The TATL framework for CALL development

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Abstract. The Theory Actions Techonology Learner context (TATL) framework provides an initial analysis tool to guide Computer-Assisted Language Learning (CALL) development. It entails joint consideration of four key factors that need to be considered prior and during development activities: (1) the underlying pedagogical theory; (2) the learning tasks arising from the theory; (3) the technological provision available for a given language; (4) the cultural context and cognitive style of the learner. The background to this proposal is based in the research and development of speech technology and CALL applications in the ABAIR initiative for Irish (*An Sintéiseoir Gaeilge,* www.abair.ie). Extensive evaluations of three multimodal interactive platforms have led directly to the formulation of the TATL framework.

Keywords: interdisciplinarity, personalised learning, future CALL environment, localisation, TTS synthesis, Irish, Gaelic.

1. Introduction

A framework is proposed, TATL, which aims to provide a 'master environment' for CALL development. It consists of four key factors which we propose should ideally be considered together at the planning and development stages in order to optimise the effectiveness of CALL applications. While much of the CALL literature in the past has been dominated by discussions of its history, its scope and of terminology issues (Davies, Walker, Rendall, & Hewer, 2012), we focus here rather on evolving a framework which can allow CALL development to proceed in a way that takes account of the theoretical and practical context.

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Underwood's (1984) characterisation of CALL as "letting computer whizzes first explore how the computer can do something particularly well and then design the program to take advantage of that" (p. 83) still rings true more than thirty years later. In the real world, CALL development, just like other educational development, occurs in a complex context which needs to be explicitly taken into account and the TATL framework is intended as a guideline that encourages this wider level of consideration for practitioners and developers. Clearly, technological innovation should come, not as a response to technical innovation as such, but rather as a response to pedagogical need, and be informed by pedagogical theory and by that branch of cognitive science which explores language learning/language acquisition. This puts the emphasis back on the learning, or on the cognitive modification experienced by the learner, as the central focus of the CALL endeavour. Furthermore, it is crucial that this be done in a way that takes account of the learner's context, level of language skill and outlook. From this perspective, the computer provides a means of delivering the desired content in exciting ways, rather than being the central focus.

2. Developing multimodal synthesis-based platforms for Irish

The present proposal draws on experience gained from research on the development and evaluation of interactive language learning CALL platforms which exploit Text-To-Speech synthesis (TTS) for Irish (Gaelic), a minority language (Ní Chasaide et al., 2011; Ní Chiaráin, 2014; Ní Chiaráin & Ní Chasaide, 2014, 2015). The ABAIR initiative has been developing speech technology resources for Irish, an endangered language (Moseley, 2010) which nonetheless as the first national language is taught to all schoolgoers throughout the Republic of Ireland.

Text-To-Speech facilities have been developed for the three major dialects of the Irish language. A major concern is to ensure that these are exploited for language learning purposes. To this end, a number of interactive synthesis-based platforms have been developed (Ní Chiaráin, 2014). The first, an interactive game, *Digichaint*, involves the learner in solving the mystery of a lost lottery ticket and this is done by interrogating a range of characters in a virtual reality setting. The dialogue is predetermined and at each turn there are a select number of conversational interactions from which the learner can choose. The second platform, *Fáilte go TCD*, is geared towards listening comprehension and the learner navigates a virtual reality scene, eavesdropping on groups of conversants. In the third platform, the learner converses with a conversational agent, a talking monkey, *Taidhgín*. Here,

the learner is free to create the language input. However, as we do not yet have speech recognition for Irish, the input is necessarily in text form, while the monkey speaks back.

These platforms were extensively evaluated in many schools by pupils and teachers. One of the major points to emerge from the exercise was the need for CALL developments to be embedded in a considered framework which explicitly recognises the intersection of requirements needed for effective educational resources.

3. The TATL framework

The complex environment which needs to be considered for the development of CALL applications can be summed up in terms of the following four key elements.

- **T**heory: the prevailing theory or theories of language acquisition.
- **A**ctions: learning activities prompted by the theory.
- **T**echnology: the current state of technological development, especially its capacity to deliver content appropriate to these actions.
- **L**earner context: this covers a multiplicity of factors, such as: the learners' engagement with the technology and its likely influence on their motivation to acquire the target language; learners' language level; cognitive style; sociocultural background and overall motivation.

3.1. Theory

The important point in our view is that developers of CALL applications be theoretically aware, so that at least the assumptions being made are explicit and open to scrutiny. This meta-awareness is all the more important because theory evolves and at present we have no unitary or incontrovertible theory of language acquisition. The dominant theoretical approach to language learning for many years now has been the communicative approach where the emphasis is on the functional use of the target language to communicate in a meaningful way. With the rapid growth in neuroscience there will undoubtedly be a constantly evolving understanding of the learning process.

3.2. Actions

The communicative approach emphasises the need for task-based learning, preferably involving a real-life or simulated real-life engagement between the learner and the system. Two of our platforms involved interactive tasks. The scripted game, *Digichaint*, allowed the learner to control the direction of the game, but the language content was predetermined (even if there were many choices at each turn). The second platform allowed open-ended input (though in text only), and users were tickled by the fact that the monkey appeared to understand and respond to them. This latter game turned out to be the most popular, perhaps not surprisingly as it comes closer to a real-life engagement, even if one does not habitually talk to a monkey.

3.3. Technology

As for Irish, the available technologies often impose limits on what can be provided in CALL. For endangered languages there is a vicious circle. Endangered languages have fewer technology resources available. The consequent lack of attractive teaching resources results in greater difficulties engaging and motivating learners.

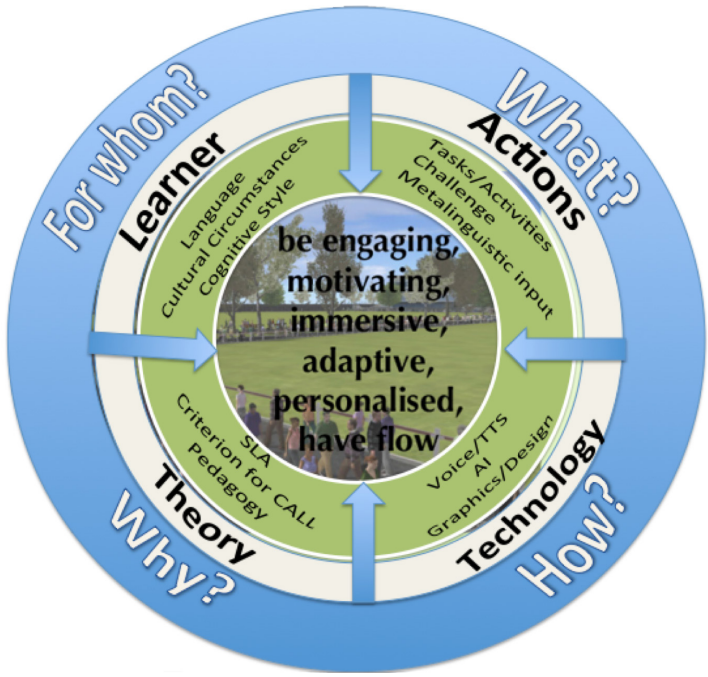
Nonetheless, technological deficits, such as the lack of recognition facilities for the *Taidhgín* conversing monkey platform can at least be partly overcome. In this case by using text input, the illusion of a 'conversation' was maintained. The fact that learners found the game to be highly entertaining is encouraging and will empower the evolving cycle of technological developments (here recognition) that will provide the possibility for true simulated dialogue partners.

3.4. Learner context

Within the TATL framework, personalisation of content, localising and adapting it to the needs of learners from a variety of socio-cultural backgrounds, levels and cognitive styles, is paramount. The circumstances in which the learning is taking place is critical. For example, a major challenge for Irish is that many learners have limited access to native speaker models and can often be poorly motivated.

In this context, high quality synthesis-based educational games can play a particularly crucial role: the former deficit is remedied at least partially by the fact that students are exposed to native level speech and the fun aspect of the interactive game has a positive impact on motivation.

Figure 1. Blueprint for a future CALL environment



4. Discussion and conclusion

Initial TATL analysis is intended to raise consciousness from the outset of what the limiting features of a particular CALL application are likely to be and thus, one can adjust one's goals, methods, etc. to take account of them, ensuring that they are, in so far as possible, 'fit for purpose'. The TATL analysis is also useful for those who, like our ABAIR group, are developing the underlying speech and language technologies that are likely to be used in downstream CALL applications, in order to provide useful guidelines as to where the deficits are most keenly felt and where the priorities should be. This goes hand in hand with involving educationalists and end users. The earlier this is done, the greater the potential educational value of the technological development. To this end, the ABAIR group, who are developing speech resources for Irish, use not only the TATL framework but also extensive collaboration and testing with end users.

TATL, at a high-level, underscores the need for interdisciplinary development, ideally involving the cooperation of linguists, pedagogues, engineers, graphics

and design experts. Ultimately, to ensure that the broader context guides CALL development, such an interdisciplinary approach should help ensure theory and technology take full account of the learner and the learner's context.

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