interaction and attention to the relationships of form, function, and meaning that need to be further developed. The materials, their directions and maintenance need to satisfy researchers' goals for both immediate data collection and eventual application to SLA theory. If they are to be used longitudinally in a classroom environment, directions need to be straight-

forward to allow students to carry them out without continuous involvement of their teacher. Teacher and researcher involvement in the designing, piloting, and revising of the tasks as well as the writing of the directions is essential to the success of this effort. Consistency across task directions is important if the data are to be pooled in an amount that is sufficient for later analysis.

Having access to the different task types ensure that the learners can work on all categories of form, function, and meaning, and provides researchers with ample data for analysis. In a given week, learners can engage in a meaning-focused activity, such as a discussion, during their first session, and then spend the following days reading a text passage based on the discussion and completing its companion Spot the Difference task, then reading and discussing a different passage and completing its companion Jigsaw or Grammar Communication task.

Because learners often tend to work independently, it is important to gather data that represent their interaction and attention even while they work alone. The tasks do this in several ways. First, learners are not allowed to show each other their passage versions, so oral interaction is ensured as they make their choices and justify their answers. Secondly, they are asked to share the same page to complete the cloze step of the task, again ensuring against parallel, private work. Finally, they are asked to write their responses to the cloze and to their identification of differences between their choices and those of the original passage. Although this precaution limits the speaking requirement, the written responses provide a record for further analysis.

Instrument for Data Analysis

If a task is designed to activate attention to form, function, and meaning and require spoken and written interaction throughout its implementation, it can yield a rich source of data for analysis of the relationship of attentional and interactional processes, as they bear on SLA. Such data also eliminate or greatly reduce the need to rely on follow-up interviews or introspective data for insight into attentional processes.

Operationalization of attentional processes is necessary in accounting for the data. Noticing, for example, can be operationalized in several ways.

* Simple *noticing of form* is characterized by learners' segmentation of a targeted form in isolation or in the word or phrase in which it appears in a passage.

* To be categorized as *noticing the difference*, learners must segment, or extract, both their own and each other's form.

* For *noticing the gap*, they must offer a positive or negative value judgment about their own or each other's form, phrase, or sentence, or between these latter and their counterpart in the original passage, indicating, for example, that one item is "wrong," or another is "better." This evaluation feature is necessary because, as learners who produce interlanguage talk, they are not likely to provide a fully target-like version of the form, phrase, or sentence that they have identified as the more accurate one.

* *Noticing form, function, and meaning relationships*, characteristic of awareness, is operationalized through learners' references to these relationships, either in themselves or with respect to a meaning-focused experience, such as an earlier discussion.

* *Recall* is characterized in terms of oral and/or written responses to the cloze passage, and utterances with metalanguage that refer to memory processes, such as, "I remember that…" To be coded as recall, the utterance must be made when the passages in which the forms had appeared are not accessible. Thus, the cloze step is the most valid of all the steps with respect to this attentional process. Recall can be encoded with respect to the form, function, and meaning of a targeted item, or form or function/meaning only. These distinctions should be noted when analyzing the data.

It is also important to operationally define those interactional processes that relate to SLA, including interaction modified through negotiation and responses of adjusted output. Among them would be simple signals, as well as signal and response utterances that syntacticize or semantically adjust previous utterances carrying the forms on which the learners needed to focus their attention. Also important are explicit correction and recasting. This latter can occur as a result of one pair member's simply reading an alternate version of a sentence in a passage, which happened fortuitously to follow the other member's erroneous one. Pair-generated recasting can occur during any of the task steps, as one pair member recodes the other's non-target use of a form with low salience while maintaining utterance meaning.

As was illustrated in Table 1, interactional processes that relate to targeted forms can occur throughout task implementation. Attentional processes can be activated throughout the tasks, though noticing is more likely to occur in Step (3), as learners choose between answers. Similarly, awareness of form, function, and meaning connections is more likely to arise as the learners are justifying their choices in Step (3). However, it

can also occur as they recall their choices during cloze passage completion in Step (4). Although not fully tested under multiple conditions for SLA, this model of task-based interaction and attention allows for initial description and analysis of data gathered from task implementation, and it is to a small-scale, descriptive study of implementation that we now turn.

Task Implementation: A Study of Interaction and Attention to Form in a Meaning-Focused Classroom

This section summarizes a study addressing learners' need to attend to forms with low salience in their meaning-focused classrooms. It aims to provide a description of the ways in which their interaction on tasks based on their classroom texts might meet these attentional needs. Thus, the study offered a way to address broad issues on attention to relationships of form, function, and meaning in SLA, and to test the tasks as research treatments and instruments for data collection and analysis.

There was one overarching question: What does learners' interaction on tasks that require them to use forms with low salience reveal about their attention to these forms?

This was followed by three research questions: (a) How does learners' task implementation assist their attention to these forms? Which attentional processes are assisted? (b) How does their task implementation promote modified interaction for SLA? Which interactional processes are promoted? (c) Is there a relationship between these attentional and interactional features? Also of interest was whether there were differences among the tasks in the extent to which their implementation drew attention to the forms, their functions and meanings.

Method

Participants

The participants were twelve adult, intermediate-level learners of English with L1 backgrounds of Korean, Mandarin, and Taiwanese, enrolled in a short-term intensive course, English through Film, in which information gap tasks were a crucial component. These ten female and two male participants had at least six years of prior formal instruction in English and an average residence in the U.S. of four years.

Semi-structured interviews and e-mail exchanges were used to elicit the specific low-salience forms that had been observed to give the learners trouble during classroom interaction and which were targeted by the information-gap tasks. As illustrated in the task examples in Figures 1a-1c, these were articles, determiners, pronouns, connectors, modal verbs, and verb inflections.

The learners' omissions, substitutions, and inconsistencies in their use of the forms during the interviews and in the e-mails established that they had some degree of control over the forms, which were emerging in their interlanguage with varying degrees of accuracy.

Their intermediate proficiency, together with their history of L2 instruction and exposure, also served as preliminary indicators of developmental readiness to advance in acquisition of these forms. Since the present study was focused on questions as to attention and interaction for SLA, the participants appeared to be suitable. Follow-up studies on questions regarding their development and acquisition of target-like features would require much more documentation of participants' readiness and motivation.

Procedure

The study took place over five days. Data were collected during the task-based portion on the last three days of instruction. On Days 1 and 2, participants and their teacher watched *Philadelphia* and engaged in comprehension exercises and discussed characters, story line, and theme. Medical and legal terminology was defined and explained as an aid to film comprehension. At no point during the study or course were participants given instruction on the low-salience forms targeted by the tasks.

Prior to the first information-gap task, the twelve learners were randomly organized into pairs, which remained intact for the study. Following initial instructions by the teacher, the pairs carried out each of the three information-gap tasks: the Grammar Communication on Day 3, the Spot the Difference on Day 4 and the Jigsaw on Day 5. In order to avoid disrupting the flow of interaction during the tasks, the teacher intervened only when learners solicited clarification or support. All interaction was tape recorded and later transcribed. The pairs also wrote their answers to the cloze step of each task. These answers provided data as to whether the learners were able to recall the items they had read and then chosen during Steps 1-3.

Tasks

Each of three different task types was created using passages taken from three different reviews (Brenner n.d.; Ellis n.d.; Hicks 1994) of the movie *Philadelphia* (Demme 1993). All review passages already contained numerous examples of the targeted low-salience forms. As a result, they needed only minor modification, mainly to ensure uniformity of length (13 sentences). Three versions of each passage were created to accommodate the three different form categories: one for articles and determiners, another for pronouns and connectors, and another for verb features.

Data were gathered on one version of each task-type. This range allowed the researchers to study task implementation and classroom compatibility and to track attentional and interactional processes associ-

ated with low-salience features across the tasks. Thus, for example, on Day 3, all six pairs read the same passage for the Grammar Communication task, but pairs 1 and 2 completed the version whose passages had been modified for articles and determiners, pairs 3 and 4 completed the version modified for pronouns and connectors, and pairs 5 and 6 completed the version modified for verb endings and modals.

Figure 2
Task Implementation Matrix

<table>
<tr><th></th><th>Days 1-2</th><th>Day 3 Grammar Communication Task</th><th>Day 4 Spot the Difference Task</th><th>Day 5 Jigsaw Task</th></tr>
<tr><td>Pair 1</td><td rowspan="6">Watch film; read reviews; discuss</td><td rowspan="2">Articles, Determiners</td><td rowspan="2">Verb Morphology, Modals</td><td rowspan="2">Pronouns, Connectors</td></tr>
<tr><td>Pair 2</td></tr>
<tr><td>Pair 3</td><td rowspan="2">Pronouns, Connectors</td><td>Pronouns, Connectors[3]</td><td rowspan="2">Verb Morphology, Modals</td></tr>
<tr><td>Pair 4</td><td>Verb Morphology, Modals[3]</td></tr>
<tr><td>Pair 5</td><td rowspan="2">Verb Morphology, Modals</td><td rowspan="2">Pronouns, Connectors</td><td rowspan="2">Articles, Determiners</td></tr>
<tr><td>Pair 6</td></tr>
</table>

Results and Discussion

Jigsaw, Spot the Difference, and Grammar Communication task findings for all paired participants are shown in Table 2, which appears in the Appendix. There are three columns under Task Steps 3-5. Columns 1 and 2 provide frequencies and percentages of the sentence or phrase decisions the pairs made for that step. Since the six pairs needed to make decisions in choosing, recalling, and comparing the form of twelve sentences on their task passages, the base number used for determining the percentage scores for each step was 72 for the Jigsaw and Grammar Communication sentences. Because only five of the pairs recorded their Spot the Difference implementation, their number of decisions was 60. Column 3 under each step provides the distribution of the attentional or interac-

[3] A printing error on the articles and determiners version of the Spot the Difference Task resulted in a last minute substitution.

tional process across its respective step. These percentage figures are also displayed in Figures 5, 6, and 7. The data were coded by the researchers for these attentional and interactional features. Inter-rater reliability was .95 for attentional features, .91 for interactional features, and .99 for recall scoring. Steps 1 and 2, which involved silent reading, did not allow for collection, coding or analysis of attentional or interactional data.

The first research question asked about the ways in which the learners' task implementation assisted their attention to forms with low salience. First, as revealed in Table 2 and displayed in Figure 3, each task engaged the pairs in the three noticing processes that comprised Total Noticing. As shown in the Totals column, there were 116, 128, and 108 decisions involving the passage sentences and phrases in which the forms were noticed for the Jigsaw, Spot the Difference, and Grammar Communication tasks, respectively. This reflects the fact that making a decision in choosing, recalling, or comparing sentences often featured two or more noticing processes. As Figure 3 displays, noticing was especially prominent during Step 3, the 'choose' step. As revealed in Column 3 of Step 3, 85 percent of two of the pairs' Total Noticing occurred during this step for the Jigsaw task, 96 percent for the Spot the Difference, and 92 percent for the Grammar Communication tasks. These multiple applications of noticing suggested that for these learners, noticing consisted of orientations that ranged from simple perception to more articulated identification of differences and evaluations of accuracy.

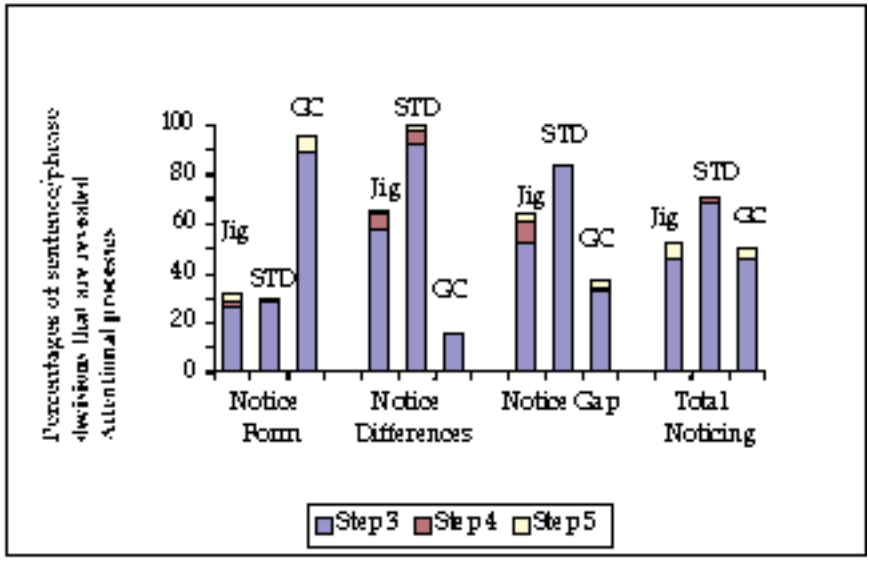
The consistency across percentages for Step 3 was offset somewhat by distributional differences in attentional processes. These differences are illustrated in Figure 3. During the Jigsaw task, 58 percent of the sentences were noticed with respect to their differences and 53 percent were noticed for their gaps. These percentages, at 93 and 83 percent, were also high on the Spot the Difference task. Noticing figures during Step 3 were much lower for the Grammar Communication task, as the pairs displayed noticing of differences for only 15 percent of their sentences, and noticing the gap for 33 percent. On the other hand, simple noticing, displayed as the pairs dealt with 89 percent of the sentences, was much more apparent.

Differences in the distribution of noticing in the Grammar Communication task compared to the Jigsaw and Spot the Difference tasks may have been related to the number and format of their options for choosing. During the Grammar Communication task, pair members had four phrases from which to choose. They tended to present each other with their phrases and announce their decisions. In the Jigsaw and Spot the Difference tasks, the pair members had to choose between two sentences. This set up a basis for comparison and evaluation.

All six pairs revealed awareness of the forms, their functions, and meanings during at least one of the steps. They made 12 sentence decisions in which they revealed awareness during the choose step on their

Jigsaw task. This constituted 60 percent of the pairs' awareness that was distributed across steps 3-5. Awareness constituted 35 percent of the recall step and was revealed as the pairs deliberated over the items that they had chosen. However, it was negligible during the comparison step. This pattern of awareness was consistent across the Spot the Difference task as well, distributed as 45 percent of the choose step, 40 percent of the recall step, and 5 percent of the comparison step. For the Grammar Communication task, awareness was revealed primarily during the choose step, as the pairs commented on relationships of form, function, and meaning for 32 percent of their sentences decisions. However, it was negligible during the recall and comparison steps.

Figure 3
Distributions of Attentional Processes across Task Steps

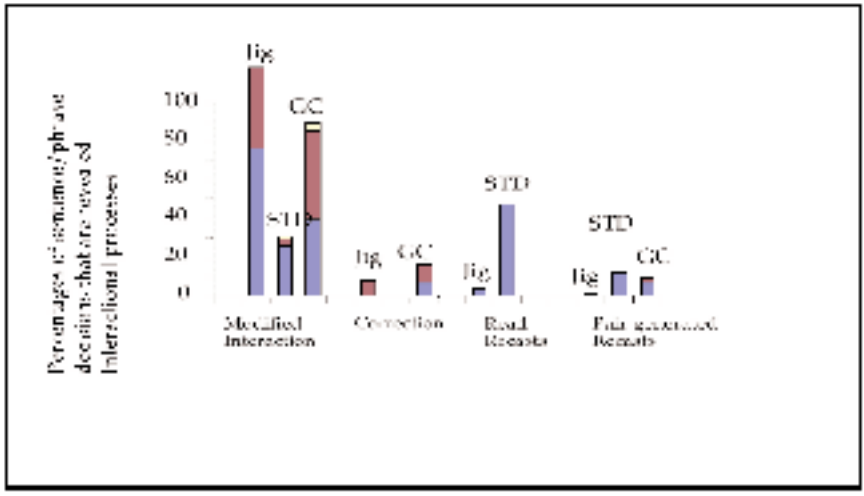


Across the tasks, all pairs were able to recall phrases with the targeted forms from the passages they had read in Steps 1 and 2, and chosen in Step 3. This was revealed during their spoken decisions and written responses to the cloze passage of Step 4. On the Jigsaw and Spot the Difference tasks, the pairs were able to recall 89 and 97 percent of their phrases with non-salient forms. For the Grammar Communication task, this figure was 82 percent. There was a strong relationship between noticing a form as encoded in the passages of Step 3 and recalling it while completing cloze version of these passages of Step 4. Thus, of the 64 phrases that were recalled during the cloze of the Jigsaw task, 81 percent had been noticed during Step 3. These figures were 95 percent for the phrases recalled for Spot the Difference and 81 percent for those of Grammar Communication. Although some of the noticed forms were not

recalled, their frequencies were much lower than those that were recalled. Thus, on the Jigsaw task, seven of the forms that had been noticed in Step3 were not recalled in Step 4. This accounted for only 8 percent of the noticed forms, however. Similar patterns were found for the Spot the Difference task. Only two of the forms that had been noticed in Step 3 were not recalled in Step 4. This figure was somewhat higher for the Grammar Communication task, as 13 or 18 percent of the noticed forms were not recalled in Step 4.

The second research question asked about the ways in which task implementation promoted interactional processes that have been shown to assist SLA. Findings are displayed in Figure 4 and in Table 2. During the Jigsaw task, all six pairs often modified their interaction through negotiation signals and responses of modified output, doing so as they made 76 percent of their decisions during the choose step and as they recalled 42 percent of them during the cloze step. Modified interaction occurred throughout the steps of the Grammar Communication task as well. However, there was less overall modified interaction than in the Jigsaw task, and slightly more modified interaction during the recall step than during the choose step. These figures were 39 and 46 percent, respectively.

Figure 4
Distributions of Interactional Processes across Task Steps



These differences in the choose step appeared related to its different demands. The fill-in format in each sentence and the four phrase options of the Grammar Communication task may have enabled the pairs to hone in on a preferred form. The pairs were not required to either reorder sentences or hunt down subtle differences between the two versions of each

sentence, as they were asked to do in the Jigsaw task. A further reason for this difference in interactional processes is that the Jigsaw task gave the pairs two ways to choose. They were asked to choose the order of their sentences and, after that, to choose the sentence they thought was better. However, as the pairs chose their order, they would often stop and choose between the two versions, reminding each other that this step was to be taken after the ordering, but nonetheless pausing to choose between the versions. Their modified interaction is shown below in Excerpt 2 between a Learner 1, a native speaker of Chinese, and Learner 2, a native speaker of Korean:

Excerpt 2

Learner 1: Uh. The sentence four. Charles Wheeler, the firm, firm's senior partner assigns Andrew a case that involves their most important client.
Learner 2: Yeah. I think that. But my sentence is, Charles Wheeler, the firm's senior partner assigns Andrew a case that must involve. I think must should be omitted. Must. Not must involve.
Learner 1: *Must?* (Syntactically Modified Negotiation Signal)
Learner 2: Yeah, must. My sentence is must involve, but I don't think so. (Notice the Gap/Syntactically Modified Response)
Learner 1: Yeah
Learner 2: Just involve. (Notice Form/Syntactically Modified Negotiation Signal)
Learner 1: Yeah

During the Spot the Difference task, the pairs engaged in modified interaction for 25 percent of their sentences during their choose step, but only 4 percent during the recall step. On the other hand, it was during this step that they recast 28, or 47 percent, of their sentence choices as they read their passage versions to each other, and yet another 7 of their sentence choices in pair-generated responses. There was minimal recasting by the pairs on the two other tasks. The emphasis on recasting in Spot the Difference might have been task specific. The layout of the sentences during its Step 3 was a paragraph, whereas on the Jigsaw task, the sentences were listed in a scrambled order, and in the Grammar Communication task, they were interrupted by blank lines with choices beneath. The paragraph format may have lent itself more to reading as a way for the pairs to keep track of their choices, or by association with the passage reading they had just completed for Steps 1 and 2.

Correction, although low in frequency, was provided by all six pairs during only two steps of the task, and mainly during the recall step. The

low amount of correction might have been related to an absence of truly ungrammatical phrases in either of their versions. Formations such as a books or wented were not used to encode erroneous phrases, but rather, forms that were inconsistent with passage meaning or with the original passage the learners had read.

The third research question asked about attentional and interactional relationships. As has been noted throughout the previous findings, most of the attentional and interactional activity occurred during the choose step. Although noticing processes, modified interaction, and recasting differed in their distribution, there was a strong relationship between noticing forms with low salience and interactional processes claimed to assist SLA on this step. The correlation was .62. Despite the overall correlation across the three tasks, relationships between noticing and interaction were more prominent during the Jigsaw and Spot the Difference tasks. Thus of the 72 sentence choices that the pairs made for Jigsaw, 81 percent of those that revealed simple noticing, or noticing of differences or gaps were encoded in negotiation signals, modified responses, corrections, or recasts. These figures constituted 82 percent of the 60 choosing decisions for the Spot the Difference task

However, these noticing and interactional processes were revealed together in only 45 percent of the 72 decisions for the Grammar Communication task. This might have been yet another reflection of task format, as the straightforward, familiar, fill-in-the-blank layout of the task drew the pairs toward noticing the phrases placed below each blank. This might also have reduced their need to modify their interaction toward mutual understanding. In addition, task sequence might have contributed to this pattern. Grammar Communication was the first of the three tasks in which the pairs engaged. It is possible that they might not have anticipated the precision that the subsequent cloze step required.

These noticing through interaction connections appeared to assist the pairs' accurate recall of phrases from the choose step. Thus, 74 percent of the phrases recalled for the Jigsaw and 80 percent of those for the Spot the Difference tasks had been both noticed and encoded in an interactional process during the preceding choose step. On the other hand, only 35 percent of the recalled Grammar Communication choices had been noticed and encoded in this way. Of particular note was the finding that those choices made within the context of recasts, which predominated the Spot the Difference task, were recalled more accurately than those that were accompanied by modified interaction (the dominant mode of the Jigsaw task), and that both interactional processes were connected with high recall percentage scores. Thus, scores of 89 percent on the Jigsaw and 97 percent on the Spot the Difference tasks suggest that the pairs applied interaction moves judiciously as needed during their task implementation.

The pairs' success with recall for the Grammar Communication task appeared to rely on simple noticing of forms in phases, attesting again to the relative simplicity of the task layout and presentation of phrase options. The other two tasks activated a greater frequency and variety of interactional and attentional processes. Not only did the pairs achieve higher recall scores, but they had more opportunities to notice crucial perceptual differences on the low salience forms with which they clearly needed help.

Concluding Comments

The success of information gap tasks as classroom activities and research instruments has been well established by their long-standing presence in professional references, textbooks, and SLA research. The findings of this descriptive study suggest additional roles for these tasks. As the study revealed, the tasks can offer a classroom-based methodology for the study of attention and interaction in SLA. As instructional treatments that can help learners acquire and use low salience L2 forms which have shown little development over time, they allow for the study of long term SLA as well. Observations of the discussions and lessons, the two formats that typified meaning-focused classrooms, revealed that students' omissions and misapplications of such forms were seldom acknowledged by their teachers, or noted by the students themselves (e.g., Pica 2002). Notably missing were activities that would draw attention to these forms but preserve the overall focus of the content curriculum. Since information gap tasks had already been shown to promote attention to message form in the interest of achieving precision in message exchange and goal attainment, we believed they would be good candidates for form focus. Our resultant of the research employing Jigsaw, Spot the Difference and Grammar Communication tasks, though somewhat different in their goals, nevertheless shared attention-promoting features. They could be adjusted to target the forms that the students needed, activate interaction and correction, and provide authenticity and variety to classrooms.

These connections across task, attention and interaction in relation to L2 form, function, and meaning are represented in the excerpts below. As shown in Figures 5 and 6, a pair of learners engaged in modified interaction to choose, recall, and compare the forms that encoded the meaning of sentences in their texts. At the same time, the pairs revealed processes of noticing the form in itself and in comparison with its counterpart. Discussion of their choices revealed awareness of the functions of the forms and the meanings encoded.

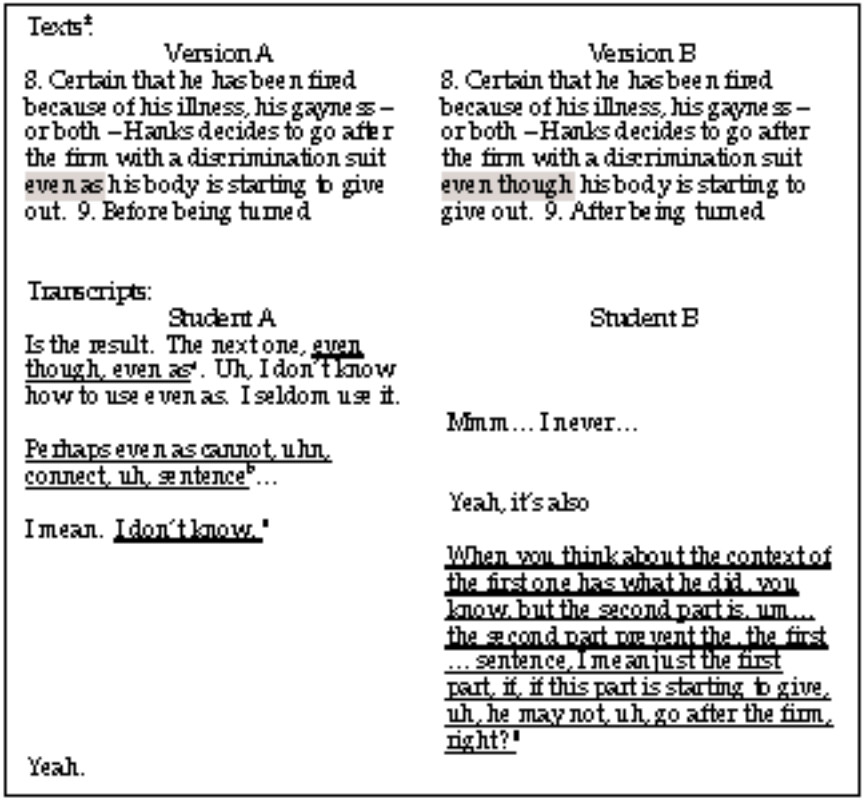
When asked to locate differences and choose between sentences, the learners did so by extracting phrases and often referred to them in ways that suggested noticing and awareness of form, function, and meaning.

These processes are revealed in Figure 5

Attentional processes of recall were also exhibited, almost exclusively during the cloze portion of the tasks. In Figure 6, the pair worked together to remember the item they had chosen earlier, as documented in Figure 5.

Beyond these more obvious contributions, the tasks appear to have unanticipated methodological implications. Task design features make it possible for researchers to identify attentional processes directly, through observing and recording learners' talk and action. Data from the learners' verbalized decision making offer an enhancement to introspective inter-

Figure 5
Step 3: Choose between Sentences/among Phrases in Version A and B and Justify Choices



[4] The targeted forms are highlighted here for the purpose of illustration but were not marked in any way on the learners' versions.

[a] Noticing the difference.

[b] Awareness of form and function relationship.

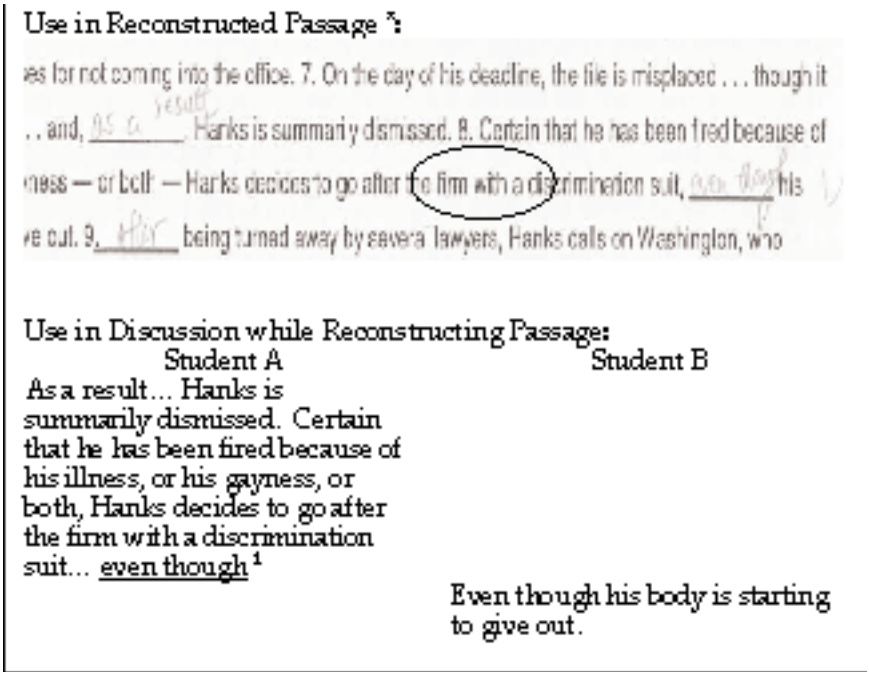
[c] Negotiation signal.

[d] Modified interaction.

views and protocols often used to collect data on the interface of cognition and interaction in L2 learning.

The written cloze component to Step 4, in which learners are asked to recall as well as write phrases from the passage sentences they have compared and chosen, provides record of their attentional processes. This step documents what the learners recalled, if indeed they failed to verbalize or discuss their decisions and judgments about form, function, and

Figure 6
Step 4: Recall Choices from Step 3 and Insert in Cloze Version of Original Passage



meaning.

Although the tasks and their procedures do not prohibit the kinds of introspective protocol analyses or exit interviews appropriate for a controlled situation, the more relaxed format of texts, tapes, and cloze passages offer the classroom authenticity needed to sustain teacher and learner participation in long term studies. Such studies are sorely lacking, but very much needed, if the field of SLA is to successfully address questions on the acquisition of forms that defy the learner's mastery in the short term.

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[5] The form the students used to complete the cloze is circled here for the purpose of illustration. It was not marked in any way on the students' versions.

[e] Recall form during completion of cloze.

Because the tasks are consistent with daily classroom activities, and supportive of the subject content curriculum, they bring one additional, methodological bonus. They are especially helpful for classroom SLA research that requires the long term group or cohort data that classrooms are able to provide. The successful implementation and incorporation of the present tasks in the classrooms for which they have been designed has been one of the most promising findings of our project.

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Appendix A

Figure A1
Spot the Difference Passage Versions for Pronouns and Connector*

Version to Student A	Version to Student B
"Philadelphia" opens strongly with an effective collection of city scenes. 2. We see Andrew as a typical workaholic attorney, already living with HIV as part of life. 3. HIV from the outset is simply one element in Andrew's life, but not the defining element. 4. Joe Miller is equally well-established, both at work and at home. 5. As a result, he recognizes the social similarities between being a black man and being a person with AIDS.	"Philadelphia" opens strongly with an effective collection of city scenes. 2. We see Andrew as a typical workaholic attorney, already living with HIV as part of his life. 3. HIV from the outset is simply one element in Andrew's life, and not the defining element. 4. Joe Miller is equally well-established, both at work or at home. 5. Nevertheless, he recognizes the social similarities between being a black man and being a person with AIDS.

* Differences are highlighted in the passages above for the sake of illustration. However, these forms were not highlighted or in any way marked in the versions given to students.

Figure A2
Spot the Difference Passage Versions for Verb and Modal Morphology

Version to Student A	Version to Student B
"Philadelphia" opens strongly with an effective collection of city scenes. 2. We see Andrew as a typical workaholic attorney, already living with HIV as part of his life. 3. HIV from the outset must be simply one element in Andrew's life, but not the defining element. 4. Joe Miller is equally well-established, both at work and at home. 5. Nevertheless, he recognizes the social similarities between being a black man and being a person with AIDS.	"Philadelphia" opens strongly with an effective collection of city scenes. 2. We saw Andrew as a typical workaholic attorney, already living with HIV as part of his life. 3. HIV from the outset is simply one element in Andrew's life, but not the defining element. 4. Joe Miller was equally well-established, both at work and at home. 5. Nevertheless, he recognized the social similarities between being a black man and being a person with AIDS.

Appendix B

Figure B1
Jigsaw Passage Versions for Articles and Determiners

Version to Student A	Version to Student B
Sentence 1 "Philadelphia" opens strongly with an effective collection of city scenes.	Sentence 1 "Philadelphia" opens strongly with an effective collection of city scenes.
Sentence _____ Joe Miller is equally well-established, both at work and at his home.	Sentence _____ Joe Miller is equally well-established, both at work and at home.
Sentence _____ We see Andrew as a typical workaholic attorney, already living with HIV as part of his life.	Sentence _____ We see Andrew as one typical workaholic attorney, already living with HIV as part of his life.
Sentence _____ Nevertheless, he recognizes the social similarities between being a black man and being a person with AIDS.	Sentence _____ Nevertheless, he recognizes social similarities between being a black man and being a person with AIDS.
Sentence _____ HIV from the outset is simply one element in Andrew's life, but not the defining element.	Sentence _____ HIV from the outset is simply one element in Andrew's life, but not a defining element.

Figure B2
Grammar Communication Version for Articles and Determiners

Version to Student A	Version to Student B
"Philadelphia" opens strongly with an effective collection of city scenes. 2. We see Andrew as _____ a typical workaholic attorney the typical workaholic attorney already living with HIV as part of his life. 3. HIV from the outset is simply one element in Andrew's life, but not _____. 4. Joe his defining element its defining element Miller is equally well-established, both at work and at _____. home the home 5. Nevertheless, he recognizes _____ between their social similarities social similarities being a black man and being a person with AIDS.	"Philadelphia" opens strongly with an effective collection of city scenes. 2. We see Andrew as _____ one typical workaholic attorney his typical workaholic attorney already living with HIV as part of his life. 3. HIV from the outset is simply one element in Andrew's life, but not _____. 4. Joe a defining element the defining element Miller is equally well-established, both at work and at _____. his home this home 5. Nevertheless, he recognizes _____ between these social similarities the social similarities being a black man and being a person with AIDS.

Appendix C

Table 2
Frequencies and Distribution of Attentional and Interactional Processes across Task Steps, Sentences, and Phrase Decisions

Steps 1 and 2. Read passages	Step 3. Choose and justify.			Step 4. Recall during cloze			Step 5. Compare cloze w/original.					
Attentional and Interactional Processes	Decisions that Revealed Processes		Dist. of Process across Steps 3-5	Decisions that Revealed Processes		Dist. of Process across Steps 3-5	Decisions that Revealed Processes		Dist. of Process across Steps 3-5	Total Decisions		Total Dist. of Process
	N	%	%	N	%	%	N	%	%	N	%	%
Notice Form												
Jigsaw	19	26	82	2	3	9	2	3	9	23	32	100
STD*	17	28	94	1	2	6	0	0	0	18	30	100
GC **	64	89	93	0	0	0	5	7	7	69	96	100
Notice Differences												
Jigsaw	42	58	89	4	6	9	1	1	2	47	65	100
STD	56	93	93	3	5	5	1	2	2	60	100	100
GC	11	15	92	0	0	0	1	1	8	12	17	100

Notea for Table 2:
* STD stands for the Spot the Difference task.
** GC stands for the Grammar Communication task.
*** f/f/m stands for form, function and meaning.
1. Though all six pairs completed all three tasks, a tape-recorder malfunctioned during the Spot the Difference task and failed to record one pair's interaction. This accounts for the difference in the amount of data generated for the Spot the Difference task compared to that of the other two tasks.
2. Percentages are rounded to the nearest hundredth.

Steps 1 and 2. Read passages	Step 3. Choose and justify.			Step 4. Recall during cloze			Step 5. Compare cloze w/original.					
Attentional and Interactional Processes	Decisions that Revealed Processes		Dist. of Process across Steps 3-5	Decisions that Revealed Processes		Dist. of Process across Steps 3-5	Decisions that Revealed Processes		Dist. of Process across Steps 3-5	Total Decisions		Total Dist. of Process
	N	%	%	N	%	%	N	%	%	N	%	%
Notice Gap												
Jigsaw	38	53	83	6	8	13	2	3	4	46	64	100
STD	50	83	100	0	0	0	0	0	0	50	83	100
QC	24	33	89	1	1	4	2	3	7	27	38	100
Total Noticing												
Jigsaw	99	46	85	12		10	5	7	4	116	54	100
STD	123	68	96	4	2.5	3	1	.5	1	128	71	100
QC	99	46	92	1	.5	1	8	4	7	108	50	100
*Awareness of F/F/M****												
Jigsaw	12	16	60	7	10	35	1		5	20	28	100
STD	10	17	45	9	15	40	3	5	5	22	37	100
QC	23	32	82	2	3	7	3	4	11	28	39	100
Recall												
Jigsaw	NA	NA	NA	67	93	100	0	0	0	67	100	
STD	NA	NA	NA	56	93	100	0	0	0	56	100	
QC	NA	NA	NA	58	82	100	0	0	0	58	100	

Steps 1and 2. Read passages	Step 3. Choose and justify.			Step 4. Recall during cloze			Step 5. Compare cloze w/original.					
Attional and Interactlional Processes	Decisions that Revealed Processes		Dist. of Process across Steps 3-5	Decisions that Revealed Processes		Dist. of Process across Steps 3-5	Decisions that Revealed Processes		Dist. of Process across Steps 3-5	Total Decisions		Total Dist. of Process
	N	%	%	N	%	%	N	%	%	N	%	%
Modified Interaction												
Jigsaw	55	76	62	30	42	34	4	6	4	89	41	100
STD	15	25	83	2	4	11	1	2	6	18	31	100
QC	28	39	44	33	46	52	3	4	5	64	89	100
Corrattion												
Jigsaw	0	0	0	5	7	83	1	1	17	6	5	100
STD	0	0	0	0	0	0	0	0	0	0	0	100
QC	4	6	36	7	10	64	0	0	0	11	15	100
Rad Reasts												
Jigsaw	6	3	100	0	0	0	0	0	0	6	3	100
STD	28	47	100	0	0	0	0	0	0	28	47	100
QC	0	0	0	0	0	0	0	0	0	0		0
Par-generated Reasts												
Jigsaw	0	0	0	1	1	100	0	0	0	1	1	100
STD	7	12	100	0	0	0	0	0	0	7	12	100
QC	4	6	67	2	3	33	0	0	0	6	8	100