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From input to intake: researching learner cognition

Introduction

The distinction between input, what the teachers say to their learners, and intake, what the learners hear, has been recognised in research into second language acquisition at least since (Corder, 1967). The distinction is important because language development does not result from the input to which learners are exposed but what the learners take in. If a teacher in a class focussing on the past simple says “Harry and Megan cooked a curry last weekend,” the input that the learners are exposed to is “Harry and Megan cooked a curry last weekend.” However, if a learner hears “Harry and Megan cook a curry last weekend” then this sentence, in all its non-standard grammaticality, is the intake and this episode is unlikely to contribute to the learner’s command of the past tense. If, for example, researchers were interested in identifying the number of instances of the past tense needed for learners to acquire this tense, research that counted the number of times the teacher used the past tense will only help us to understand the acquisition process if there is a systematic relationship between what the teacher says, the input, and what the learner hears, the intake. However, the conceptual distinction between input and intake in SLA has been poorly operationalized and much research treats input as a straightforward proxy for intake. This article explores the relationship between input and intake in order to identify strategies for researching language development that are based on a more solid understanding of the connections between input and intake.

Input and intake

Second language knowledge and ability in second language instruction develop from learners being exposed to, and processing, samples of language. A key element in this is how the input to which learners are exposed becomes intake. Input is “acoustic-phonetic events, in the case of speech, or graphic objects in the case of written text, produced by an individual for some purpose on a specific occasion. These events and objects are observable by third parties: they can be recorded and are measurable, analysable, and hence objectively definable” (Carroll, 2001: 8).

In contrast, intake is “that part of input which has actually been processed by the learner” (Sharwood Smith, 1994: 8) or “that which is taken in by the hearer” (Carroll, 2001: 10). Some commentators make a distinction between what language users take in during communication and what learners take in as a part of the learning process along the lines of Krashen’s (1981) distinction between comprehensible input and comprehensible input plus *i*. Schmitt, who sees noticing as central to learning, says intake is “that part of the input that the learner notices” (Schmidt, 1990: 139). Schmidt illustrates this with a description of how he learnt to produce complex questions in Portuguese, (e.g. “O que e que voce quer?” [What is it that you want?]) as opposed to the simpler “O que voce quer?” [What do you want?]). Here are his comments on the long form of questions words:

It is very clear that these forms had been present in comprehensible input all along. I heard them and processed them for meaning from the beginning, but did not notice the form for five months (Schmidt, 1990: 140).

This difference between intake for communication and intake for learning, which may be further divided (cf. perceptual output systems in Truscott, 2015), leads to some ambiguity in research design and evaluating research would be made easier if we had agreed terms for

these two kinds of intake. However, as input for learning must be a subset of input for communication, this debate does not affect the main issue addressed here, the connection between input and intake.

Schmidt's definition (1990: 139) of intake as "that part of the input that the learner notices" is in line with much discussion of the relationship between input and intake. So Wong (2001: 346) says learners "derive" intake from input and VanPatten (2002: 757) talks of learners "getting" intake from input. This suggests a transmission view of communication where what learners hear or read is a partial version of the input to which they are exposed, constrained by their knowledge of the target language. This view is illustrated with Schmidt's sentence in figure one.

<figure one about here>

The transmission model mischaracterizes the communicative process. Speakers and writers produce an acoustic or graphic signal (cf. de Bot, 1992: 3; Kormos, 2006; Levelt, 1989) but this signal does not contain the speaker or writer's message. The acoustic signal contains no phonemes or words. The listeners construct the units of language from an interaction between their knowledge of the language and the sounds to which they are exposed (Field, 2008b: 127). Learners' knowledge is partial and so their constructions do not always match what the speaker said or the writer wrote. When researchers who are expert users of the target language go into language classrooms their understanding of what has been said, the expert intake, will be more or less the same as the teacher's understanding. In contrast, the expert intake will differ from what individual learners understand, the learner intake, and the learner intake will vary from learner to learner depending on their knowledge of the target language and their level of commitment to constructing intake from the input. The

speakers to whom Schmidt listened may well have said “O que e que voce quer?” [What is it that you want?] and expert users would have constructed this from the acoustic signal.

What Schmidt heard (O que voce quer?), was not a degraded version of that sentence but a construction based on the acoustic data and his then knowledge of Portuguese.

In a similar example related to Japanese, Churchill (2008: 347) reports that he heard a doctor asking him to provide a sample of blood in the words “採血を 採っ”

[transliterated as “saiketsu wo totte”]. He later discovered that this utterance was ungrammatical and that the actual utterance was probably “採血をして” [“saiketsu wo shite”]. Churchill constructed the Japanese phoneme /t/ when what had been said was /ʃ/.

The need for language users to construct intake is also true of written language. “A” and “a” are objectively very different but those with knowledge of the Roman alphabet construct them as orthographically identical. Similarly, “匕” will be seen either as a way of writing the first element of “tea” or of “匕首” (dagger) depending in whether the reader is literate in English or Chinese. At word level, whether the meaning of the three letters of “air” relates to something which we breathe or the water that we drink will depend on whether the reader is making use of knowledge of English or Bahasa Melayu. Spoken and written intake depend on “learners’ internal processing” (Mackey 2006: 424). Figure two is an attempt to illustrate the constructive nature of communication.

<Figure two about here>

For much language-related research, language users have similar levels of knowledge of language and so the intake created by different users will be very largely the same and input (strictly the expert intake) can be treated as a proxy for the input created by the participants. Where the area of investigation is second language instruction, the participants

will bring varying levels of knowledge and engagement to the input to which they are exposed and the intake learners create will be different from what experts would create and researchers cannot rely on what they have read or heard but need to identify strategies for investigating learners' internal cognitive processes.

Researching input to learners

Accessing learner cognitions is difficult and much research treats the cognitions as useful but not central. So Ellis says research should include "some measure of learners' ability to process a structure under real operating conditions" (2001: 34-35) and Leow says researchers should make efforts "to ascertain what learners really attended to or became aware of while exposed to or interacting with L2 data" (Leow, 2000: 570). "Some measure" or "efforts" underplays the role of learner intake and perhaps reflects a sense that expert intake is somehow more objective than learner intake. In an echo of Carroll's definition of input, Widdowson once said, intake data "are intrinsically participant, first and second person, phenomena which cannot be detached to be third person data of an objective kind and are not therefore susceptible to scientific enquiry" (1980: 166).

Widdowson's comments about the possibility for scientific research into subjective phenomena are unduly pessimistic. Over a hundred years ago a judge said, 'the state of a man's mind is as much a fact as the state of his digestion' (Edgington v Fitzmaurice 1885 29 Ch D 459). The issue is how best to investigate this category of facts and the rest of the article reviews three approaches, those which manipulate the input to groups of learners, those which focus on individual learners and those which use learner reports.

Manipulating input

Research design strategies related to learner cognition often use experimental design to ensure that learners receive specific kinds of input, presumably as a way of manipulating learner intake. However, these studies treat input as a proxy for intake and so do not investigate actual learner cognitions. For example, McDonough and Nekrasova-Becker (2014) provide skewed input (i.e. learners were exposed to different number of the target items) and balanced input (i.e. learners were exposed to the same number of tokens of each of the target items) related to ditransitive constructions (e.g. “Please fix me something to eat”). See table one. The study found that balanced input resulted in the learners achieving higher levels in the use of di-transitive verbs.

No information was collected about learner intake so, when the teacher said “fix”, we do not know whether the learners heard, for example, “fit” “fizz”, “fix” or something completely different and if they heard the same thing for each token of “fix.” This undermines their explanation of how the learners processed the data. A more direct measure of intake would have provided a more solid basis for the claim that the learners distinguished skewed and balanced input.

The aim of this research was to investigate the link between grammar and semantics.

Indirect objects in di-transitive construction are typically (e.g. “Please fix **me** something to eat”) but not always human (e.g. Mary was decorating her house for Christmas, so she cut **the Christmas tree** some ribbons”) and so semantics are a useful but not consistent guide to understanding di-transitivity. The experimental input included some sentences where the indirect object could be interpreted as human e.g. “clinics” in “the discounts on the products would save the clinics a combined \$10 million a year”. The researcher did not ask

the learners how they understood the word “clinic,” although this aspect of learner cognition was central to their research. No reason is given for this but, in a similar study, McDonough and Trofimovich(2014) rejected the use of reports from the learners as insufficiently robust.

Table 1: Input characteristics(McDonough & Nekrasova-Becker, 2014: 427)

Condition	Token frequency	Order
Skewed first	8 tokens of <i>send</i> and 3 tokens each of <i>pass</i> , <i>owe</i> , <i>teach</i> and <i>fix</i>	<i>Send</i> items first, then mixed
Skewed random	8 tokens of <i>send</i> and 3 tokens each of <i>pass</i> , <i>owe</i> , <i>teach</i> and <i>fix</i>	Mixed sequence
Balanced	4 tokens each of <i>send</i> , <i>pass</i> , <i>owe</i> , <i>teach</i> and <i>fix</i>	Mixed sequence

Révész, Sachs, and Hama (2014) also attempted to manipulate learners’ intake by providing skewed and balanced input in tasks of different levels of complexity. The initial part of the study sought to justify the researchers’ intuitions about the relative complexity of two tasks using a range of strategies, including asking two doctoral students to rate the difficulty of two tasks. They did not ask the learners in their study because this was too subjective a measure(2014: 622). It is not clear why the views of doctoral students about the difficulty experienced by learners should be preferred to the views of the learners themselves.

Their study found no difference between the participants who received skewed or balanced input, which suggests that the participants processed data in ways differently from the participants in McDonough and Nekrasova-Becker (2014), The focus on input rather than

intake meant that the researchers did not investigate differences between the intake constructed from the skewed or balanced input and so it is difficult to explain the differences between the two studies. Both these studies show that even carefully designed input on its own cannot be used as a proxy for intake.

Observing the individual learner

Some research strategies focus in individual learners and this enables some investigation of differences in learner cognitions. Eye-tracking technologies (Cintron-Valentin & Ellis, 2015; Godfroid, Housen, & Boers, 2010; Indrarathne & Kormos, 2016) are probably the most widely used of these. Eye-tracking studies assume that the ways in which readers' eyes move provides information about the features of the text to which they are attending and/or processing. The fixation duration, that is the amount of time that readers devote to an area of interest such as phrase, word or syllable on the screen, is taken to reveal readers' cognitive processes but what it reveals is understood in a range of ways. Smith (2012: 6) treated a duration of 500 milliseconds or more as showing the learners had noticed something. Indrarathne and Kormos (2016), using "attention" rather than "noticing", had no threshold but treated longer durations as indications of greater levels of attention. Both Smith (2012) and Indrarathne and Kormos (2016) offer plausible, though inconsistent, accounts of the links between eye movements and learner cognition. The difference in these two studies between a threshold or continuum view of what becomes intake could be resolved by more direct measures of learner cognitions. If we had a body of research which involved both eye-tracking data and the intake research methods described below this would provide an empirical basis for the currently largely hypothetical links between eye

movements and learner cognition. In our current state of knowledge, eye-tracking studies on their own do not provide reliable information about intake.

Listening to learners

A more direct source of data about learner cognition is provided by learner reports. One little used approach is the transcription exercise. Field (2008a) used a paused transcription technique to investigate differences in the way L2 users of English processed function and content words. In this technique, participants listen to an authentically produced piece of speech into which pauses had been inserted and transcribed the last few words they heard. The participants recognised content words more easily than function words. While this technique is focussed more on decoding than comprehension skills (Field, 2008b) it provides insight into learner cognitions and for example would usefully supplement studies into skewed and balanced input (McDonough & Nekrasova-Becker, 2014; Révész et al., 2014) and the eye-tracking studies (Indrarathne & Kormos, 2016; Smith, 2012) studies discussed above.

A more widely used research strategy is the think-aloud protocol (Hama & Leow, 2010; Leow, Hsieh, & Moreno, 2008; Mackey, 2006). Mackey, Gass, and McDonough (2000: 486) made recordings of feedback episodes in a class and, after the class, played them back to the learners involved and asked them to explain what they had been thinking at the time.

A: There are [flurs]?

B: Floors?

A: [fluwərs] uh flowers.

When asked to say what had happened at this point, A said “I was thinking that my pronounce, pronunciation is very horrible” which indicates that A’s understanding matched B’s intention. Often this was not the case. In the following exchange

- C: So one man feed for the birds.
D: So one man’s feeding the birds?
C: The birds.

D was trying to indicate that the grammar of the verb was wrong and that the preposition “for” was not needed. C’s comment on this interaction was “When I saw the picture I thought this is a park and I tried to describe”(Mackey et al., 2000: 485), which suggests C’s interpretation was different from D’s. In fact, the study found that feedback intended to relate to morpho-syntax was only recognised by learners as such in 13% of cases(Mackey et al., 2000: 484).

Think-aloud protocols provide some of the best data on learner cognition and would have usefully supplemented the studies discussed in previous sections. However, protocols only give a partial view of learner cognitions because of a lack of temporal granularity: they focus on a small number of episodes which teachers or researchers select. Secondly, these kinds of protocols may be distorted by power relations. Even though careful researchers tell learners to say nothing if they do not recollect what they were thinking at any point of the class, many learners will feel the need to offer the teacher or researcher a response which is respectful of the teacher even when they do not remember. The evidence from think-aloud protocols can be strengthened by triangulation with other research instruments e.g. Mackey and Gass (2006) combined learner diaries with think-aloud protocols but issues related to granularity and power relations remain.

The final and most complete learner reports are auto-ethnographies, where learner/researchers research their own language learning (McIlveen 2008: 3). Auto-ethnographies address the issue of temporal granularity (Tomlin & Villa, 1994: 185) because the learner/researcher determines how often data are collected and the issue of power because the research and learner are the same person. Auto-ethnographies have been used in the study of language learning. The Schmidt auto-ethnography discussed in this paper (Schmidt, 1990; Schmidt & Frota, 1986) has been very influential in second language research but while the concept of “noticing” which came from this research has been widely adopted, the research methodology has not. The current paper has also referred to Churchill’s investigation of his informal learning of Japanese (2008). Other studies of language learning (Bailey, 1991; Jenks, 2015; Ogulnick, 1999; Winkler, 2014) and teacher development (Canagarajah, 2012) exist but auto-ethnographies remain rare in language education research and I have found only one study of learning English as a second language, Ai (2016), and this is largely about Ai’s development as a teacher.

Auto-ethnographies do present challenges for researchers. Part of these challenges are to do with ensuring that the reports are as accurate as possible and do not distort either the communicative or learning process. This could be addressed through training similar to that currently used in protocol studies, with the advantage that the experience of reporting could be repeated over several studies rather than the one-off experiences typical of participants in protocol studies. A more intractable issue relates to the number of participants possible in research: auto-ethnographies have only one participant. This would make large scale studies resource intensive but would encourage a greater degree of integration of learners into the research process. If we had the information about the intake

of some learners provided by auto-ethnographies, we would be in a stronger position to make claims about language development using other research strategies.

Summary

The fact that language development in form-focussed instruction happens as a result not of the input to which learners are exposed but of the intake which learners construct from that input undermines research which are based on data related to input, such research needs to be validated by research strategies which provide information about intake. This paper has explored three strategies, transcriptions, think-aloud protocols and the most comprehensive auto-ethnographies. While auto-ethnographies can only be used with individuals, the use of research designs where auto-ethnographies are paired with, say, eye-tracking studies or what I have called manipulating input studies, would clarify the extent to which we can use techniques which allow for larger numbers of participants to understand the impact of input and intake on language development.

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Author Bio

Richard Badger educates TESOL teachers at the University of Leeds. He recently completed the monograph (2018) *Teaching and Learning English: a problem-solving approach* for Bloomsbury. His research interests include authenticity, corpus linguistics, the teaching of listening and writing and applications of genre theory in language education.

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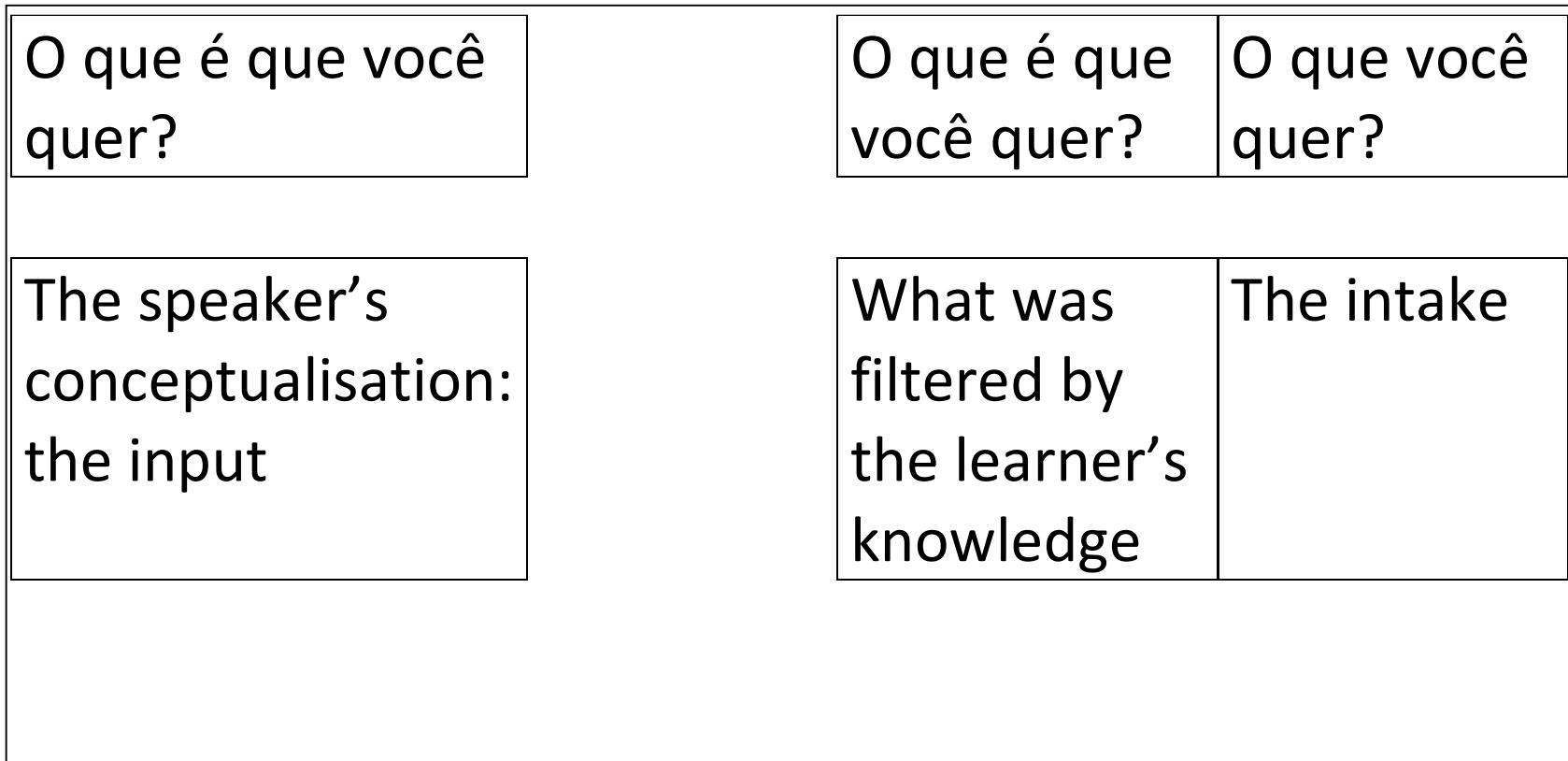


Figure 1: A transmission model of language processing/learning


O que é que você quer?				O que você quer?
				Learner Intake
The speaker's conceptualisation		The acoustic signal: the input		O que é que você quer?
				Expert intake

Figure 2: A construction model of language processing/learning