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Theory-based Support for Mobile Language Learning: Noticing and Recording

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Abstract—This paper considers the issue of 'noticing' in second language acquisition, and argues for the potential of handheld devices to: (i) support language learners in noticing and recording noticed features 'on the spot', to help them develop their second language system; (ii) help language teachers better understand the specific difficulties of individuals or those from a particular language background; and (iii) facilitate data collection by applied linguistics researchers, which can be fed back into educational applications for language learning. We consider: theoretical perspectives drawn from the second language acquisition literature, relating these to the practice of writing language learning diaries; and the potential for learner modelling to facilitate recording and prompting noticing in mobile assisted language learning contexts. We then offer guidelines for developers of mobile language learning solutions to support the development of language awareness in learners.

Index Terms—Diaries, language learning, learning journals, noticing, open learner modelling

I. INTRODUCTION

There is a large body of research on many aspects of second language learning, but often much of the relevant theory and empirical findings are overlooked by developers of language learning technology support. In this paper we consider ways to help the mobile language learner based on language learning research, focussing on explicit learner awareness of the language learning process.

In the course of acquiring a new language, learners develop an *interlanguage* [1] – internalised language rules which may match neither those of the target language, nor the equivalent rules of the learner's native language. We consider in this paper ways to help learners 'notice' features of the target language [2], and facilitate 'noticing the gap' between aspects of their interlanguage and the target language forms [3]. Awareness-raising about language has been suggested to help focus learner attention on language [4]; [2]. In the context of current communicative/meaning-focused language teaching approaches, it has been argued that priming *noticing* in input [2] through Task-Based Instruction, negotiation of meaning and 'focus-on-form' based on developmental sequences [5], can help language acquisition. While there is still no agreement on how language learning may best be facilitated through instruction, and despite the fact that the importance of noticing, or the extent of explicit noticing required for intake, have been debated [6]; [7],

some attention to language form is likely to be needed [8]. Furthermore, although whole-sale adoption of task-based 'focus-on-form' has been criticised on theoretical grounds and due to insufficient empirical evidence, the potential benefit of directing attention to language form as one of a repertoire of approaches, is still acknowledged [9].

Recent work on noticing confirms ongoing interest in approaches to prompt noticing to facilitate language acquisition in a range of contexts. For example, noticing has been explored with reference to oral output [10]; writing [11]; computer-based grammatical exercises [12]; and online text-based chat [13]. Researchers have developed a browser-based agent that assists learners in acquiring word collocations during unrestricted browsing of the Web - a 'noisy' environment in which the learner's attention needs to be drawn to examples of collocations that they might not otherwise have noticed [14].

In this paper we discuss how the second language acquisition literature on noticing can be harnessed to provide *theory-based support* to second language learners on their mobile devices. We first describe the traditional use of language learning diaries, then relate this to mobile language learning opportunities, and consider the benefits of modelling learner knowledge in this context. Finally we offer guidelines for designers and developers of mobile language learning software where the aim is to prompt learner reflection, metacognition and noticing.

II. EXPLICIT RECORDING OF NOTICING

It has been suggested that identification of what learners notice through collection of introspective data is likely to give a clearer picture of what learners attend to, than other methods might [15]. This section is in three parts. We first consider one of the traditional methods of encouraging learners to explicitly note aspects of language, or the language learning process: language learning diaries. Such diaries allow detailed (though often unstructured) insights into learner language. We then suggest how recording of noticed elements at the time of noticing might be facilitated using a mobile device, and how modelling noticing more systematically may further enhance the learning process in mobile contexts.

A. Language Learning Diaries

Language learning diaries are used by various parties involved in the second language education context. Diary studies have been defined as "first-person case studies" [16], and can provide insight into learners' explicit thoughts about their knowledge or the learning process: learners record aspects of their learning in their diaries,

which may include their thoughts, feelings and attitudes about their learning, or features of the target language that they notice. This is best done within an environment where learners have a certain degree of autonomy, i.e. the freedom to make some decisions about their learning such as taking responsibility for objectives, content, progress and method of learning [17]; [18]. The diary can be part of the formal learning process, but it can also be an informal or complementary activity.

Language learning diaries have been written by:

- *students*, to help focus their attention onto their language learning strategies [19], increase their language awareness [20] and promote reflection on the target language [21];
- *trainee teachers*, to encourage a reflective approach amongst trainees [22];
- *researchers*, providing examples of the potential of the diary approach [3].

In addition, diaries provide evidence of learning, and they can be used as part of a Year Abroad or placement experience. Teachers have used students' diaries to help them to better understand the needs of their students [23]; and the link has also been made between diaries and blogging [24].

In this paper we are interested in particular in the issue of facilitating and recording noticing [2]. As an illustration of the potential for language learning diaries for recording the occurrence of noticing, we present an example from a diarist quoted in [25]:

"Today was the day of el imperativo. No matter what I did or where I was, I kept noticing various types of imperative verbal forms. For example, on the bus I noticed a flyer encouraging people not to throw their trash on the street: 'No tires basura!' At the bus station, I saw another poster advertising a new Mexican movie 'Dame tu cuerpo'. On the return bus, I kept hearing how the parents were giving commands to their children: 'Dámelo!'" [25]

The above excerpt demonstrates the learner's increased awareness of the imperative form in the language input to which they were recently exposed. Presumably they had also been exposed to this previously, but only at the point of recording this information had they become explicitly aware of the imperative form to this extent. Such information can be used as a reminder for the learner and, of course, the act of formulating the entry for their diary may also help to consolidate their new knowledge. This information is also of interest to applied linguistics researchers who are investigating issues relating to noticing, and may also reveal useful information about their students, to language teachers.

We are interested in considering how this kind of explicit approach to noting language features may be facilitated in a convenient manner by new technologies. In the following section we expand on the above, suggesting how mobile learning applications could be usefully applied to facilitate the recording of noticing.

B. Recording Noticing using Mobile Devices

The growing popularity of personal technologies offers new opportunities for technology to support and transform language learning; technological advances have led to increased interest in educational use of mobile devices [26]. A key part of language learning for many learners is

a short or prolonged visit to a country where the language is spoken, for example: for business purposes, as a language student, or as a tourist. Personal mobile devices lend themselves to activities that take advantage of ready access to information and data collection in different contexts. For second language learners this includes being able to capture examples of language, in electronic form (e.g. using text or voice input), along with observations about how the language is used. This fits especially well with the idea of noticing aspects of language since, as illustrated in the excerpt from [25] above, noticing may occur in a range of locations at a variety of times, and from different forms of language input. The availability of a mobile device can facilitate the recording of noticing conveniently in different locations - i.e. learners can be supported as they notice during their daily routine, using a device that they would normally be carrying with them. Mobile scenarios include situations where learners can be unobtrusive observers of language in use; e.g., when travelling and listening to the radio or when attending an event such as a seminar or a conference.

Recording noticing in this manner is similar in essence to the use of a language learning diary. As indicated above, such diaries allow learners to explicitly record noticed language elements or other aspects of their learning. Recording noticed features with a mobile device 'on the spot' provides a different method of obtaining data on what learners notice to complement existing experimental approaches to researching second language learner processes [27], which may be of interest to Applied Linguists.

Allowing learners to tag noticed elements in a systematic way will offer additional benefits. Data collected through a convenient computer-based method can be made more readily searchable and easier to manipulate for *learners, teachers and researchers*: to facilitate noticing for the language learner and to facilitate data collection for the teacher or researcher. Data from a specific group can be used by teachers to inform their teaching for that target group, which may be especially useful for less experienced teachers; and data from an individual could, of course, help language teachers address specific needs of a student. Such a method of data collection could also contribute further evidence to the debate about the importance of noticing in language learning.

We therefore recommend the use of mobile devices to record noticing in a fitting and straightforward manner, to facilitate the development of explicit awareness of target language features to complement their other language learning activities.

C. Modelling Noticing

Given our assertion that mobile devices could be effectively employed to record noticing by the language learner, and the potential interest of this data to teachers and researchers, we suggest also that capturing this information in a learner model could be of benefit to all parties.

In order to adapt appropriately to the needs of the individual learner, adaptive learning environments maintain a model of the learner's understanding (e.g. knowledge, skills, difficulties, misconceptions), inferred from their actions in the environment (such as responses to questions, tasks of various forms, browsing, or requests for hints or help). This learner model is a model of *current*

understanding (i.e. it is not a performance score or list of correct/incorrect answers), and is typically used together with a model of the domain (the target features of the second language), to allow the environment to infer appropriate individually tailored teaching, coaching or guidance strategies to meet the student's specific current learning requirements. For example, the learner and domain models can be compared for the selection or generation of appropriate materials, feedback, exercises or tasks for an individual. Previous work has investigated the potential for modelling aspects of interlanguage and learner language, to assist learners in PC-based intelligent computer-assisted language learning environments (e.g. [28]; [29]). Such learner modelling could also be applied to mobile language learning diaries. Learners may not only record language elements that they notice, as described above, but these noticed items can also contribute to the learner modelling process. Using a mobile device, a student could record noticed elements at the time of noticing, to contribute to their learner model information - thus linking the traditional language learning diary approach to the learner model. Learner models to represent explicit knowledge of language features can be built, based in part on a learner's direct contributions, and in part on inferences made according to those contributions (e.g. the system can infer that if a learner has noticed Y, they probably already know X). Based on findings in the second language acquisition literature, a language learning environment could also predict how a learner is likely to progress (see [30] for a learner modelling example). This information could, for example, be used as a basis to prompt further noticing (e.g. by suggesting to learners what they should look out for next, given the current state of their knowledge).

Although the learner model is traditionally used to inform system adaptation to the individual, there is now growing interest in opening the learner model to the learner it represents, in an understandable form (i.e. an 'open learner model'). An important reason for allowing the learner to access their learner model content is to provide them with information about their understanding to prompt reflection on their knowledge, and on the learning process [31]; [32]; [33]. Often this is discussed within a framework of metacognition, but in language learning it relates closely to the second language acquisition literature on noticing (see above).

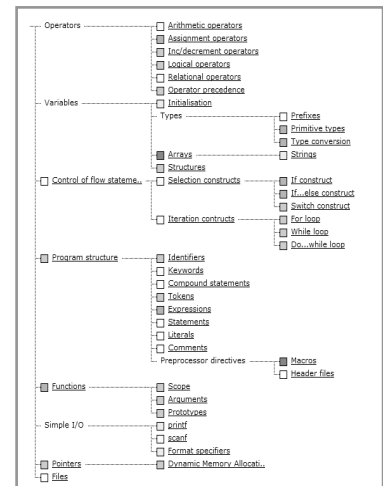
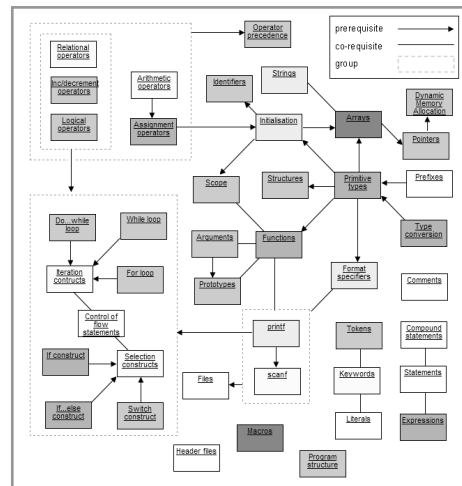
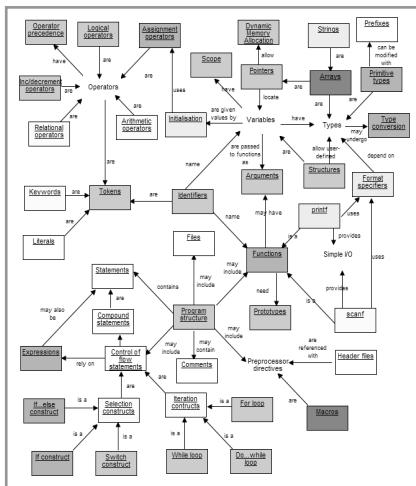


Figure 2. Three of the structured open learner model views of 'Flexi-OLM' (Mabbott & Bull, 2006).

Verbs having medial long vowels Your knowledge is: Very Limited

Example: Catherine (feel) **felt** sad when her father passed away.

Example: Our company (deal) **dealt** with many European countries in 1999.

Try: Sam (keep) **keep** **kept**/**kept** his car in the garage.

Figure 1. Excerpts from the open learner model of 'Notice' (Shahrouh & Bull, 2008).

Thus externalising the learner model to the language learner can be designed to help prompt noticing. Comparing their learner model to an expert/domain model of the relevant target language features [12] can also lead students to notice the mismatch between certain features of their interlanguage and the corresponding target language norms as in 'noticing the gap' [3], as a starting point to modification of their interlanguage.

This approach has been shown to have potential in language learning: it has been demonstrated with the *Notice* system that an open learner model can help prompt noticing using salience techniques to highlight learner model information, and that many of the learning gains made during use of the open learner model were retained one week after the experimental session [12]. Part of the *Notice* open learner model is shown in Figure 1, for one of the verb types modelled in the simple past tense. Highlighting is used to raise learner awareness of the target forms, with the colour of the highlight indicating the learner's level of understanding of application of that rule. (Here 'limited knowledge' is indicated by brown (boxed) text; the node preceding the type of verb is also brown; the verbs in the examples are highlighted to match the learner's level of knowledge. The final sentence shows the form(s) that the learner is using (currently three, thus these three are indicated in the sentence for the learner to consider). This aims to prompt the learner to 'notice the gap' between their output and the target forms [3].

Figure 1 is just one example of how an open learner model might be shown. Figure 2, from *Flexi-OLM* [34], illustrates three other open learner model structures for comparison (concept map, prerequisite structure and hierarchical relationships between concepts), which also use colour to indicate knowledge level. Further information about their knowledge can be gained by the user, by clicking on the coloured nodes.

The structures in Figure 2 are used in an open learner model for C programming, but suitable structured open learner models could also be defined for language learning. For example, they could be structured according to functions of language or grammatical forms; following the notion of natural developmental sequences [35]; or according to the likelihood of language transfer [36] with reference to the learner's native language, etc. Thus an open learner model for language learning need not necessarily be presented as in Figure 1.

Notice and *Flexi-OLM* are 'independent open learner models' [37] - learner models that are inferred in the usual manner, but that are not part of a larger tutoring system. A key purpose of independent open learner models, in addition to prompting knowledge awareness as described above, is to facilitate formative assessment and promote learner independence: rather than an environment inferring a learner model in order to be able to adapt the interaction to guide the individual user, the learner model is the core of the environment. Learner access to their learner model gives the user explicit insight into representations of their understanding, which they would not normally see (as in open learner models in general), but the primary aim is that they should use this work to overcome any difficulties. This focus fits well with [17] and [18]'s view of the mentioned above; and heightens the importance of learner responsibility and control over their learning as can be provided by open learner modelling [38]. While system suggestions for what to look out for according to the learner model information (see above) would be very useful in this type of language learning context, the particular focus on knowledge-awareness typical of independent open learner models, is especially relevant to noticing in language learning. Increasing the role of the learner model for promoting learner independence alongside helpful system prompts for noticing, would be particularly useful in a mobile language learning diary context.

III. COMPARISON TO EXISTING WORK ON LANGUAGE LEARNING SUPPORTED BY HANDHELD DEVICES

With a few exceptions (e.g. [39]; [40] and [41]), relatively little attention has focused on language learning environments that have the ability to adapt to the user's knowledge with reference to the mobile context. In this section we describe the general direction of current research in mobile language learning, and then highlight how the modelling of learner language might be beneficial in mobile situations where one of the goals is to prompt noticing or raise learner awareness.

As described by [42], mobile-assisted language learning (MALL) studies are divided between those that are largely content-based, i.e. focusing on delivering and evaluating traditional language learning content and exercises to learners in formal education, and those that concentrate on design issues related to developing new kinds of learning materials and activities specifically tailored for mobile devices and mobile contexts of learning. In the latter case, it is noticeable that learners are expected to take control of what they learn rather than having pre-defined learning delivered to them; however this approach is not yet widespread:

"Mobility and portability too often seem not to be fully exploited in the design of MALL activities... Many of the

studies ignored the 'anytime, anywhere' affordances supposedly offered by mobile devices; for example, SMS messages were sent to learners at set times, on set days... rather than learners being able to obtain this information as and when they wanted it." [42]

To take full advantage of mobility, some researchers have begun to design more personalised experiences relevant to language learners' changing circumstances and needs. References [40] and [41] describe a computer-supported ubiquitous language learning environment that interacts with sensors in the environment to provide learners of Japanese with the appropriate polite expressions for their current context. The system supports collaboration between learners via a bulletin board and instant messenger-like chat tool, so that learners are able to see who entered a particular expression and can use the communication tools to ask questions about it. To encourage learning from authentic and immersive contexts, [43] have designed a system that supports language learning activity on mobile devices tied in with watching everyday television programmes selected by the learner in their home. For those who are studying in a foreign country, it has been proposed that a mobile group blog can support enculturation through learner-driven sharing of observations about local language use and local customs [44]. What these strands of research have in common is a concern with providing support for understanding and producing language in specific contexts that correspond to learners' current needs.

In general, the approach of open learner modelling allows the creation of an individually personalised environment for use in a mobile context, suitable therefore for students at different stages of language acquisition, with different language backgrounds, and different individual difficulties. However, a primary aim of this approach is to gain some of the benefits found from the traditional paper-based language learning diary: facilitating the recording of language as it is used. This information may be helpful to language learners, teachers and researchers in a similar manner to the conventional diary; but the electronic form will enable additional search capabilities and easy access to information at times when the learner has a few minutes to spare to benefit from short learning opportunities between other scheduled activities [39]. The learner modelling may allow both adaptation to the individual learner in their particular mobile learning context and activities, and promote reflection and noticing from the student's recording of noticed features and the facility to view their learner model.

The modelling of learner language could be particularly beneficial in situations such as:

- students spending a period of study abroad, who are uniquely placed to notice local language use, e.g. within social circles and subcultures that are not readily accessible to outsiders
- professional updating among migrant workers who need to notice current phraseology, specialist terms and colloquialisms that are part of daily professional practice in their field
- continuous teacher development, where evidence from learner noticing can raise teachers' awareness and enrich their understanding of real language issues encountered in communication outside the classroom

IV. GUIDELINES DRAWN FROM THEORY

Based on the literature on noticing in language learning, much of which is based on the noticing hypothesis, and the relationship of this body of research to language learning diaries, we recommend supporting or prompting noticing and the explicit recording of noticing by learners. This can be achieved conveniently using students' usual mobile devices. We argue that this approach could be of use to several groups: the students themselves, to facilitate noticing; language teachers, to help them better understand the specific needs of individuals or a group; and applied linguistics researchers. Such an approach could be designed specifically to facilitate noticing in a particular context, such as the examples of studying abroad, professional updating and teacher development above, or could offer additional benefits embedded in other mobile-assisted language learning approaches. Based on an examination of the literature, our recommendations to application designers and developers of environments to support the recording and facilitation of noticing are:

- Listing typical difficulties of a targeted language group will help in the design of an environment to address the specific difficulties of learners - i.e. it can help in determining suitable language elements to suggest learners look out for in their daily activities and communications. These could be elements such as forms of address, question tags, modal verbs, prepositions, and so on; some will be location-specific, for example features of a dialect.
- Consideration of the processability of features at different stages of learning will assist in the identification of elements to look out for more generally. This can be done by targeting the language features that learners should be focusing on in the next stage of their language development.
- Familiarisation with the concept of 'noticing' in language learning will help in fostering explicit language awareness in learners, and highlighting the benefits of encouraging such awareness. This can be done, for example, by showing a video of learners describing what they have noticed and how it has helped them; this video can be made available on a learner's mobile device.
- The language learning diary literature will help in the familiarisation of how learners may naturally record explicitly noticed language features. This should assist in the design of an environment allowing learners to contribute information about their noticing, to suit the specific aims of a course; or for the inclusion of such an approach within a mobile-assisted language learning application.
- Inclusion of even a simple learner modelling approach. Opening the learner model to the learner, for them to view and contribute noticed elements to their learner model, will help individualise the interaction to suit the specific needs of the learner, and encourage formative assessment and reflection. Periods of commuting and travel would be conducive to such reflection.
- Consultation of the second language acquisition literature on salience techniques can help identify methods to direct learners' attention to elements of particular relevance in their learner model. [45] notes positive and negative salience techniques, namely increasing the salience of correct forms or words, or drawing attention to the learner's errors. This can be implemented by highlighting, boldening, underlining, capitalising or italicising text.
- Noticing may be more motivating and more effective if combined with opportunities to communicate with others about what has been noticed. Sharing open learner models with peers is one way in which spontaneous face to face discussion about learner knowledge may be facilitated. Instant messaging and social networking on mobile devices can assist this dialogue.
- Learners should be able to take control of what they learn, in the sense of being able to direct at least some of their learning towards goals that meet their individual needs, rather than relying entirely on pre-defined learning being delivered to them. This is in line with the independent open learner model approach, where there is a focus on learner responsibility, and suitable for the mobile assisted language learning context where goals can change focus in response to the learner's environment.

V. CONCLUSIONS

This paper has described some of the theoretical language learning literature relating to noticing and its effect on learner language; how this relates to the use of language learning diaries; and how this diary approach could be facilitated using mobile devices which learners will normally be carrying with them. An interest in noticing and the use of diaries or journals is consistent with current educational approaches that give primacy to formative assessment, learning journals [46] and reflective learning [47]. It is also in line with contemporary practices in teacher development that foreground the benefits of noticing in the context of researching one's own practice, in order to keep improving on an ongoing basis [48].

Based on our review of theoretical considerations, we offer guidelines for mobile learning researchers and system developers interested in explicit recording and facilitation of noticing - information of relevance to learners, teachers and researchers. Our guidelines focus on identifying language elements that learners can be encouraged to notice, promoting and illustrating the actual processes of noticing, enabling learners to reflect individually and collectively, and being open to the inclusion of learners' own goals. Researchers and teachers wishing to test the effectiveness of the guidelines would need to evaluate each of these aspects and consider the relationships between them.

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