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Interaction and instructed second language acquisition

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Interaction is an indispensable component in second language acquisition (SLA). This review surveys the instructed SLA research, both classroom and laboratory-based, that has been conducted primarily within the interactionist approach, beginning with the core constructs of interaction, namely input, negotiation for meaning, and output. The review continues with an overview of specific areas of interaction research. The first investigates interlocutor characteristics, including (a) first language (L1) status, (b) peer interaction, (c) participation structure, (d) second language (L2) proficiency, and (e) individual differences. The second topic is task characteristics, such as task conditions (e.g. information distribution, task goals), task complexity (i.e. simple or complex), and task participation structure (i.e. whole class, small groups or dyads). Next, the review considers various linguistic features that have been researched in relation to interaction and L2 learning. The review then continues with interactional contexts, focusing especially on research into computer-mediated interaction. The review ends with a consideration of methodological issues in interaction research, such as the merits of classroom and lab-based studies, and the various methods for measuring the noticing of linguistic forms during interaction. In sum, research has found interaction to be effective in promoting L2 development; however, there are numerous factors that impact its efficacy.

1. Introduction

Interaction has played an important role in SLA theory for several decades. The interaction hypothesis, proposed by Long (1981, 1983) and revised in 1996 (Long 1996), was based on discourse analysis research during the 1970s (e.g. Wagner-Gough & Hatch 1975; Hatch 1978) and has developed and matured with burgeoning empirical research since then. Indeed, the hypothesis has developed into a theoretical approach (see Mackey & Gass 2015), containing a description of multiple processes associated with L2 learning (Jordan 2005; Mackey 2012; Pica 2013). Such processes include learners' exposure to and production of language, and the interplay of such input and output with learners' cognitive resources and other individual differences (Long 1996; Gass 1997; Mackey 2012; Pica 2013; Gass & Mackey 2015; Long

2015; Loewen & Sato 2017). Investigation into the effects of interaction on L2 development has been considered a component of instructed second language acquisition (ISLA) (e.g. Mackey 2006; Loewen 2015; Long 2017; VanPatten 2017b), which is concerned with the manipulation of the processes and mechanisms of L2 learning. Consequently, interaction research has occurred in both intact classrooms and in laboratory contexts, with results of the latter studies generally considered in light of their implications for the L2 classroom. Thus, the current review considers any research conducted within the interaction approach.

Much of the early interactionist work explored how interaction occurred in various contexts. Seminal works investigated, among other topics, speech modifications and miscommunication in native speaker/non-native speaker interaction as well as non-native/non-native speaker interaction (Gass & Varonis 1985; Varonis & Gass 1985; Doughty & Pica 1986; Porter 1986; Pica 1988; Gass & Varonis 1990; Loschky 1994). In particular, researchers were interested in the frequency with which negotiation of meaning, a series of discourse moves to resolve a communication breakdown, occurred, how it occurred, and what factors influenced its occurrence (e.g. Long & Porter 1985; Pica et al. 1991; Pica 1994; Lyster & Ranta 1997). As the characteristics of interaction became clearer, researchers began to investigate the effects of specific variables pertaining to interaction on (a) discourse moves such as modified output (Swain 1985, 1995, 2005), (b) cognitive constructs such as noticing (Schmidt 1990, 1995, 2001), and (c) most importantly, L2 development and acquisition (see Mackey 1999; Spada & Lightbown 2009; Mackey 2012). Variables under investigation, and which comprise a large part of the current review, can be categorized as follows: those pertaining to (a) the interlocutors (e.g. L2 proficiency, L1 status, gender), (b) the task characteristics (e.g. complexity, type of task), (c) linguistic targets, and (d) the interactional context (e.g. setting, modality).

Indeed, the interest in interaction, its effects, and the variables impacting its effectiveness have attracted considerable attention, resulting in numerous empirical research studies, reviews (Gass 2003; Plonsky & Gass 2011; Mackey, Abbuhl & Gass 2012; Goo & Mackey 2013; Lyster & Ranta 2013; Lyster, Saito & Sato 2013; Plonsky & Brown 2015; Kim 2017), and meta-analyses (Keck, Iberri-Shea, Tracy-Ventura & Wa-Mbaleka 2006; Russell & Spada 2006; Mackey & Goo 2007; Li, 2010; Lyster & Saito 2010; Brown 2016; Ziegler 2016a) of interaction in general or specific components of interaction. Overall, these works have found that interaction is beneficial for L2 acquisition. For example, Keck et al.'s (2006) meta-analysis of 14 quasi-experimental interaction studies revealed a large effect on immediate posttests for learners involved in interaction (and negotiation). Mackey & Goo's (2007) meta-analysis of 28 interaction studies conducted both inside and outside the classroom found large effect sizes for learners who were engaged in interaction compared to those who were not. These results were seen more clearly on delayed posttests. Indeed, in terms of interaction, there is some consensus that 'there is a robust connection between interaction and learning' (Gass & Mackey 2015: 181), with the result that researchers have shifted their focus from the general effectiveness of interaction to the details of which components of interaction might be more or less effective in which contexts with which learners (Mackey et al. 2012).

Interaction research in ISLA, at its broadest, encompasses several areas of research that focus only on specific aspects of interaction; nevertheless, such research is supported by the theoretical underpinnings of the interactionist approach. For example, corrective feedback

has a robust research tradition in its own right, as evidenced by multiple reviews and meta-analyses (e.g. Russell & Spada 2006; Li 2010; Lyster & Saito 2010; Lyster et al. 2013; Brown 2016); however, corrective feedback is also a central component of the interactionist approach. In another example, task-based language teaching and learning is an area of considerable current interest with its own research agendas (e.g. Baralt, Gilabert & Robinson 2014; Skehan 2014; Long 2015; Gilabert, Manchón & Vasylets 2016; Plonsky & Kim 2016; Ziegler 2016a), but much of the rationale for tasks is based on the interaction approach (Bygate, Skehan & Swain 2001; Ellis 2003; Long 2016; Ellis 2017b; Kim 2017). In reviewing the literature over 30 years since the initial proposal of the interaction hypothesis (Long 1981), Long (2015) emphasized that 'it is this theory and related empirical findings that provide the main psycholinguistic underpinnings for TBLT [task-based language teaching]' (p. 61). The current review will draw on studies from these various areas of research.

2. Components of interaction

Before going further in this review, it is important to consider the key constructs of interaction, namely input, negotiation, output, and noticing.

2.1 Input

Input is a necessary component of all theories of language acquisition, including the interactionist approach (Gass & Mackey 2015). In particular, interactionist researchers have been interested in the input that learners receive, whether naturalistic, pre-modified (i.e. simplified and/or elaborated), or interactionally modified. Two issues here are the effects of input on comprehension and L2 development. In terms of comprehension, there is evidence that interactionally modified input may be more beneficial (e.g. Pica, Young & Doughty 1987; Loschky 1994). Furthermore, interactionally modified input, as exemplified in the subsequent examples, has generally been found to be better for L2 acquisition than pre-modified or unmodified input (e.g. Ellis & He 1999; Mackey 1999). Because interactionally modified input is promoted as an optimal type of input for acquisition, few studies within the interactionist approach have investigated simplified or elaborated input alone. However, Ellis & He (1999) compared pre-modified and interactionally modified input, finding no difference between the two types of input in a task-based study of vocabulary learning. Other researchers have investigated input-based and output-based instruction, although much of this research is not directly situated with the interactionist approach and is consequently beyond the scope of this review (e.g. DeKeyser & Sokalski 1996; Erlam 2003; Shintani 2015).

2.2 Negotiation for meaning

Negotiation for meaning is at the heart of the interaction hypothesis, with a breakdown in communication being posited as the driving force in improving learner comprehension and L2 development (Long 1996). When L2 learners and their interlocutors do not understand

each other, they may signal that a communication breakdown has occurred. Hence, key elements of negotiation for meaning include clarification requests, confirmation checks, and comprehension checks, all of which are responses to a communication breakdown. These are the primary discourse moves that have been investigated in research studies that examine the occurrence of negotiation (e.g. Ellis, Basturkmen & Loewen 2001a; Loewen 2004; Gass, Mackey & Ross-Feldman 2005).

Confirmation checks aim to ensure that what has just been said has been heard correctly and understood. Confirmation checks often take the form of a repetition of the trouble source with rising intonation, or a question such as *Do you mean X?* In Example 1, taken from a spot-the-differences task, two learners are discussing the objects in their respective pictures. Learner 2 checks to confirm her understanding of the information that Learner 1 has just provided, to which Learner 1 answers in the affirmative.

Example 1: Confirmation check (indicated by SMALL CAPS) (Gass et al. 2005: 585)

Learner 1: *En mi dibujo hay un pájaro.* 'In my drawing there is a bird.'

Learner 2: *¿SOLAMENTE UN? Tengo, uh, cinco pájaros con un hombre, en sus hombros.*
            'ONLY ONE? I have, uh, five birds with a man, on his shoulders.'

Learner 1: *Oh, oh, sí, sí.* 'Oh, oh, yes, yes.'

In contrast to confirmation checks, clarification requests attempt to elicit additional information from the interlocutor regarding the meaning of their utterance, through questions such as *What do you mean?* In Example 2, which occurred in an information and opinion gap task, Learner 2 simply requests more information from his interlocutor by asking *What?*

Example 2: Clarification request (indicated by SMALL CAPS) (Gass et al. 2005: 586)

Learner 1: *¿Qué es importante a ella?* 'What is important to her?'

Learner 2: *¿CÓMO?* 'WHAT?'

Learner 1: *¿Qué es importante a la amiga? ¿Es solamente el costo?* 'What is important to the
            friend? Is it just the cost?'

The final major category of negotiation for meaning is comprehension checks, which are used to ensure that the addressee understands what is being said. Comprehension checks can take the form of questions such as *Do you understand what I'm saying?* In Example 3, in which learners are engaging in a map description task, Learner 1 asks if Learner 2 would like her to repeat the information that she has just provided.

Example 3: Comprehension check (indicated by SMALL CAPS) (Gass et al. 2005: 586–587)

Learner 1: *La avenida siete va en una dirección hacia el norte desde la calle siete hasta la calle ocho. ¿QUIERES QUE REPITA?* 'Avenue Seven goes in one direction towards the north from Street Seven to Street Eight. DO YOU WANT ME TO REPEAT?'

Learner 2: *Por favor.* 'Please.'

2.3 Negotiation of form

Although negotiation for meaning is sometimes present during communicative interaction, it has become clear that such negotiation does not always occur frequently in the classroom (Foster 1998; Eckerth 2009). Consequently, in addition to investigating negotiation for meaning, some interactionist researchers expanded their scope to include negotiation that occurs as a result of a desire for linguistic accuracy, rather than as a result of communication breakdown (e.g. Lyster & Ranta 1997; Ellis et al. 2001a; Lyster et al. 2013). This type of negotiation is particularly relevant to ISLA because it often involves teachers' pedagogical intervention. More precisely, negotiation of form can be attributed 'a more didactic function' (Lyster 1998b: 190), often consisting of feedback with corrective intent. Corrective feedback that is didactic in nature (e.g. didactic recasts) occurs when someone, often the teacher, responds to a learner's linguistically problematic utterance, even though the meaning of the utterance is clear. Thus, in Example 4, Will uses the wrong preposition in discussing his army experiences, to which the teacher responds with the correct preposition. Will repeats the correct form, and they continue with their interaction.

Example 4: Corrective feedback (indicated by SMALL CAPS) (Loewen 2005: 371)

Will: when I was soldier I used to wear the balaclava

Teacher: and why did you wear it Will, for protection from the cold or for another reason

Will: just wind uh protection to wind and cold

Teacher: PROTECTION FROM

Will: uh from wind and cold

Teacher: right, okay not for a disguise

Considerable research has investigated corrective feedback during interaction over the past 25 years (e.g. Lyster & Ranta 1997; Long, Inagaki & Ortega 1998; Ammar & Spada 2006; Ellis, Loewen & Erlam 2006; Mackey 2006; Yang & Lyster 2010; Li, Zhu &

Ellis 2016; Nakatsukasa 2016), resulting in numerous research syntheses (e.g. Long 2007; Lyster, Saito & Sato 2013; Nassaji 2013; Ellis 2017a) and meta-analyses (e.g. Russell & Spada 2006; Li 2010; Lyster & Saito 2010; Brown 2014). Several important distinctions have been made concerning corrective feedback, including (a) negative versus positive evidence (Leeman 2003), (b) input-providing versus output-prompting feedback (Lyster 2004; Goo & Mackey 2013; Lyster & Ranta 2013), and (c) explicit versus implicit feedback (Sheen & Ellis 2011; Lyster et al. 2013). Regarding the first distinction, negative evidence indicates to learners what is not acceptable in the target language, while positive evidence provides examples of well-formed utterances. Researchers have long argued that negative evidence is an important component of corrective feedback (e.g. Schachter 1991); however, research has indicated that the positive evidence provided by recasts can also be important (Leeman 2003).

Input-providing feedback provides the correct linguistic form for the learner. For example, a recast, which reformulates a learner's incorrect utterance, provides the correct form immediately after the learner's erroneous utterance. In contrast, output-prompting corrective feedback does not provide the correct form for the learner; rather, it attempts to elicit the correct form from the learner. The effectiveness of these two types of feedback has been widely debated. Theoretical arguments and empirical investigation have been used to support the superiority of both input-providing feedback (e.g. Long 2007; Goo & Mackey 2013) and output-prompting feedback (e.g. Lyster 2004; Lyster & Ranta 2013), although some studies have also found similar effects between the two (e.g. Loewen & Nabei 2007). This state of affairs has led some researchers to suggest that teachers should provide a variety of feedback types in the classroom (Lyster & Ranta 2013; Ellis 2017a).

In terms of the explicit-implicit distinction (Lyster et al. 2013), several researchers (e.g. Long 1996, 2007; Goo & Mackey 2013) have argued that feedback should be relatively implicit, primarily taking the form of a recast so as not to interrupt the flow of communication. For example, Long (2015) reiterates that recasts 'have a solid track record in both L1A [first language acquisition] and SLA, and to the extent that implicit negative feedback does the job, teachers and learners are freed up to devote their primary attention to tasks and subject-matter learning' (p. 57). In contrast, other researchers (Lyster 2004; Ellis, Loewen & Erlam 2006; Loewen & Philp 2006; Lyster & Ranta 2013) have suggested that more explicit types of corrective feedback, such as explicit correction or metalinguistic information, are more likely to be noticed by learners and thus have the possibility to influence the learner's interlanguage system.

Language-related episodes (LREs), which occur when one or more of the participants 'generate [linguistic] alternatives, assess [linguistic] alternatives, and apply the resulting knowledge to solve a linguistic problem' (Swain & Lapkin 1998: 333), are also an example of negotiation arising out of a general concern for linguistic accuracy. In LREs, specific linguistic items are topicalized by learners as they engage in meaning-focused communication. Numerous studies, both experimental and descriptive, with L1 or L2 interlocutors, have employed LREs to identify learning opportunities during interaction (e.g. Swain & Lapkin 1998; Williams 2001b; Storch 2002; Loewen 2005; Kim & McDonough 2008; Yilmaz 2011; García Mayo & Azkarai 2016). In Example 5, a group of learners focus on a lexical issue (*rascacielos/skyscrapers*) in Spanish. Jenny does not recognize the word that Larry used. Larry

then explains the meaning of the word, which is subsequently accepted by the other members of the group. As this example shows, an LRE does not necessarily contain corrective feedback; rather, an LRE consists of collaborative exchanges surrounding a linguistic issue.

Example 5: Language-related episode (Fernández Dobao 2016: 40)

Larry: *entre dos rascacielos, grandes* 'between two big skyscrapers'

Ruth: *dos* 'two'

Jenny: *qué es?* 'what is it?'

Larry: skyscrapers

Jenny: *rascacielos?* 'skyscrapers?' oh!

Ruth: *rascacielos rascacielos* 'skyscrapers skyscrapers'

Jenny: look at you

Larry: *sí* 'yes'

Jenny: *rascacielos* 'skyscrapers'

Ruth: okay

2.4 Output

The final construct to consider within the interactionist approach is output, namely, the language that learners produce during meaning-focused interaction. Although some SLA theories do not ascribe an important role for language production in L2 development (e.g. Krashen 1982, 2003), the interactionist approach draws strongly on Swain's (1985, 1995, 2005) Comprehensible Output Hypothesis, which claims that output is not merely a representation of L2 development but is a causal factor for L2 development in several ways. First, Swain argues that learners need to be pushed to produce language that is syntactically more complex and accurate. Learners tend to process language semantically, and if they can grasp the meaning of an utterance without needing to process all of the linguistic features, they will do so. But if learners have to produce language, then they have to consider which specific linguistic forms encode which meanings (i.e. the noticing function). Second, Swain proposes that output allows learners to test their linguistic hypotheses and possibly receive feedback on these hypotheses (i.e. the hypothesis-testing function). For example, learners may decide

to try out a new structure during communication, but if such use results in communication breakdown or corrective feedback, learners may realize that they need to revise their original hypothesis about the target language structure. Third, Swain asserts that output serves a metalinguistic function, 'enabling [learners] to control and internalize linguistic knowledge' (Swain 1995: 126). Finally, as output necessarily involves language use, it facilitates production practice and, thus, the development of fluency and automaticity (see DeKeyser 2001; Lyster & Sato 2013; DeKeyser 2017a).

2.5 Attention

While the previously discussed constructs are discoursal, this final one is cognitive in nature. Long's (1996) characterizations of the interaction hypothesis argues that interaction 'connects input . . . ; internal learner capacities, particularly selective attention; and output . . . in productive ways' (451–452). Indeed, Schmidt's noticing hypothesis (1990, 1995, 2001) has played an integral role in the interaction approach, with the claim that L2 learning does not occur without awareness. Similarly, Robinson (1995, 1996, 2003) claims that attention, namely the 'process that encodes language input, keeps it active in working and short-term memory, and retrieves it from long-term memory' (2003: 631), is essential for L2 learning. Although interaction researchers do not agree on the precise nature of these constructs, there is general agreement that 'the cognitive constructs of attention, awareness, and the related construct of noticing are part of the interaction–L2 learning process (Gass & Mackey 2015: 191). Consequently, researchers have expended considerable effort investigating the effects of interaction not only on L2 development but also on attention, awareness, and noticing (e.g. Mackey, Gass & McDonough 2000; Williams 2001b; Philp 2003; Gass & Alvarez Torres 2005; Mackey 2006; Philp & Iwashita 2013; Sagarra & Abbuhl 2013).

   Although it is important to identify the key components of interaction, the primary concern of interactionist research has been to examine how the various components of interaction, particularly negotiation for meaning, corrective feedback, and output, occur in different contexts and are influenced by different characteristics (e.g. Gass 2003; Keck et al. 2006; Russell & Spada 2006; Mackey & Goo 2007; Li, 2010; Lyster & Saito 2010; Plonsky & Gass 2011; Mackey et al. 2012; Goo & Mackey 2013; Lyster & Ranta 2013; Lyster et al. 2013; Plonsky & Brown 2015; Ziegler 2016a; Brown 2016; Kim 2017). To that end, the review will now focus on studies that have examined the influence of (a) interlocutor characteristics, (b) task characteristics, (c) linguistic targets, and (d) interactional contexts.

3. Interlocutor characteristics

From its inception, interaction researchers have been concerned with the effects that the interlocutor has on interaction (e.g. Long 1983; Long & Porter 1985; Varonis & Gass 1985; Pica 1988). Indeed, an important set of moderating factors related to L2 interaction involve the various characteristics of the individuals engaged in communication. This section

will investigate several of these features, including (a) L1 status, (b) peer interaction, (c) participation structure, (d) L2 proficiency, and (e) cognitive and psychological individual differences.

3.1 L1 status

Interactionist researchers have long been interested in the effect of L2 learners speaking with L1 speakers (often operationalized as native speakers) and other L2 speakers (often operationalized as non-native speakers) of the language (see Long & Porter 1985). In particular, researchers have explored whether L1 and L2 speakers are equally capable of providing the linguistic support that is arguably necessary for L2 development (e.g. input modifications and corrective feedback: see Pica 2013). Much of this L1–L2 interaction research has been conducted in the laboratory because not many L1 speakers, apart from the teacher, who may or may not be an L1 speaker, are present in instructed L2 contexts. Furthermore, not many studies have examined naturally occurring L2 learner interactions outside the classroom in L2 contexts, such as study abroad (see Pérez-Vidal 2017). Of course, such interaction with L1 speakers is generally not possible in a foreign language context where the L2 is not spoken in the wider society, although technology now allows L2 learners access to L1 speakers, which was previously not possible (e.g. Sauro 2013b).

Research comparing L1–L2 and L2–L2 speaker interaction has investigated four key interactional features: input modifications, corrective feedback, modified output, and self-initiated modified output. First, studies that compared L1 and L2 speakers as input providers reported that L1 speakers tend to provide lexically richer and syntactically more complex input than do L2 speakers. Pica et al. (1996), for instance, gave picture jigsaw tasks (picture description and story completion) to L1–L2 and L2–L2 dyads. The analysis of frequencies of lexical and morphosyntactic modifications of the two types of interlocutors revealed that L1 speakers provided more modifications after communication breakdowns but only for the picture description task (see also Porter 1986). However, not all studies have found in favour of L1 speakers. For example, García Mayo & Pica (2000) replicated Pica et al. (1996) with English-major university students whose paper-based TOEFL scores ranged from 580 to 630. The researchers found that the advanced L2 interlocutors produced structurally richer input to their partners than did the L1 speakers. In a more recent study, Sato (2015), by comparing the density and complexity of L1 and L2 interlocutors' speech production, found that learners can provide a comparable amount (i.e. mean length of utterance) and variety (i.e. the number of types of verbs) of input to that of L1 speakers primarily due to the linguistic simplifications that the L1 speakers tended to produce (i.e. foreigner talk: see Ferguson 1975). However, learners sometimes provided their partners with grammatically incorrect input or concluded their interaction with non-target-like solutions (see Bruton & Samuda 1980).

Second, concerning feedback, researchers have investigated learners' signalling of non-understanding as well as learners' provision of feedback. Regarding the first issue, research indicates that learners are often more willing to indicate a lack of understanding when they are interacting with another learner. In the aforementioned Pica et al. (1996) study, the analysis of the amount of feedback showed that there were significantly more such instances

in L2–L2 interaction (for one of the two tasks implemented in the study). The researchers concluded that L2–L2 interaction 'did offer data of considerable quality, particularly in the area of feedback' (1996: 80). A similar conclusion was reached by Eckerth (2008) in his study of L2–L2 interaction in two German L2 university classes. He found that learners provided each other with 'feedback rich in acquisitional potential' (2008: 133) on both linguistics structures targeted in the tasks as well as structures that arose incidentally during the interaction.

Research has also found that learners tend to react to feedback by modifying their initial errors (modified output) more often during interaction with L2 peers rather than when they interact with L1 speakers. Sato & Lyster (2007) compared the interaction of university-level Japanese learners of English with each other and with L1 speakers of English from Australia and Canada. Sato & Lyster found that the Japanese learners modified their erroneous utterances after feedback from their peers more often than from native speakers. This tendency was consistent across feedback types. In Mackey, Oliver & Leeman (2003), lower-intermediate learners of English with a variety of L1 backgrounds interacted with L1 English speakers in information gap tasks. The analysis of 24 adult dyads showed that while L2 speakers provided more output-promoting feedback, the quality of the resulting modified output – modification of the original error – in the two types of dyads was comparable. However, Shehadeh (1999), who examined the interactions between adult English as a second language (ESL) learners in the UK and between L2 learners and L1 speakers, showed that learners were more likely to 'make an initial utterance more accurate and/or more comprehensible to their interlocutor(s)' (1999: 644) when feedback was given by another L2 speaker than by an L1 speaker, especially when negotiation was extended between the interactants (see also Fujii & Mackey 2009).

Finally, while much less investigated, research indicates that learners tend to self-correct more while interacting with other learners than when interacting with L1 speakers. Self-corrections, which can be argued to be 'overt manifestations of the monitoring process' (Kormos 2006: 123) and are included in Swain & Lapkin's (1998) definition of LREs, are hypothesized to facilitate L2 processing in the same way as modified output triggered by feedback (de Bot 1996). Shehadeh (2001), in a follow up examination of his earlier data (1999), showed that 93% of self-initiation led to modified output during L2–L2 interaction, which was proportionally higher than L2–L1 interaction, again after extended negotiations. In her investigation of L2 pair interaction among English as a foreign language (EFL) learners in Thailand, McDonough (2004) found that learners rarely modified their output in response to peer feedback, choosing instead to produce self-initiated modified output. Nevertheless, increased peer interaction led to improved production of English conditionals, the target feature (see also Buckwalter 2001; Toth 2008; Smith 2009).

One special type of peer group that has received recent attention is heritage language (HL) learners, who have had some degree of exposure to the target language at home. For example, Bowles, Toth & Adams (2014), comparing HL–L2 and L2–L2 dyads, found that HL–L2 dyads were more likely to reach target-like outcomes during dyadic interaction and negotiation. There was also a greater amount of talk and more LREs when an HL learner was involved. Bowles et al. suggest that there is an imbalance when L2 learners work with HL learners, with the L2 learners receiving more benefit from the interaction than do the HL

learners. In addition, learners were more likely to stay in the target language when speaking with an HL learner than with another L2 learner.

In sum, these studies indicate that L1 interlocutors can interact with L2 learners in positive ways, but it is not always the case that interaction with L1 speakers is better than interaction with L2 peers. Indeed, L2 speakers can sometimes be better for interlocutors than L1 speakers, something that should perhaps be stressed in the classroom as support for interactive tasks (Long & Porter 1985). Furthermore, this is good news since opportunities for L1 speaker interaction are considerably limited for most learners.

3.2 Peer interaction

In addition to the above mentioned L1–L2 distinction, another interlocutor characteristic is the difference between interacting with the teacher versus fellow students or peers. Confounded with this variable is the fact that teacher and student roles often overlap considerably with participation structure, with whole class interaction being primarily teacher-led, while small group and dyadic interaction is generally with peers.

As early as 1985, Varonis & Gass (1985) concluded that peer interaction can be 'a good forum for obtaining input necessary for acquisition' (p. 83). Indeed, peer interaction is often thought of as the primary participant structure for interaction to occur, and more research has recently investigated the effects of peer interaction in large part because it is probably the most common type of interaction in many communicatively oriented classrooms. In particular, researchers have investigated learner interactions with other learners in order to examine whether peers can also be a helpful learning resource (see, for reviews, Philp, Adams & Iwashita 2014; Sato & Ballinger 2016). Indeed, TBLT, which will be discussed in more detail, utilizes peer interaction as a vehicle to enhance the effectiveness of tasks.

The psycholinguistic benefits of peer interaction may include relatively longer processing time for input and output, which in turn leads to frequent feedback and opportunities for testing out or practicing the language. In a recent comprehensive monograph of peer interaction, for instance, Philp et al. (2014) argued that peer interaction gives learners 'a context for experimenting with the language' (p. 17). In addition, peer interaction offers a psychological benefit. That is, an increased comfort level may positively affect learners' L2 processing by helping them notice errors in their partners' speech, correct those errors, and modify their own errors when given feedback. Moreover, a greater comfort level seems to increase the amount of overall language production, which leads to more opportunities for language practice. Philp et al. (2014) asserted that peer interaction is 'generally felt to be less stressful than teacher-led interaction, precisely because it will not be carefully monitored' (Philp et al. 2014: 198). In Sato's (2013) study of learners' perceptions of peer interaction, learners explained that they did not have to worry about making errors while talking to each other, especially in comparison to a teacher-centered conversation.

However, Tomita & Spada (2013) found that social context was an important factor in classroom interaction among Japanese high school learners of English. Students sometimes chose not to communicate in English during peer interaction because using English was socially stigmatized as showing off. However, if learners could position themselves as

incompetent learners who struggled with the language, then using English was more socially acceptable. A similar finding was reported by Yoshida (2013), who investigated the relationship between learner beliefs and actions. Learners of Japanese at an Australian university expressed that although they believed that participation improves speaking skills, a lack of confidence related to accuracy inhibited their actual participation. To this end, Storch (2002) suggests that learners' level of comfort may depend on the relationship that a pair or group of learners construct together. Indeed, Sato (2016) examined the relationships among (a) learner psychology towards interlocutor and/or task, (b) peer interaction patterns, and (c) developmental outcomes, and discovered that the learners who approached peer interaction with a positive mindset tended to engage with the tasks and benefited from interaction more than those who exhibited a non-collaborative mindset.

Arguments suggesting that peer corrective feedback should be discounted because of its poorer quality compared to teacher feedback have been investigated. Adams (2007) analysed dyadic interactions between adult ESL learners. Based on the feedback episodes, Adams developed a tailor-made posttest. Results showed that 59% of feedback led to learning across different linguistic structures, showing a positive role of peer feedback. However, in another study, Adams, Nuevo & Egi's (2011) correlation analyses between the frequency of feedback received by learners and their gain scores showed that the provision of explicit corrections and the development of past tense were significantly negatively correlated. The researchers concluded that 'feedback may not play as important a role in learner–learner interaction as it plays in native speaker–learner interactions' (2011: 56). In a classroom setting, Sato & Lyster's (2012) experiment showed positive effects of peer corrective feedback. In this study, learners were trained to provide feedback to each other in order to compensate for the weaknesses of peer feedback (e.g. infrequent, inaccurate, or unfocused feedback). This intervention resulted in an increase in grammatical accuracy. The researchers explained the effect by invoking Levelt's (1983) perceptual loop theory and proposed that peer corrective feedback serves a dual function and benefits both the provider and the receiver. That is, in order to provide corrective feedback to their classmates, learners need to notice errors in their classmates' speech first. This monitoring process facilitates L2 learning in the provider (see also Naughton 2006; Fujii & Mackey 2009; Sato & Ballinger 2012; Fujii, Ziegler & Mackey 2016; Sato 2017).

These varied findings underscore the importance of a classroom environment where learners' collaborative interaction is encouraged and, possibly, explicitly taught. In such an environment, learner psychology may be aligned to psycholinguistic processes conducive to L2 development. Indeed, the relationship between interaction and learner psychology has been under-investigated, although as early as 2000, Dörnyei & Kormos (2000) argued that 'all the cognitive and linguistic processes discussed in the L2 task literature depend, to some extent, on this initial condition [task attitudes]' (p. 281). We will turn to this topic when we discuss individual differences.

3.3 L2 proficiency

Interaction may be influenced by the proficiency levels of the interlocutors (e.g. Yule & Macdonald 1990; Leeser 2004). Two groups of studies have investigated the proficiency

effect on interaction patterns as well as on L2 learning. The first group compared learner pairs of the same or different proficiency levels (Same vs Mixed). In this area of study, some research has reported that pairing learners with different proficiency levels promotes beneficial interaction. For instance, Kim & McDonough (2008) examined peer interaction of adult Korean learners and found that mixed pairs resolved language-related issues more successfully (especially for lexical LREs). However, in one of the earliest studies on interaction and proficiency, Yule & Macdonald (1990) found that different proficiency pairings resulted in more frequent and more successful interaction only if the lower proficiency had a dominant role in the interaction. In Watanabe & Swain's (2007) design, the learners were paired with learners with both higher and lower proficiency. Their analysis on the degree of collaboration (the quantity and quality of LREs) indicated that learning outcomes were mediated more by how collaborative a pair was than by interlocutor proficiency levels. Having found a similar effect for collaborative interaction, Storch & Aldosari (2013) concluded that to understand the relationship between proficiency levels and L2 learning, 'it is not only proficiency difference which needs to be taken into consideration, but also the kind of relationship learners form when working in pairs' (p. 46).

Meanwhile, other researchers have paired learners with the same proficiency level and compared high and low proficiency pairs (High vs Low). The findings from these studies have been mixed as well. Williams (2001b) analysed the amount and types of LREs that occurred between adult learners of English. Results indicated that higher proficiency pairs produced more LREs and benefited more from the LREs, as evidenced by learners' scores on tailor-made posttests. Williams claimed that higher proficiency learners can pay more attention to formal aspects of the target language (see also Williams 2001a). Similarly, Nassaji (2013) found that advanced learners benefited more from focus on form episodes (FFEs, which are similar to LREs) than did beginner or intermediate learners, even though there were not substantial differences in FFE frequency, with 39% occurring in beginner, 24% in intermediate, and 37% in advanced level classes.

However, Iwashita's (2001) study with adult learners of Japanese failed to show such an effect for proficiency. She quantified the amount of corrective feedback and subsequent modified output that learners produced. The comparisons between pairs with different proficiency levels did not detect any statistical differences. Furthermore, Oliver's (2002) study of younger learners found that the lower the proficiency of a pair, the more negotiation for meaning (more clarification requests and confirmation checks) that occurred. Contrary to Williams (2001b), Oliver argued that when a dyad's proficiency is low, there is 'a greater chance that communication breakdown will occur and, hence, a greater need for the use of negotiation strategies' (2002: 107). Sato & Viveros (2016) compared intact EFL classes in a high school in Chile that had been divided into high and low proficiency classes. Their analysis of the recorded communicative group tasks suggested that the learners in the lower class engaged in more language-related collaboration. The researchers explained that the difference was caused by the degree of collaboration rather than the interlocutors' proficiency levels, supporting the claims made by Watanabe & Swain (2007) and Storch & Aldosari (2013) regarding collaborative interaction and L2 learning.

3.4 Individual differences

There are a number of interlocutor individual differences that have been posited to influence interaction, although the amount of research varies depending on the characteristic (Robinson 2005; DeKeyser 2012; Mackey et al. 2012; Baddeley 2015; Li 2017). Individual differences that have received more attention include (a) anxiety, (b) cognitive abilities, including language aptitude, and working memory, (c) willingness to communicate, (d) learner beliefs, and (e) age.

Anxiety, which has been described as 'the subjective feeling of tension, apprehension, nervousness, and worry' (Horwitz, Horwitz & Cope 1986: 125), may affect L2 interaction. Specifically, Horwitz et al. refer to communication apprehension, a type of state anxiety that occurs in specific contexts, which may hinder learners' ability to process input and produce output during L2 interaction (Sheen 2008). Considerable research has investigated L2 anxiety (see Dewaele 2017 for an overview); however, only a handful of scholars have examined the effects of anxiety within the interactionist approach. One of the first, Sheen (2008) examined anxiety and corrective feedback with ESL learners in the US, finding that low-anxiety learners benefited more from feedback than did high-anxiety learners. Similarly, Rassaei (2015) found that low-anxiety EFL learners were more likely to perceive the corrective nature of feedback than were high-anxiety learners.

However, not all interaction studies have found an influence for anxiety. For example, Révész (2011) used questionnaires to assess learners' anxiety and investigate any moderating effects on learners' production of accurate and complex language during simple and complex tasks. Surprisingly, Révész found no impact for high anxiety on task performance. Finally, in a study investigating the effects of interaction context on L2 anxiety, Baralt & Gurzynski-Weiss (2011) compared the levels of anxiety of L2 Spanish learners as they engaged in one-on-one task-based interaction with their instructor either face-to-face (FTF) or through computer-mediated communication (CMC). They used an anxiety questionnaire, which they administered to learners half-way through the task, and then again at the end of the task. They found no differences in anxiety levels between modalities or at the two different times of measurement. While these studies indicate that anxiety may influence the effectiveness of interaction for L2 acquisition, they also point to the need for more studies to investigate factors affecting learner anxiety in order to ameliorate them during interaction.

Another area of individual differences that has begun to receive attention in interactionist research is cognitive differences in, primarily, language learning aptitude and working memory. More generally, language learning aptitude has a relatively long research history in SLA (Carroll 1981, 1990) and has been defined as a set of cognitive abilities, such as language analytic ability, phonetic coding ability, and rote memorization, that are 'predictive of how well, relative to other individuals, an individual can learn a foreign language' (Carroll & Sapon 2002: 23). Similarly, working memory, which 'involves the temporary storage and manipulation of information that is assumed to be necessary for a wide range of complex cognitive activities' (Baddeley 2003: 189), has a research tradition within SLA (see Juffs & Harrington 2012 for an overview), as well in the interactionist approach (Mackey et al. 2002; Sagarra 2007; Goo 2012; Mackey & Sachs 2012; Révész 2012). There have been suggestions that working memory may be a component of language learning aptitude (Li 2017), but

regardless, the important consideration for the interaction approach is the relationship between cognitive abilities and the effectiveness of L2 interaction.

The few studies of language aptitude and interaction seem to suggest that higher aptitude may be beneficial for interaction because of the generally more implicit nature of attention to language during interaction. One study by Li (2013) investigated the effects of cognitive differences on the effectiveness of implicit and explicit corrective feedback on implicit and explicit L2 knowledge of Chinese classifiers. For language analytic ability, which he operationalized as sensitivity to grammatical structures, as measured by the Words in Sentences subtest of the Modern Language Aptitude Test, Li found that language analytic ability was a significant predictor of grammaticality judgement test gain scores for the implicit feedback group but only on the delayed posttest. He concluded that 'in the absence of metalinguistic information, learners with higher analytic ability achieved more' (2013: 647). Thus, language learning aptitude may help compensate for the lack of explicit attention to language, whereas such aptitude is less important in more traditional classroom activities in which direct and explicit information is provided about the target language (see also Long 1996; Ranta 2002).

In a study of a suite of individual cognitive differences, Trofimovich, Ammar & Gatbonton (2007) examined learners' working memory, phonological memory, analytical ability, and attention control in relation to learners' ability to notice and benefit from recasts. Thirty-two Francophone learners of English received recasts on both grammatical and lexical items. Overall, learners were able to both notice and benefit from recasts, although there was considerable individual variability. The individual differences found to account for the gain scores were attention control, phonological memory, and analytical ability, with attention control being the strongest predictor. Trofimovich et al. concluded that 'in L2 interaction, attention control may characterize learners' ability to efficiently switch attention among different aspects of language or among different cognitive tasks, thereby determining learners' success in using interactional feedback' (2007: 194).

In terms of working memory, the hypothesis is that learners with greater working memory capacity may benefit more from interaction than learners with smaller working memory because higher capacity learners will be able to hold and access more linguistic information in their short-term cognitive system, which is particularly useful when, for example, comparing interlocutor feedback with one's own erroneous production (Mackey et al. 2002; Sagarra 2007; Goo 2012; Mackey & Sachs 2012; Sagarra & Abbuhl 2013). In Révész (2012), EFL learners in Hungary were divided into three groups: recast, non-recast, and control. L2 development was measured via a grammaticality judgement test, a written production task, and oral production tasks, while learners' working memory was examined by digit span, non-word span, and reading span tests each of which tapped into different subcomponents of working memory. Results showed that the subcomponents of working memory mediated the effects of recasts in different areas of L2 development. For example, significant correlations were detected between the gain scores of the oral description task and the digit span and non-word span tests, suggesting that, learners with high phonological short-term memory benefited from recasts in the area of oral production. Li's (2013) previously mentioned study also investigated working memory (operationalized using a listening span test) as a moderating variable in the effectiveness of implicit and explicit feedback on English L1

learners' implicit and explicit knowledge. He found that working memory was a significant predictor of grammaticality judgement test and elicited imitation test gain scores for the explicit feedback group but only on the delayed posttests. In another study, Kim, Payant & Pearson (2015) examined the impact of task complexity and working memory on the noticeability of recasts as well as the development of question formation. Regardless of the task condition (simple or complex), the learners received recasts during task-based interaction with a native speaker. They were instructed to repeat the last-heard utterance when the native speaker knocked on the desk twice. Noticing was measured by type of response after the knocks (e.g. full repetition of the recast). The analysis of oral production tests given three times revealed that working memory was the only predictor of the level of noticing as well as L2 development, suggesting 'the benefits of high WM [working memory] on the learning of morphosyntactic features during interactional tasks while receiving feedback' (Kim et al. 2015: 574).

The relationship between interaction and psychological individual differences has been a growing, yet under-investigated, area of research. For example, the link between motivation and interaction has largely been overlooked (Dörnyei 2002). In particular, task motivation, which explains 'why students behave as they do in a specific learning situation where they are carrying out a specific task' (Csizér 2017: 424–425), has been under-investigated (see Dörnyei & Kormos 2000; Kormos & Préfontaine 2016; Poupore 2016). Also, willingness to communicate (WTC), which concerns 'the probability that a learner will USE the language in authentic interaction' (emphasis in original: MacIntyre et al. 1998: 558), could considerably impact learners' interaction behaviour (see MacIntyre, Burns & Jessome 2011). Cao and Philp (2006) compared learners' self-reported WTC and their classroom behaviour, finding little correlation between the two. In interviews, learners reported group size and self-confidence as two important factors influencing WTC behaviour. More recently, Cao (2014) argued that learner WTC is better viewed as dependent on 'dynamic situational variables' (p. 789) rather than as a learner trait characteristic.

Another individual difference that has received some attention pertains to individuals' beliefs about interaction. The underlying assumption is that if teachers and learners value interaction and see it as a useful activity, then they are more likely to benefit from it. However, if learners think that an L2 classroom should consist of explicit grammar and vocabulary instruction accompanied by different drills, then such learners may devalue interaction and be less likely to benefit from it. In two early studies, Schulz (1996, 2001) examined the beliefs of students and teachers in the US and Colombia about grammar instruction and error correction. She found that students in both contexts valued error correction; however, teachers were much less positive about the provision of corrective feedback. Schulz commented that such a mismatch could possibly hinder language learning if students' expectations are not met. In another study, Loewen et al. (2009) investigated the beliefs of over 700 learners of various languages at a US university. They found that learners viewed corrective feedback and grammar instruction as different constructs, which is positive given the different effects of grammar instruction and corrective feedback on the development of L2 knowledge. Furthermore, Loewen et al. found that learners studying different languages had differing beliefs about interaction and corrective feedback. For example, ESL learners were the most positive about interaction compared to foreign language learners. Such positive beliefs may

incline learners to be more receptive to interaction in the classroom, thereby increasing its benefits (see also Lasagabaster & Sierra 2005; Brown 2009). Importantly, unlike other individual differences pertaining to individuals' capacities (e.g. WM), learner beliefs may be altered by instruction. Sato's (2013) ten-week intervention, designed to raise learners' awareness of the effectiveness of peer interaction and peer corrective feedback, showed that learner beliefs positively changed over time, which was reflected in the increased provision of peer corrective feedback. Certainly, intervention research designed to enhance positive psychology is called for (see MacIntyre & Gregersen 2016).

Learners' age is another individual difference that is important to ISLA as instructors may adjust their teaching strategies according to the students' age groups. While there exists abundant research as to how the age of acquisition affects the ultimate attainment (see DeKeyser 2017b), investigation of the relationship between age and L2 interaction has been limited partly because of the methodological difficulty in teasing apart L2 development from children's general psychological and emotional development as well as L1 development (Oliver, Nguyen & Sato 2017). However, Oliver and colleagues' studies (Oliver 2000; Oliver & Mackey 2003; Mackey, Kanganas, & Oliver 2007) have shown that children and adult learners benefit from interaction in different ways. For instance, Oliver (1998) compared her dataset of 196 children, aged from 8 to 13, with that of the adult learners in Long (1983). While both age groups negotiated for meaning, Oliver found that the child learners used fewer clarification requests and confirmation checks. More recently, Oliver, Philp & Duchesne (2017) compared interactions between 11 pairs of younger (5–8 years) and 10 pairs of older (9–12 years) learners. Among several key differences, Oliver et al. identified learner's engagement as a mediating factor of the effectiveness of interaction. For example, depending on the topic of the task, older learners 'simply wanted to get the task done' (2017: 8), resulting in fewer instances of negotiation for meaning.

It is clear that learner individual differences may affect learner interaction, as well as the effectiveness of that interaction. However, there is still much that is unknown about individual differences and interaction. Only a few variables have been investigated, and these with only a handful of studies. In general, learner psychology requires further research as the way in which L2 learners approach communicative tasks may influence their interaction behaviour and determines the ultimate benefit of interaction (Sato 2016). Furthermore, individual differences such as personality and learning styles can reasonably be assumed to influence interaction (Dewaele 2017). How do more introverted or extroverted learners feel about and engage in interactive tasks? What are the effects of using more social learning strategies on interaction? One other new area of interaction research is individual creativity, with some studies suggesting that creativity can influence linguistic production during task-based interaction (McDonough, Crawford & Mackey 2015). These areas warrant further research.

4. Task characteristics

Apart from interlocutor characteristics, there are numerous task features that may impact interaction (e.g. Doughty & Pica 1986; Robinson 2001; Pica 2005; Keck et al. 2006; Pica,

Kang & Sauro 2006; Kim 2008; Tavakoli & Foster 2008; Jenks 2009; Kormos & Trebits 2012). In fact, in the task-based language learning and teaching literature, there has been considerable interest in the characteristics of tasks and the impact of these characteristics on interaction as well as L2 development (e.g. Bygate et al. 2001; Samuda & Bygate 2008; Ellis 2017b). Again, while some studies, particularly those conducted in the earlier years of the interactionist approach, were more descriptive in nature, there has been a growing concern with the impact of different types of tasks on interaction patterns and L2 development (e.g. Gurzynski-Weiss & Révész 2012; Baralt 2013; Nassaji 2013).

There have been several different conceptualizations of what constitutes a task (e.g. Skehan 1998; Ellis 2003; Long 2015); however, there is some consensus that several key features must be included in a task. The main focus of a task should be on communication and meaning rather than linguistic forms. Learners should use primarily their own linguistic resources, and the goal of the task should be non-linguistic in nature. This emphasis on communication is broadly in line with an interactionist approach.

When one considers task design, there are several key features to take into account, such as task conditions (e.g. information configuration, interactant relationship, and goal orientation), task complexity (e.g. more versus less complex), and task participation structure (e.g. dyad, small group, or whole class).

4.1 Task conditions

The ways in which information is distributed among learners, and the ways in which they must exchange information can impact learner interaction (Doughty & Pica 1986; Foster & Skehan 1996; Ellis 2003; Pica et al. 2006; Gilabert, Barón & Llanes 2009). For example, information configuration and interactant relationship refer to how the task information is held and shared among the interlocutors. In one-way tasks, generally one person has the task information and provides that information to other participants. However, in two-way tasks, the information is shared among the learners, and they must exchange that information with each other to complete the task.

In terms of goal orientation, tasks may be convergent, in which learners must agree on a specific outcome, or divergent, in which learners may hold different opinions regarding the task outcome. In general, information gap tasks are convergent, while opinion gap tasks are divergent. For example, Gilabert et al. (2009) investigated the effects of different tasks types on interactional features such as negotiation of meaning, recasts, and LREs. They found that a convergent map task, with only one possible solution, resulted in more negotiation of meaning than did more divergent tasks. Similarly, Gass et al. (2005) found that task type was the primary factor that significantly affected interaction in their study of L2 Spanish learners. Their consensus task resulted in learners' interaction containing fewer interactional characteristics than did their picture differences and map tasks, a difference that the researchers attributed to presence or absence of required information exchange. In the consensus tasks, both interlocutors had only to provide their opinion about a set of information that they shared in common. In the other two tasks, the interlocutors had different pieces of information that they had to exchange in order to complete the task.

The necessity of exchanging information, rather than expressing opinions, resulted in more interaction.

However, Newton (2013) found slightly different results in his investigation into vocabulary use during convergent, information gap tasks and divergent opinion gap tasks. He found that in the information gap task, one of which asked learners to exchange information about the location of animals in a zoo, learners were less likely to negotiate meaning than when they had to share their opinions. Newton suggests that the learners were able to complete the information gap task rather mechanically, while in the opinion gap tasks, the learners had to focus more on the meaning of each other's utterances.

In general, the amount of information each learner holds and the way in which the information is exchanged during interaction have an impact on interaction behaviour. As those features can be manipulated by task designs, this research warrants further investigation so as to provide classroom learners with more effective tasks.

4.2 Task complexity

Another task characteristic that has received considerable attention is task complexity (e.g. Robinson 2007, 2011; Révész, Sachs & Hama 2014), which Gilabert & Barón (2013) define as 'the internal cognitive demands that language tasks impose on learners' processing and language use' (p. 45). Thus, task complexity is affected by the attention, memory, and reasoning demands imposed by the task. Task complexity has been operationalized in several different ways. In one study, Kim (2012) used $+/-$ reasoning demands and $+/-$ few elements, in tasks with three levels of complexity (simple, +complex, and ++complex). For instance, to complete a task called 'university students' part-time job,' learners in the simple group had to exchange information about university students provided on activity cards, while learners in the ++complex group were required to recommend appropriate jobs for those students based on their profiles. In another study, Révész (2009) used $+/-$ contextual support, in which learners had to narrate stories either with or without the aid of accompanying photos. Finally, Baralt (2013) used $+/-$ intentional reasoning, which 'requires reflection on the intentional reasons and cognitive mental states that cause other people to do certain actions' (p. 698). For instance, in completing a story-retelling task, the simple-group learners were provided with a series of pictures with thought bubbles which contained information; however, this information was hidden for the complex-group learners.

The results of studies on task complexity and interaction have been mixed. For example, Baralt (2013) examined learner interaction on more or less complex tasks in both FTF and written synchronous CMC contexts, with learners receiving recasts on their erroneous use of the Spanish past subjunctive. She found that learners perceived difficulty based on the modality of interaction rather than on $+/-$ intentional reasoning. Thus, learners thought the task was more difficult if they had to do it FTF, even if they had to provide their own intentional reasoning. Also, engaging in the more complex task resulted in more learning for the FTF group but not the CMC one. Baralt argues that the combination of the recasts and the CMC environment, especially the disjointed feedback that occurs in written chat, was

cognitively overwhelming for the learners, thereby blocking the expected benefits of more complex tasks.

In another study, Gilabert & Barón (2013) investigated task complexity and pragmatic moves in dyadic interaction. They triangulated their own operationalization of complexity (i.e. tasks with more or less complex reasoning demands and time on task) with learners' impressions of difficulty, based on the amount of time learners thought they had spent performing the task compared to the actual time on task. All three measures were found to correspond to each other. As for the effects of complexity on pragmatics, learners produced a greater number of pragmatic moves in the more complex tasks; however, there was a task effect for the types of pragmatic moves that were used. Conditionals were used more frequently in the complex task than in the simple one, and *want* statements occurred in the simple task but not the complex one.

Task complexity has received much attention from cognitive-interactionist researchers. Nonetheless, the research often lacks clear pedagogical implications, especially with task complexity being operationalized in multiple ways. Future research may benefit from examining actual classroom materials or by implementing tasks with differing complexities in real learning settings.

4.3 Task participation structure

Task participation structure includes whole class, small group, and dyadic interaction. Generally, whole class interaction, and sometimes small group interaction, involves learners interacting with the teacher, while dyadic interaction, and small group interaction generally involves learners interacting with their fellow L2 speaking peers. Another issue is whether learners are direct participants in or observers of the interaction.

Nassaji (2013), in his investigation into task participation structures, found that incidental focus on form occurred more frequently in whole class interaction. Also, preemptive FFEs occurred more frequently than reactive ones. However, student-initiated FFEs occurred more frequently in small group and dyadic interaction, while teacher-initiated FFEs were more common in whole class interaction. Nassaji investigated the effects of FFEs by using tailor-made post-hoc tests. Overall, students responded correctly 58% of the time; however, accuracy was greater if the FFEs occurred in dyads or small groups (69% and 66% respectively) than whole class interaction (48%). Furthermore, student-initiated FFEs had a 72% accuracy rate, while teacher-initiated had only a 46% rate. Nassaji concluded that 'although the majority of FFEs occurred in whole class interactions, learners were more likely to benefit from FonF [focus on form] when it occurred in small group and one on one interactions' (2013: 861–862). Whole class contexts may limit learners' opportunities for interaction and attention to language, in part because more individuals are involved in the interaction.

There are other aspects that influence interactional participation structures. For example, McDonough & Hernández González (2013) found that pre-service teachers tended to dominate interaction in conversation groups organized by the researchers specifically to provide communication opportunities for the learners. The groups had between 2 and 16 learners, with a median of 8; consequently, the groups may blur the line between whole class

and small group interaction. Nevertheless, learners produced less than 25% of the total words, suggesting that interaction with a teacher may not provide the best interactional opportunities. Alcón's (2002) comparison between peer interaction and learner–teacher interaction also exhibited a similar phenomenon in the classroom. Her observation of EFL classes (one teacher-led and the other peer interaction focused) indicated that learners employed more requesting strategies with each other (i.e. a type of feedback) than when they interacted with the teacher (see also Toth 2008).

Furthermore, in small group and whole class interaction, it is possible that not all learners engage directly in interaction or negotiation for meaning (e.g. Foster 1998). For example, Loewen (2003) observed that not all students in his New Zealand ESL classes participated equally in FFEs. In fact, roughly 13% of students were not involved in any direct exchanges, suggesting that any benefit for them would have to come through observing the interaction of others. Indeed, recent research has begun to investigate the effects of learners engaging directly in interaction or being an observer of interaction. For instance, Fernández Dobao (2016) focused on a silent learner during group work. By examining participation patterns (LREs) as well as their subsequent impact on L2 learning, she discovered that the silent learner benefited from interaction as much as those who actually produced language. She argued that being active listeners (observers of LREs) can help learners acquire new linguistic knowledge, possibly by engaging in sub-vocal private speech.

In another study, Yilmaz (2016) examined the effects of learners receiving feedback on errors that they themselves made (direct condition) or errors that their fellow students had made (indirect) on two different Turkish linguistic structures. Yilmaz found that for the plural morpheme both receivers and non-receivers outperformed a comparison group on immediate and delayed production tests, but only the receivers outperformed the comparison group on the recognition test. In addition, the receivers outperformed the non-receiver group on all but one test. However, for the locative morpheme, there was no difference between the receivers and non-receivers. Also, neither group outperformed the comparison group. In another study, Philp & Iwashita (2013) examined learners in task-based dyadic interaction to see what interactors and observers noticed, and to see if their role in the interaction affected noticing. Seventeen students interacted, while nine observed a DVD of interaction. Noticing at the level of awareness was measured through stimulated recall and exit questionnaires. Interactors commented more on the target (French gender agreement/passé composé) and other linguistic structures than did the observers. The observers commented more on comprehension, participants' feelings, and task strategies. Half of the participants, regardless of group, reported noticing the target forms after or during participation.

Due to the somewhat differing results, more research is needed to explore the differences between engaging directly in or observing interaction, especially in contexts where interaction occurs more often in whole class contexts. In this sense, Batstone & Philp's (2013) discussion of private spaces may be relevant. The researchers distinguished classroom interaction in public and private spaces. Public spaces are open and include teacher-led interaction as well as subgroup work in which discourse is meant for all members of the group. Private spaces included only specific members and are not open to the larger group. Batstone & Philp argued that such private talk has a compensatory function in that it allows learners to relate the larger interaction to their own learning needs.

5. Linguistic targets

The role of linguistic structures during interaction varies, with some tasks allowing interlocutors to target linguistic structures incidentally, while other tasks attempt to draw learners' attention to specific forms (Ellis 2003). Additionally, not all aspects of language have been found to benefit from interaction equally (e.g. Mackey & Goo 2007).

One mediating factor impacting learners' success in L2 development during interaction may be the saliency of certain linguistic features. Saliency of a particular linguistic structure during interaction can be controlled by instructional interventions, for instance, giving learners tasks designed to elicit specific linguistic features (i.e. focused tasks), exposing them to certain features to facilitate production of the same structures later (i.e. priming), or drawing their attention to certain features by providing corrective feedback. In this sense, DeKeyser (2012) discussed the relationship between instruction and linguistic structures and argued that 'different structures have a differential need for instruction, in particular instruction designed to enhance their salience (by drawing learners' attention to the existence, patterning, and importance of the non-salient structures)' (p. 196). Additionally, Long (2015) suggests that the perceptual saliency of linguistic structures combined with learners' sensitivity to input can account for 'success and failure' (p. 60) in acquiring individual structures (see Gass, Spinner & Behney 2018 for a recent volume on saliency).

5.1 Incidental linguistic features

Research suggests that L2 learners, especially adult learners, struggle in acquiring features that are non-salient in input (e.g. VanPatten 1990, 2017a). This difficulty is evident from a body of research revealing that learners' attention is drawn to certain features more than others when there is no external manipulation, regardless of the target language (e.g. English: Mackey 2006; French: Ayoun 2001; Japanese: Loschky 1994). In general, learners tend to focus on lexical items over other aspects of language. For example, Williams (2001a) observed adult intensive ESL classes and found that more than 80% of LREs were lexical rather than morphosyntactic in nature. Similarly, Jeon's (2007) quasi-experimental study of English-speaking learners of Korean showed that conversational interaction was more beneficial for lexical features (nouns and verbs) compared to morphosyntactic ones (object relative clauses and subject–verb agreement). The influence of selective attention can be observed within different grammatical structures as well. For instance, Shintani (2014a) compared acquisition of English plural –s and copula be by providing young Japanese learners of English with focus on form tasks. The analysis of the productive knowledge tests showed that after nine lessons of 30 minutes, the learners gained knowledge of the plural –s but not copula be.

The differential impact of interaction on L2 learning depending on linguistic features has several explanations. First, the amount of exposure during interaction might be a factor affecting which features are more readily acquired. Collins et al.'s (2009) corpus study examined different degrees of saliency depending on linguistic structures when L2 learners were aurally exposed to them. The researchers compared different grammatical structures

(the simple past tense, the progressive, and the possessive determiners) and discovered that more difficult-to-acquire structures were not necessarily salient in the classroom input, implying that infrequent input may partially explain why learners struggle with those features. Second, the communicative value of linguistic features affects the developmental patterns of different features. That learners tend to attend to lexical items more than grammatical items can be explained by the fact that nouns carry more important value when negotiating for meaning (Spada & Lightbown 2008). In the same vein, Shintani (2014a) argued that learners acquired plural *–s* but not copula *be* because *–s* was necessary to complete the task. Third, the acquisition of particular features can be promoted by their saliency because learners' attention is drawn to more salient features. Perceptual saliency, however, is susceptible to the relationship between a learner's L1 and L2 as some morphosyntactic features may or may not exist in the learner's L1 system (see Tokowicz & MacWhinney 2005). Also, learner readiness may affect which features are more salient for a particular learner (Lightbown 2013).

5.2 Targeted linguistic features

While incidental focus on form does promote L2 learning (Loewen 2005), learning of different linguistic features can be facilitated by providing learners with focused tasks. Focused tasks elicit specific linguistic features, either by design or by the use of methodological procedures that focus attention to form during the implementation of the task. Ellis (2003) separates focused tasks into three types: structure-based production, comprehension tasks, and consciousness-raising tasks, among which structure-based production pertains to interaction. Structure-based production tasks are designed to incorporate specific linguistic features for learners to reproduce (e.g. dictogloss, picture differences, picture description, and story completion tasks). For example, Fortune (2005) examined four dictogloss tasks. Eight advanced EFL learners from various L1 backgrounds worked in pairs to reconstruct texts. Although learners were not required to use the same type of syntactic structure or lexical items from the text, the analysis of the LREs revealed that the learners' attention was successfully drawn to the linguistic targets as shown by the metalanguage they produced (see also Leeser 2004).

There exist pedagogical challenges in eliciting specific linguistic structures through focused tasks. First, tasks often do not work as the teacher planned. Breen (1987) observed differences between outcomes derived from task design (task-as-workplan) and actual outcomes derived from learners (task-in-process). He argued that this divergence resulted from an unpredictable interaction between the learner, task, and situation. In other words, learners may arrive at a task with different assumptions about their roles and the demands of the task. Second, tasks may not work in the way they were designed (but see Ellis 2017b). Collins & White (2014) analysed classroom interaction of Grade 6 ESL learners in Quebec and discovered that certain features (e.g. possessive determiners) were more difficult to elicit even when the task was designed to do so (e.g. talking about family members). Consequently, relying on tasks to elicit specific linguistic features may be less than ideal.

Priming may be another effective way of manipulating learners' production of specific linguistic features. Among different types of priming (see Trofimovich & McDonough 2011), syntactic priming concerns elicitation of specific grammatical features, and is described by

McDonough & Mackey (2008: 32) as 'a speaker's tendency to produce a syntactic structure encountered in the recent discourse, as opposed to an alternate structure'. In order to test whether priming is effective in eliciting certain grammatical structures, researchers select a structure with several alternative forms. Then, learners are provided with primes of only one alternative to see if their production patterns change and they start to use the primed structure. For instance, Thai EFL learners in McDonough & Chaikitmongkol's (2010) study often alternated between two *wh*-question structures, one of which is grammatical (e.g. *how do people damage their health?*) and the other ungrammatical (e.g. *how people damage their health?*). The learners were provided with grammatically correct primes, which led to significantly more production of the grammatically correct alternative. More recently, McDonough, Trofimovich & Neumann (2015) tested three targets in the classroom context and revealed that priming was successful for relative clauses and adverbial clauses but not for passives. They suggested that passives were easier to elicit in English for academic purposes classes and thus did not yield a significant difference between the control and experimental groups. In other words, the pedagogical strength of priming activities lies in the fact that they 'help students produce a difficult or infrequent structure' (McDonough et al. 2015: 78) in the classroom context.

It is perhaps unsurprising that vocabulary should figure so prominently in meaning-focused interaction, especially when learners are left to their own devices. Consequently, there may be less of a need for manipulation of lexical items before, during, and after interactive tasks, and a greater need to draw learners' attention to grammar. For example, Newton (2013) argues that 'communication tasks [are] a potentially valuable source of opportunities for incidental vocabulary learning' (p. 165) because learners are likely to encounter unfamiliar words. Newton examined learners' negotiation of lexical items in opinion gap and information gap tasks. He found gain scores of roughly 4 words per 30 minutes of task. However, there was also considerable improvement on vocabulary items that were not negotiated, leaving Newton to suggest that negotiation of meaning is only one way that learners can learn vocabulary during communicative tasks. He suggests that encountering words in context, as well as observing negotiation can have an influence. Zhao & Bitchener's (2007) observation of a university-level ESL class also revealed that vocabulary was the most attended linguistic aspect during both learner-learner and learner-teacher interactions, a finding that was confirmed by Simard & Jean (2011) who observed L2 classes of young learners (Grade 9 to Grade 12) of English and French.

Among a variety of focus on form techniques that teachers can utilize, corrective feedback has generated a considerable amount of research, as can be seen in the number of recent meta-analyses of corrective feedback (e.g. Russell & Spada 2006; Li 2010; Lyster & Saito 2010; Brown 2016). Two issues are relevant as far as different linguistic features and corrective feedback are concerned: (a) which linguistic features do teachers tend to react to more and (b) which linguistic features benefit most from feedback? First, a body of classroom observation studies examining different types of linguistic targets in different languages (see Loewen 2012) suggests that teachers tend to provide more corrective feedback on morphosyntactic errors than on other types of errors. Brown's (2016) meta-analysis of 21 studies showed that 43% of corrective feedback was directed to morphosyntactic errors, followed by lexical (28%), and phonological errors (22%). The reason for this tendency is as yet unknown. However,

Brown's (2016) moderator analysis revealed that the teaching context (second vs foreign language contexts) affected the linguistic foci: teachers in foreign language contexts focused on grammatical errors more than those in L2 teaching contexts. Brown's study also found that teachers with more experience tended to focus on lexical rather than pronunciation errors, suggesting a change in teachers' beliefs about which linguistic features to correct (Basturkmen, Loewen & Ellis 2004).

Contrary to teachers' tendency to provide feedback more on morphosyntax errors than on lexical errors, feedback effectiveness is more observable in the development of lexis than morphosyntax. Noticeability may explain this gap. Mackey, Gass & McDonough's (2000) stimulated recall data showed that feedback that was intended to correct lexical, semantic, and phonological errors was perceived more accurately than feedback targeting morphosyntactic errors (see also Egi 2007). In this sense, the nature of different linguistic features may affect the degree of noticeability. Among several studies that compared different linguistic targets, Yang & Lyster (2010) examined corrective feedback on English regular and irregular past tense. Having found differential impacts on the two forms, the researchers invoked Skehan's (1998) dual-mode system which distinguishes an analytic rule-based system (e.g. regular past tense) and a memory-driven exemplar-based system (e.g. irregular past tense). Yang & Lyster argued that the noticeability of irregular forms (e.g. *bought*) was higher than regular (e.g. *shopped*) and thus feedback affected the development of lexical items more easily than rule-based items regardless of type of feedback (recasts and prompts). In another study, Yilmaz (2016) found different effects for corrective feedback on Turkish plural and locative morphemes, which he attributed, in part, to their morphophonological differences. The plural morpheme has two allomorphs, while the locative has four. Yilmaz also suggests that the relationship between the participants' L1 (English) and Turkish might also play a part. English and Turkish plurality is similar, but locative expression is not. Finally, Li (2014) investigated relationships between feedback types, linguistic targets (Chinese noun classifiers vs perfective aspect particle *le*), and learners' proficiency levels. The results revealed that feedback effectiveness was mediated by linguistic targets. Li argued that proficiency levels may also have played a role. Because learners with higher proficiency had more cognitive resources, they were able to take advantage of feedback given on the non-salient aspect makers.

Several studies of focus on form have found that pronunciation is not targeted frequently during classroom interaction (e.g. Ellis et al. 2001a), which may be somewhat unexpected due to the influence of pronunciation in learner comprehensibility (Kennedy & Trofimovich 2017). Similarly, there has been a lack of research studies focusing on interaction and pronunciation; however, this lacuna is being addressed (see special issue of *Studies in Second Language Acquisition* Gurzynski-Weiss, Long & Solon 2017). For example, Parlak & Ziegler (2017), in an investigation of the effects of recasts on English lexical stress errors in FTF interaction and oral synchronous computer-mediated communication (SCMC), found no statistical differences in comparisons with control groups. However, the researchers found that the FTF recast group did alter vowel duration following feedback. Additionally, results revealed that learners perceived the SCMC context as being less stressful and more helpful for language learning. In the same issue, Loewen & Isbell (2017) investigated pronunciation-focused LREs in learner–learner FTF interaction and oral SCMC, finding that only 14% of LREs addressed pronunciation with 90% targeting segmental rather than suprasegmental

features. Prior to these studies, much pronunciation-focused interaction research has been conducted by Saito, who in a series of studies (Saito & Lyster 2012; Saito 2013; Saito & Wu 2014; Saito 2015), found mixed results for the effects of interaction and corrective feedback on pronunciation. For example, Saito (2013) found added benefits for form-focused instruction combined with recasts for L1 Japanese learners of English and their production of /ɹ/. However, Saito & Wu (2014) found only marginal effects for the addition of corrective feedback to form-focused instruction on Cantonese L1 speakers' perception of Mandarin tones. Finally, in another study, Lee & Lyster (2015) targeted perception of the /i-I/ distinction in English, comparing instruction alone with instruction plus corrective feedback. Participants were given five hours of instruction over five days, and the researchers found that the corrective feedback group improved more than the instruction alone group. These results suggest that pronunciation during interaction warrants more investigation.

Pragmatics is an area of linguistics that has been generally overlooked by interactionist researchers, especially in comparison to grammar and vocabulary. Consequently, Mackey et al. (2012) point to the need for further research in this area due to 'the fact that few studies investigating the effects of interaction have addressed pragmatic and phonological targets' (p. 10). For instance, Mackey & Goo (2007) were not able to include any pragmatics studies in their meta-analysis of interaction research; the studies included investigated only lexis and grammar. However, there have been several studies that have examined the effects of interaction on pragmatic development. For example, Alcón (2002) investigated the development of requests in teacher–student versus student–student interaction in Spanish EFL classes. Learners were presented with role-play contexts that necessitated the use of requests. In addition, they were provided with explicit instruction and recordings of interaction focused on requests. Learners in both groups improved in their use of requests; however, the student–student groups engaged in more interaction, while the teacher provided corrective feedback more often in the teacher-led group. In another study, Sykes (2005) compared the effects of interaction in three different modalities (written chat, oral chat, and FTF) on L2 Spanish learners' development of invitation refusals. Sykes found that participants in the written chat group outperformed the other two groups in producing more native-like refusals, a result she attributed to the additional processing time available in written chat interaction as well as the need for more linguistic responses due to the lack of paralinguistic features such as intonation and laughter. More recently, Gilabert & Barón (2013) examined the effects of task complexity on the production of request and suggestions by English L2 learners in Spain. They found that learners produced more requests in more complex tasks, and the linguistic forms used to produce the requests varied according to tasks. There is clearly a need for more investigation into the effects of interaction on the use and development of pragmatics (for a review, see Bardovi-Harlig 2017). Indeed, it is conceivable that task-based interaction could provide interactional opportunities for L2 learners that would allow them to experience a range of social contexts that are not typically found in the classroom (Eisenchlas 2011). In many cases, these social contexts might need to be artificially created.

Finally, very few studies within the cognitive-interactionist paradigm have investigated discourse level phenomenon or features that might be considered markers of interactional competence, such as turn-taking. One exception is Ziegler et al. (2013) who looked at the development of conversational features, such as overlapping speech, turn-taking and

floor-holding, during naturally occurring L2 German conversation groups. The study found that learners who adapted to the more German conversational style became more active interactors, while those who failed to do so became more passive, but they were still able to attend to the input and benefit from the interaction. All learners viewed the conversation groups as a positive experience. Due to the paucity of research in this area, there is a need for research that investigates the discourse level components of interactional competence to determine if the benefits of meaning-focused interaction that have been found to generally apply to grammar and lexis also apply to larger discourse level aspects.

6. Interactional context

6.1 Instructional setting

In the late 1990s and early 2000s, a series of studies investigated the occurrence of interaction characteristics in different instructional contexts. One of the earliest was Lyster & Ranta's (1997) description of the frequency and types of corrective feedback that occurred during communicative activities in a French immersion high school context in Canada. They found that the teachers provided a variety of feedback, which was subsequently categorized into six types, with recasts being the most frequent. The researchers also identified different learner responses in reaction to feedback (i.e. uptake). In following analyses of the same data set, Lyster (1998a, 1998b) examined more closely the types of corrective feedback that occurred, as well as the types of output that learners provided in response to different types of feedback. Results indicated that learner uptake occurred more frequently after output-prompting feedback, suggesting that recasts were less useful than other types of feedback during interaction in promoting L2 production.

A series of studies in New Zealand ESL classes for young adults (Ellis et al. 2001a, 2001b; Loewen 2004) also examined the types of corrective feedback and output responses that occurred during interaction. Results indicated that recasts were the most common type of corrective feedback, and successful uptake of the feedback occurred roughly 75% of the time. In a synthetic analysis of the data from Lyster's and Ellis et al.'s studies, Sheen (2004) compared the interaction that happened in those contexts with her own data from communication classes in Korea. She found that uptake rates in the Canadian context (Lyster & Ranta, French immersion: 54.8%; Panova & Lyster, Canadian ESL: 46.6%) were significantly lower than in New Zealand (80.4%) and Korea (82.3%). A similar tendency was found for the relationship between uptake and recasts: students in Korean and New Zealand contexts responded significantly more to recasts (82.5% and 72.9%, respectively) than did ESL (39.8%) and immersion (30.7%) students in Canada. The results suggest that contextual variables such as type of classroom and sociolinguistic status of the target language may affect how learners respond to corrective feedback.

These initial descriptive studies were important for understanding the occurrence of interaction in classroom contexts, and indeed there are still some recent examples of purely descriptive studies. For example, Bowles et al. (2014) examined the types of interaction that

occurred when L2 learners of Spanish performed tasks with heritage learners of the language. They found that interaction was largely similar regardless of whether the interlocutor was an HL learner or not. In another recent descriptive study, Basterrechea & García Mayo (2013) looked at the effects of instructional context on the occurrence of LREs, comparing content and language integrated learning (CLIL) and EFL settings in Spain. CLIL, a primarily European term, refers to 'the learning of a non-language subject through a foreign language where the subject and language have a joint role' (p. 28); it is similar to immersion programmes in North America (Lyster 2007). Basterrechea & García Mayo found that LREs were present in student interaction in both CLIL and EFL contexts, but there were more LREs in the CLIL context, suggesting that there were important differences between the two contexts (see also Llinares & Lyster 2014).

6.2 Modality

Although interactionist research has traditionally been interested in oral, as opposed to written, interaction, the use of technology in communication has expanded the purview of interactionist research. In particular, researchers have investigated the features and effectiveness of synchronous CMC (SCMC), both oral and written (e.g. Smith 2003; Sauro 2013b; Adams, Alwi & Newton 2015). Written SCMC occurs primarily as text chat, in which two or more interlocutors are present in an online forum where they can exchange typed messages. Several researchers have proposed advantages for this context (e.g. Sauro & Smith 2010), and in fact text chat has sometimes been referred to as communication in slow motion because the modality allows for learners to take more time as they communicate. This slower pace of interaction is proposed to benefit learners by giving them more time to draw on their explicit linguistic knowledge as they formulate their text. In addition, researchers argue that text chat can help with noticing because there is a written record for learners to refer to, thus allowing them to scroll back through the conversation to check on linguistic forms (Beauvois 1992; Smith & Sauro 2009).

However, some studies have found impoverished linguistic production in written SCMC, compared with FTF or oral SCMC. For example, Loewen & Wolff (2016) examined negotiation for meaning, LREs, and recasts in task interaction in the three abovementioned modalities. They found that the oral SCMC and FTF interaction had similar numbers of interactional features; however, the numbers were significantly reduced in the written SCMC condition. Similarly, Kim (2014) found that more communication strategies, such as circumlocution and direct appeal for assistance, were present in FTF communication, while more avoidance strategies occurred in the written SCMC context. Rouhshad & Storch's (2016) data also suggested that learners engaged in the task and with each other during FTF interactions than during text chat. However, Sauro (2013) examined written SCMC as part of an authentic classroom partnership in which US college students interacted with Swedish high school students. The US students were given specific linguistic forms to target during interaction, and were told to provide corrective feedback. Sauro found that attention to form did occur during the interaction; however, the provision of corrective feedback was not always consistent.

In a recent study, Saito & Akiyama (2017) investigated the longitudinal development of L2 English learners engaged in video-based negotiations for nine weeks with L1 English speakers, who were trained to provide feedback in response to comprehension difficulties. Results indicated that L1 interlocutors generally provided feedback as trained. Furthermore, the interaction 'seemed to have a significant impact on comprehensibility, fluency, vocabulary, and grammar but not necessarily accentedness and pronunciation' (2017: 23). Additional studies of such long-term computer-based interaction are needed.

In an effort to understand how SCMC affects noticing and/or L2 development, several studies have used self-report or eye-tracking data (see an overview in Michel & Smith 2017). For instance, Gurzynski-Weiss & Baralt (2014) found no difference in learners' accurate perception of feedback in either FTF (68%) or SCMC (71%). Learners were most accurate in their perception of lexical and semantic feedback regardless of modality. In addition, there were considerable differences in the number of times learners had the opportunity to modify their output in the two modalities – 91% in FTF but only 53% in SCMC. In an eye-tracking study, Smith & Renaud (2013) measured the amount of time learners gazed at corrective feedback during SCMC interaction. Learners fixated on corrective recasts 72% of the time, and there was a significant relationship between fixation and correct posttest scores for lexical and grammatical forms. Finally, Smith (2012) used both eye-tracking and stimulated recall to measure learners' attention to recasts in written SCMC. He found a strong, positive correlation between the two measures, with learners noticing semantic and syntactic features more than morphological ones.

Research has also compared levels of learner anxiety in FTF interaction and written SCMC. While Baralt & Gurzynski-Weiss (2011) found that there was no difference in learners' anxiety during either FTF or CMC interaction, Baralt, Gurzynski-Weiss & Kim (2016) reported mode differences related to learners' affective aspects. The researchers analysed the interactions in terms of cognitive, affective, and social engagement, and showed that, first, learners' level of attention to form (language awareness) was higher in the FTF mode. Second, learners' attitude towards the task was more positive in the FTF context. In addition, learners engaged with each other more in the FTF than in the CMC interactions.

In a meta-analysis of 14 studies, Ziegler (2016a) compared the effects of modality, whether SCMC or FTF, on interaction. Although there was a slight advantage for SCMC in terms of raw scores of L2 development tests, the meta-analysis did not reveal statistical differences between modalities, leading Ziegler to conclude that 'mode of communication has no statistically significant impact on the positive developmental benefits associated with interaction' (p. 2). Further studies investigating the ever-changing modalities of interaction can provide additional evidence in this regard.

Indeed, further research will surely continue to investigate these and other modalities of interaction, and as new modes of interaction appear, interactionist research will need to continue to extend its boundaries. For example, there are some studies investigating voice-based (Bueno-Alastuey 2013) and video-based CMC interaction (Yanguas 2010). Additionally, texting via cell phones is an increasingly popular means of communication; however, no studies, to our knowledge, have investigated this context in terms of features and effectiveness of L2 interaction.

7. Methodological issues

In order to ensure the validity and reliability of interactionist research, it is important to consider the methodological choices that are made (Plonsky & Gass 2011). This section reviews some of the primary methodological issues that face interactionist researchers as they investigate the impact of interaction on L2 development.

7.1 Laboratory and classroom research

L2 interaction can happen naturalistically outside of the classroom (e.g. Schegloff 2000), but it is interaction that occurs in pedagogical contexts and/or is manipulated in some way to promote L2 development that is of primary concern to ISLA researchers as they endeavour to determine the characteristics of input, interaction, and output that are most beneficial for L2 acquisition (e.g. Mackey 2012; Loewen 2015; Loewen & Sato 2017). Much research has been conducted inside the classroom, which provides high ecological validity and insight into the daily realities that face teachers and students as they interact. However, because it is difficult to control moderating and confounding variables in the classroom (Shadish, Cook & Campbell 2002), researchers have also used laboratory studies to investigate the nature and effectiveness of interaction. For example, Mackey & Goo (2007) found that 64% of the 28 studies in their meta-analysis were laboratory-based, while only 36% were conducted in a classroom.

The generalizability of laboratory research to the classroom has been questioned (e.g. Foster 1998; Eckerth 2009, although see Gass et al. 2005). Laboratory research may involve learners in heightened awareness of language forms, even if they are engaged in communicative interaction, because of the decontextualized nature and potential novelty of the tasks. Consequently, learners may engage in more noticing of linguistic forms, which may result in disproportionately higher levels of L2 development. Evidence suggesting a greater impact was found in Mackey & Goo's (2007) meta-analysis of 28 studies in which the effects of interaction on immediate posttests were greater in laboratory-based research. However, in contrast, Russell & Spada's (2006) meta-analysis of 15 studies did not find differences between the two settings. Subsequently, Mackey et al. (2013) commented that more authentic classroom research is needed – particularly quasi-experimental research, testing the effects of interaction on L2 development.

7.2 Descriptive and quasi-experimental research

There is a trend within interaction research for studies to become more interventionist over time. That is to say, early studies of interaction were primarily observational in nature (e.g. Gass & Varonis 1986). Some studies were primarily concerned with describing interaction, while others were correlational in nature, with researchers comparing the occurrence of interactional features to noticing or the use of target structures. However,

as the characteristics of interaction, and the variables that influence them, become better understood, the tendency has been for more quasi-experimental studies that manipulate specific variables to determine their effects on L2 development. Still, descriptive studies have not entirely disappeared as researchers continue to consider features affecting interaction that have not yet been investigated. For example, Bowles et al. (2014) is one of the first interactional studies to investigate HL learners in interactional dyads. Other descriptive studies have investigated the influence of technology on interaction (e.g. Loewen & Wolff 2016).

In terms of investigating noticing, there have been several different methods used, but they can be grouped into concurrent and retrospective measures. Concurrent measures are those that attempt to measure noticing as it happens during interaction. One of the least invasive ways of doing this is to look at interactional discourse for evidence of noticing. This is what studies of uptake have done (e.g. Ellis et al. 2001a; Loewen 2005) when they have looked at how learners responded to corrective feedback that was provided during meaning-focused interaction. These studies have argued on theoretical grounds that learners' production may provide some evidence that linguistic forms have been noticed (Lightbown 1998). However, these studies have acknowledged that discourse features are not equivalent to cognitive processes or to L2 learning. Consequently, it may be possible for learners to repeat corrective feedback without noticing the form, for example; conversely, just because learners do not produce the correct form does not mean that noticing has not occurred. Therefore, other methods of concurrent measurement of noticing have been employed.

One such measure involves learners responding to a research-provided stimulus, such as a knocking sound, at critical junctures in the interaction. Several studies (e.g. Philp 2003; Bigelow et al. 2006) asked learners to repeat what they had just heard after a recast, while other studies (e.g. Egi 2007) asked learners to report what they were thinking immediately upon hearing the stimulus. The former option is similar to the discourse measures mentioned in the previous paragraph, and the approach is predicated on the idea that learner production can provide evidence of noticing. However, that latter approach, in which learners are asked to state what they were thinking at that moment, provides additional information about the cognitive activities that learners are engaged in. Of course, here, noticing is measured at the level of awareness, with the assumption that learners will report, at minimum, something that they are aware of noticing. Or they may go one step further and provide evidence of noticing at the level of understanding.

Finally, in regard to concurrent measures of noticing, we should mention the role that technology is playing. For example, eye-tracking has recently been used to measure learners' noticing of linguistic features during written SCMC (Sauro & Smith 2010; Smith & Renaud 2013) as well as during online FTF communication (McDonough et al. 2015) under the assumption of an eye-mind link in which the focus and duration of eye gaze is said to correspond with cognitive attention (see, for a review, McDonough 2017). Other technology that may provide information about noticing during interaction is brain imaging; however, we are not aware of any studies that have examined this issue yet, probably because brain-imaging technique (e.g. event-related potentials (ERPs), functional magnetic resonance imaging (fMRI)) does not permit learners to engage in spontaneous interaction invoking different

cognitive functions (see Steinhauer 2014; Morgan-Short, Faretta-Stutenberg & Bartlett-Hsu 2015).

Although they can provide some indication about learners' noticing, concurrent measures are somewhat problematic, in large part because they often interrupt the flow of conversation. As a result, retrospective measures have been more popular in measuring noticing during interaction. One popular method is stimulated recall (Gass & Mackey 2000) in which learners are provided with audio or video recordings of their previous interaction, and they are asked what they were thinking at specific moments during the interaction. Studies of stimulated recall have found that different aspects of language, such as lexis and phonology, may be more likely to be noticed during interaction than morphosyntax (Mackey et al. 2000). In addition to stimulated recall, other retrospective measures include learner journals or responses to focused questions about the interaction. For example, Mackey (2006) used learning journals during class time, stimulated recall, and post-interaction written responses to investigating learner noticing. She found that learners' reports of noticing related to linguistic development in some areas (e.g. questions) but not in others (e.g. past tense). Mackey also found that while there was some correspondence in the noticing identified by the different measures, there were also discrepancies, leading her to suggest that noticing might be best viewed as a continuum. In the case of all retrospective measures, the challenge is to maintain the veridicality of the data, ensuring that the learners' subsequent data reports their thoughts at the time of interaction rather than at the time of reporting.

Some studies have triangulated data using both concurrent and retrospective measures of noticing. For example, Gurzynski-Weiss & Baralt (2015) examined the relationship between modified output and noticing by looking at the type of modified output that occurred and the reports of noticing that accompanied stimulated recalls based on corrective feedback. They found that partial modified output most accurately predicted correct noticing in both FTF and SCMC contexts. Full modified output also predicted accurate noticing, but only in FTF. Gurzynski-Weiss & Baralt argue that full modified output is not conversationally appropriate in SCMC contexts and often, if something is repeated in full, then it is more likely to be copied and pasted, which abnegates any effects for deeper cognitive processing.

8. Conclusion

The interaction approach, with its emphasis on input, interaction, and output, has been widely investigated within the broader ISLA framework, and theorists (Mackey et al. 2012; Pica 2013; Long 2015; Mackey & Gass 2015; Long 2017) have noted that there has been a shift from investigating IF interaction is helpful for L2 development to how and under what circumstances it is effective. Consequently, there is a need for ongoing research. First and foremost, Mackey et al. (2012) have pointed to the need for replication studies to support the findings of previous studies, particularly given the methodological shortcomings of many previous studies (Plonsky & Gass 2011). As Porte (2015) summarizes, replication studies can show 'how far we can separate knowledge from the particular circumstances of time, place,

procedure, or subjects which were part of the original experiment or study' (p. 140). Given the complexity of SLA and dynamics of ISLA in the classroom setting, replication studies of various aspects of interaction are warranted. A variable that has been found to influence the effect of interaction on L2 development is linguistic target (e.g. Brown 2016). While the benefits of interaction have been found for grammar and vocabulary, more recently studies investigating its effects on pronunciation have appeared (Derwing & Munro 2015). In addition, studies that explore the potentially beneficial effects of interaction on pragmatics are needed (Bardovi-Harlig 2017).

Individual differences affecting interaction is another important area for expansion. While it may not be feasible to deliver instruction attuned to individual learners in the classroom, research focusing on aptitude-treatment interaction (DeKeyser 2017a) will further our understanding of the effect of interaction on L2 development. Moreover, the interaction approach thus far has focused primarily on cognitive factors, but scant attention has been paid to social and sociocognitive issues (Toth & Davin 2016). Much research has investigated young adults in university contexts; more research on other populations, such as child learners (e.g. García Mayo & de los Ángeles Hidalgo 2017), HL learners (e.g. Bowles et al. 2014), refugees with limited L1 literacy (e.g. Bigelow et al. 2006; Bigelow & King 2016), and other 'non-traditional' students, would help extend the parameters of the interaction approach. Additionally, there are psychological differences (whether they be static or situational), for example related to task motivation and WTC, that can impact learner interaction (Yashima, MacIntyre & Ikeda 2016). The extent to which learners are engaged with tasks (engagement) is a growing research area as well (Cao & Philp 2006; Philp & Duchesne 2016; Sato 2016). Finally, the role of gestures during interaction has begun to receive attention. For example, Nakatsukasa (2016) found that the combination of gestures and recasts on English locative prepositions lead to sustained improvement on a delayed posttest compared to recasts without gestures.

Interactional contexts continue to develop as technology changes the ways in which individuals communicate, and interaction research needs to keep pace. Researchers have conducted a fair amount of research on, especially, written SCMC; however, more investigation into audio and audio-visual SCMC is warranted (e.g. Akiyama & Saito 2016). Even less attention has been paid to other types of technology-enhanced interaction, such as texting or game-based interaction, although these communication contexts are being used for L2 developmental purposes, and only time will tell how communication and interaction continues to evolve. Interactionist researchers will need to continue to explore the implications of such new modalities for L2 development.

In terms of research methods, there has been an important call for longitudinal research and delayed testing to investigate the sustainability of the effects of interaction. Other types of research methods, such as those employed in neuroscience research, can provide additional information about the cognitive effects of interaction (e.g. Morgan-Short et al. 2012).

Interaction plays a crucial role in SLA theory and pedagogy, and there appears to be no slowdown in this regard. Consequently, interactionist research will need to continue to explore how best to implement interaction so that L2 learners receive maximal benefit for L2 development and communication skills.

Questions arising

- What are some ways to enhance the effects of different components of interaction (input, feedback, negotiation for meaning, negotiation for form, output)?
- How does learner psychology moderate the effect of interaction? How should this topic best be investigated?
- What are some ways of transferring the findings from task-based research into pedagogical interventions?
- What are some methodological weaknesses of cognitive-interactionist research?
- What challenges do new methods of communication bring to interactionist research?

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