Taking Intelligent CALL to Task

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[A] Introduction

The title of this chapter gives rise to a two-part question: What is Intelligent CALL (ICALL) and what does it have to do with task-based language teaching (TBLT)? I will address this main question and focus on a number of subordinate and related issues such as: What kind of ICALL projects have relied on a task-based design? How was this done? What kinds of task processes have been considered in ICALL systems? What contributions has TBLT made to ICALL, which ones could it make? Which contributions could ICALL make to TBLT?

After a brief sketch of TBLT in the context of computer-assisted language learning (CALL), the central goals and approaches of Intelligent CALL – a subfield of CALL which utilizes artificial intelligence techniques – will be described in broad strokes. The main part of the chapter discusses a number of ICALL projects, evaluates trends critically from a TBLT perspective to ascertain what contributions ICALL can make and has made to task-based language teaching and how TBLT can and should inform and/or has informed research and development in ICALL. Doughty and Long (2003, p. 50) argue that:

> Task-Based Language Teaching … constitutes a coherent, theoretically motivated approach to all six components of the design, implementation, and evaluation of a genuinely task-based teaching program: (a) needs and means analysis, (b) syllabus design, (c) material design, (d) methodology and pedagogy, (e) testing, and (f) evaluation.

Arguably, Doughty and Long’s claim for teaching programs in general can be transferred to the analysis, design, development, implementation, and evaluation (Colpaert, 2006) of ICALL systems. In this context, a task is seen as a 'goal-oriented communicative activity with a specific outcome, where the emphasis is on exchanging meanings, not producing specific language forms' (Willis, 1996, p. 36). This definition appears to be widely accepted (see e.g., Bygate, Skehan, & Swain, 2001, p. 11).

In contexts with a more practical focus, however, a task is understood more broadly as a 'classroom event that has coherence and unity, with a clear beginning and an end, in which learners take an active role' (Cameron, 1997, p. 346). I will bear both Willis’ meaning-focused and Cameron’s broader, activity-focused definition in mind, when it comes to the discussion of ICALL design. The process of task performance, including pre-task (Willis, 1996, p. 42) and post-task activities (Skehan, 1998, p. 149), is seen as an activity system (Engeström, 1987; Mwanza & Engeström, 2005). With its multitude of interdependent and interacting variables, its context sensitivity, and its dependence on initial conditions, the ‘inner workings’ of such a system can best be described with complexity science (Larsen-Freeman & Cameron, 2008). Of course, in a review of research and development work in ICALL, it is often difficult if not impossible to glean information about the teaching and learning contexts of individual systems. They are frequently discussed from a purely computational, linguistic, or only marginally SLA-related empirical perspective. In such cases, I will have to extrapolate from sometimes limited information, in order to situate these, at least hypothetically, in a practical pedagogic context.

When it comes to identifying language learning tasks in ICALL systems, we see them as 'a vital part of language teaching' (Skehan, 1996, p. 39), but not as the sole unit of instruction and we accept both tasks which have some relevance for learners (Eckerth, 2003) and tasks in completely fictitious contexts (see e.g., Skehan, 1998, p. 143). Given our understanding of a learning process as an activity system, a task can also be described as the collaborative, social construction of knowledge (Edwards & Willis, 2005, p. 24). Of course, when technology is used as one major mediating artefact in a language learning activity, it introduces a number of new facets that will have to be considered.

[A] Intelligent CALL

ICALL – Intelligent Computer Assisted Language Learning – is a field within CALL which applies concepts, techniques, algorithms, and technologies from artificial intelligence to CALL (Gamper & Knapp, 2002; Heift & Schulze, 2007; Nerbonne, 2003; Schulze, 2008a). Artificial intelligence describes 'the science and engineering of making intelligent machines' (McCarthy, 2007). This includes work in robotics, intelligent agents, and computer vision. Most relevant to CALL is research in four branches of artificial intelligence: (1) natural language processing, (2) user modeling, (3) expert systems, and (4) intelligent tutoring systems. *Natural language processing* deals with both natural language understanding and generation. *Natural language understanding* takes written or spoken language input and turns it into a formal representation which captures the textual input’s phonological/graphological, grammatical, semantic, and pragmatic features in a computational data structure. For example, when a written sentence is submitted to a natural language understanding system, often a parser, a tree describing the grammatical structure of this sentence with details about immediate dominance (phrase structure) and linear precedence (word order) could be the output. *Natural language generation* describes the reverse process. A formal representation, which could have been stored in a database for example, is rendered in written or spoken human language. For instance, if the relevant syntactic, semantic, and pragmatic rules of certain utterance types and a lexicon are given, the information from a database on a country’s geography can be provided in adequate prose.

Within natural language processing, software that turns utterances into written text is subsumed under *speech recognition* or speech-to-text systems; the reverse process is called *speech synthesis* or text-to-speech. *User modelling* can also be described as a sub-area of human-computer interaction research – in addition to being an area of research in artificial intelligence – because it strives to adapt computational systems to their users. Of the different research domains in user modelling, *student modelling* is, of course, of particular relevance to CALL. A student model ‘observes’ the student’s actions, maintains a data structure with this information, and infers beliefs about the student’s knowledge based on these data. If an ICALL system comprises a student model, it is possible to adapt feedback messages, instructional sequences, and learning objects to the individual student. *Expert systems*, on the other hand, capture relevant knowledge about a particular domain. Most ICALL software will have expert information about the grammatical system of the learnt language (a parser grammar). This is the program's module that enables the program to process the student input and turn it into a formal representation that contains detailed information about the form (phonological/graphological, morphological, syntactic features) and the meaning (semantic, discoursal, pragmatic features). This representation can then in turn be used to maintain a more detailed record of the grammatical knowledge the learner applied and/or to be able to locate and describe linguistic errors made by the learner. Both the student model and the expert model are essential modules of *intelligent tutoring systems*. Such systems are tutors in the context of Levy's (1997) tutor-tool distinction in CALL. They are used in the teaching of various instructional settings and for various subjects and domains.

It is these areas of artificial intelligence which are commonly applied in ICALL. However, ICALL is not only about computers as tutors. In other ICALL projects language learning tools such as grammar or spell checkers for language learners (Gamon, et al., 2009; Rimrott & Heift, 2008), specialized and corpus-enriched learner dictionaries, reading aids for foreign language readers (Roosmaa & Prószéky, 1998) have been developed. ICALL systems which support language instructors (e.g., in the semi-automatic generation of exercises) and researchers (e.g., measuring task complexity, accuracy, and fluency (Schulze, Wood, Pokorny, forthcoming)) as general tools in language learning; these are beyond the scope of this chapter, however.

Heift and Schulze (2007, pp. 55-82) identified 119 ICALL projects, which were documented in English and German publications between 1978 and 2004/5. In this chapter, I will mention and sketch some of these by selecting almost exclusively systems for written language input and output. I will also refer to selected ICALL projects of recent years, in order to investigate the relationship of TBLT and ICALL. Given the interdisciplinarity of ICALL, it is not surprising that many publications appeared outside the mainstream journals of CALL and very few in other journals of applied linguistics (for a literature survey, see Heift & Schulze, 2007, pp. 52-55). Although two more special issues on ICALL (Meurers, 2009; Schulze, 2008b) appeared in CALL journals recently, a strong connection of SLA in general and TBLT in particular with ICALL is still not immediately obvious. In the mid-1990s and after attending a conference on ICALL (Holland, Kaplan & Sams, 1995), Oxford (1993) summarized the mutual relationship of ICALL and SLA from an applied linguistics perspective:

> It was somewhat surprising to me to discover that most of the papers … contained only outdated language learning and teaching references … ICALL must devote as much attention to its language learning/teaching principles as it does to its exciting technology. (p. 174)

Oxford (1993) is correct in stating that ICALL research has all too often relied on homespun notions of language learning or borrowed from discourses in Second Language Acquisition (SLA), which had long been criticized severely and/or superseded by theoretical approaches with improved explanatory power (Schulze, 2008a). On the other hand, as you will see in the discussion of projects below, many researchers in ICALL have shown considerable awareness of current discussions in

SLA research and have been successful in applying relevant SLA research findings to ICALL.

[A] Task Design in ICALL

Designing tasks for a computer environment means that general pedagogic and SLA principles as well as software engineering and human-computer interaction opportunities and constraints have to be considered. The applied linguist Johnson (2003) identifies a list of characteristics of good task designers based on an observation study of experienced and less experienced creators of language learning materials. He argues that among other traits good task designers spend time analyzing the design problem they face by also carefully reviewing what is required of them; are sensitive to task logistics, learners and context; show maximum control of task variables; identify procedures and highlight important decisions early on; use a breadth-first strategy when considering design possibilities; at times design cyclically; create choices; and stimulate input and output a lot (Johnson, 2003, pp. 128-137). Some of the procedural stages identified by him are reminiscent of the stages in iterative software development, which also has to go through a cycle of analysis, design, development, implementation, and evaluation (for CALL see Colpaert, 2006). In both cases only a complete cycle, which often has to be repeated, increases the likelihood of a successful development outcome. It is important to note at this stage that in ICALL the main interaction can take place between learner and machine. I would not describe this as social interaction in the Vygotskian sense, but we will have to consider the human-computer interactions (Shneiderman & Plaisant, 2005) carefully in the context of learning processes. Using activity-theoretical terminology, designers of ICALL tasks need to be aware that in human-computer interaction learners act on their intentions, the object of the activity.

The computer program on the other hand performs certain operations which are obviously not intentional, but are triggered by conditions such as the reception of a string of characters, a mouse click, or a single key stroke. Most computer users, when interacting with the machine, interpret these operations as an action and ascribe it an intention, about which they reason and then react accordingly. For example, if a grammar checking algorithm of a computer program parses the input string and generates a message of canned text (associated with the rule used for the successful parse), then the learner might interpret this as a grammar checking action, conclude that the text contains a certain error and that it can be corrected in the suggested way.

Now, this may or may not be the case depending on the quality of the parsing algorithm and the coverage of the grammar, but it certainly was not the computer's intention. This means that ICALL systems, in addition to the requirements of the pedagogic principles guiding the design of language tasks, also need to consider the computational robustness of their systems and the linguistic validity of the underlying human language technology (e.g., parser grammar and algorithm, information of the expert system, disambiguation and selection procedures). Thus, meaningful tasks in ICALL are not only one prerequisite for successful language learning, but task design can also be used to restrict the linguistic domain, the constructions necessary for task completion, to facilitate robust natural language processing, since processing qualitatively limited and hence more predictable input yields outcomes of higher quality. In other words, processing more predictable input—the tasks restrict the vocabulary and the syntactic constructions the student can and will use—results in more precise and contingent feedback or a meaningful response in a dialogue system, which the student can successfully interpret and act on accordingly.

Even in this human-computer interaction, learning is an 'inherently socially situated activity' (Storch, 2005, p. 153) in the Vygotskian sense. Essentially students conduct an activity mediated by computational artefacts that were created by a community of ICALL researchers and developers. And of course, ICALL activities are not only for the lone learner in front of a computer. Many ICALL systems can be used as a trigger for a language learning activity conducted through discussion or other communicative activities by a small group of students who all work with the same system.

[A] Examples of Task-Based Language Teaching in ICALL

These design principles and considerations will become clearer once they are seen in relation to some concrete examples of ICALL systems. In the thirty years of ICALL to date, we have seen a rather heterogeneous set of projects – heterogeneous in almost every aspect of their design, implementation, and employment. In the following sections, we will encounter programs that set students a genuine task and provide the necessary scaffolding and support (see the section on communicative tasks in ICALL below). Such tasks have a clearly identifiable language learning object. They are set in a relevant communicative situation and are sometimes situated in a virtual world, which could be represented graphically or textually. The latter are often dialogue systems, in which the learner engages in a (written) L2 discourse with the ‘intelligent’ machine. Students using machine translation software are supported in their translation or textual analysis tasks.

Other ICALL systems can only be used during certain phases of the task process. They facilitate and support task performance (see the section on during-task and post-task support below) by providing linguistic and knowledge resources, scaffolding, and textual analysis tools as well as helping to increase the students’ language awareness. Facets of the learners’ interaction and task outcomes are easily recorded on a computer, so that the program can maintain a detailed, information rich record of an individual’s learning processes and outcomes in a student model (see section on measuring task performance). This model is a prerequisite for the system to be able to adapt automatically to individual learner differences and the individual learning process. This way a program can keep the learner aware and informed about progress and the necessary next steps. Also during pre-task activities such as priming the students for a particular language task and reviewing task-relevant linguistic material, ICALL systems can be employed usefully (see section on pre-task activities).

[A] Communicative Tasks in ICALL

A number of ICALL projects focused on the development of communicative competence of language learners. In early CALL projects, relatively simple text processing techniques, such as keyword searches and regular expressions were used to process sentences submitted by students, for instance, during a dialogue task, in which the student interacts with the system. Underwood’s (1984) program, *FAMILIA*, resembles the ELIZA program (see Weizenbaum, 1976). In FAMILIA, the system recognizes certain keywords, mainly family terms, and searches for verb complement combinations that are erroneous in Spanish. The entire lexicon as well as the sophisticated pattern matching technique are geared towards the discussion of family relations.

Other projects embedded the language learning software with its tasks and technology in a virtual context and designed a genuine task environment. *Spion* (Sanders & Sanders, 1995), for instance, was a spy game for students of German. Its main character, Robotky, is placed in Berlin and students have to give him advice in a variety of situations. If students respond in a complete and well-formed sentence, the recommended action will be performed by the screen character. *Spion* offered the students a motivating, fun and communicative task which used familiar traits from computer games of the time. Another project, *Herr Kommissar* (DeSmedt, 1995), also relies on a crime story scenario to engage students of German in a written exchange and uses natural language processing. Students assume the role of the detective (Herr Kommissar) and formulate questions for the suspect during an interrogation. The limited domain and the finite set of syntactic structures for questions results in adequate linguistic coverage for this engaging language game.

Menzel and Schröder (1999) have their students communicate about a market place scenario that is represented graphically. They are able to check input utterances for their semantic truth value by comparing what the student said to what is actually displayed in the graphic representation of the market scene. FLUENT I (Hamburger & Hashim, 1992) asks students to move objects in a bathroom per request. Hamburger and his team also developed an interface for teachers to create exercises that utilize the natural language processing tools of *FLUENT-2*, both written and spoken. The teacher can use the tutorial schema tool to design interactive exercises, the language tool to influence the language generated by *FLUENT-2* and the drawing tool to manipulate the graphical microworlds (Schoelles & Hamburger, 1996).

As can be seen from these examples, embedding natural language processing technology in CALL environments which provide a whole task scenario meant that these systems were able to provide students with a stimulating language learning task. Although the linguistic input can be described as rich in the relevant scenario, it usually meant that the system could function adequately although it was based on a small (but contextually relevant) dictionary and a fragment of the L2 grammar. Such programs, however, require a huge development effort and considerable time. This is often coupled with a short life span of such software since the transfer to other computer environments and teaching contexts is fraught with difficulties. Such difficulties arose because the sometimes monolithic programs were tailored to a particular group of students or a very specific language learning situation and/or components such as the interface or the human language technology lacked the robustness necessary for a straightforward implementation in another educational setting. Many such ICALL programs were developed as part of a research or a dissertation project and thus were dependent on the project's funding and other resources. Difficulties with distributing, marketing, maintaining, and supporting ICALL software from within a university system often prevented their widespread use by other language instructors and students. These and other research prototypes clearly show, however, that TBLT in ICALL can be done (at a cost) and high-quality task designs are a fruitful avenue of further research and development in ICALL. Given the cost of development in ICALL, a number of projects re-used parsers and grammars that had been developed for different purposes and with different goals in mind, e.g., for machine translation. Anderson (1995) evaluates a machine translation system, *Targumatik*, regarding its usefulness for teaching Hebrew and concludes 'that

MT [machine translation] with a properly constructed and applied learning algorithm can definitely be used to enhance language learning' (p. 90). Somers (2001), a specialist in machine translation, is more cautious and warns that 'MT software is generally not designed with language learners in mind, so one should be a little wary of using it for this purpose' (p. 28). In addition to the utilitarian value of introducing university students of a foreign language to state-of-the-art translation tools and aids, he sees a role for machine translation software in task settings in which learners are asked to pre-edit source texts iteratively to make a subsequent automatic translation more successful or to post-edit texts translated into their L1 and to comment on the L2 constructions which were necessary to edit. Similar to a comparison of various translations of varying quality (which could also come from different machine translation systems and/or human translators), such editing activities increase the language awareness of learners and facilitate their noticing of structural alignments and misalignments of L1 and L2. He warns, however, that the approach 'to use MT's weaknesses and mistakes to bring out subtle aspects of language differences or to reinforce learners' appreciation of both L1 and L2 grammar and style' (ibid.) is controversial because he sees the danger of 'reinforcing or even introducing incorrect language habits on the part of the learner' (ibid.). That a foreign language is learned through habit formation and directly influenced by erroneous input is, of course, highly questionable. On the other hand, Somers is correct in assuming that a machine translation into the students' L1 is preferable in a language learning task because the task difficulty of analyzing or editing a machine-translated text can be and often is enormous. If it is really just the goal of such a task to increase students' awareness of the two overlapping and diverging language systems and sets of linguistic conventions, then the likelihood of an appropriate and successful task design is much greater if students are working with a comprehensible, error-free source text in their L2 and a machine-translated L1 target text full of errors, inadequacies, and infelicities. However, Niño (2008), who also provides a comprehensive overview of projects which discussed and investigated the use of machine translation in second language learning, concludes from her quasi-experimental study with students of Spanish in England that her 'results advocate that for advanced students … the target language MT post-editing was especially good for creating opportunities for producing comprehensible and acceptable output and for raising language awareness through error detection and correction' (p. 44).

When it comes to task designs which involve translation, text critiquing and commenting, language awareness, error analysis and correction, or similar activities, machine translation has a role to play because it facilitates language learning and increases students' awareness of and familiarity with modern language technologies which many of them use anyway, but might not always do so in the most appropriate way (Williams, 2006).

[A] During-task and post-task support

With regard to during-task support, error detection and diagnosis resulting in corrective feedback have been the main focus of ICALL and thus form the backbone of the language help which is provided by such systems. ICALL has made great strides toward the successful integration of language engineering resources in CALL. In a number of systems, students have contextualized access to online dictionaries, inflectional paradigms of words are generated on the fly and can be displayed for the student. For example, the *GLOSSER RuG* system provides students with access to a morphological analyzer and an online dictionary. Students can extract morpho-syntactic information on any word from a reading text chosen by the learner or the instructor and thus language students' reading of a foreign language text. Knapp (2004) describes *ELDIT*, an electronic learner dictionary for German and Italian intended for reading activities and vocabulary acquisition. The system supports a number of reading tasks which aim to prepare students for bilingual proficiency examinations. After their research and development projects were completed, both systems, ELDIT and Glosser RuG, appear to be frozen in time. Glosser RuG was clearly designed as a research prototype to prove the usefulness of natural language processing resources in CALL, which they did very successfully, and its use by language learners appears to be limited. Due to the fact that ELDIT relied on manual annotation for some more complex features in the reading texts, its material is not easily scalable.

More recently, Wood (2009) developed *QuickAssist* as part of his doctoral dissertation project. The ICALL tool supports reading and vocabulary acquisition for students of German through the automatic annotation and lemmatization of texts selected by the students or their instructor. Students have one-click access to an online dictionary in which the lemma of the word in context will be looked up, can retrieve further collocations of the word from a German corpus, are provided with a morphological deconstruction of the word and the whole paradigm of relevant word forms, and have direct access to the German version of Wikipedia to look up proper nouns and concepts. Thus, the system re-uses proven, reliable, and robust human language resources which are freely available.

In addition to the systems that support foreign-language learners in their reading tasks, there are ICALL projects that support writing activities, usually through the provision of feedback on erroneous constructions. McCoy and her colleagues (Michaud & McCoy, 2006) developed ICICLE, a system for learning written English as an L2 for students with American Sign Language as L1. The system mainly supports post-task reflection on the written text: 'The interface allows the user to type in or load a text file, request an analysis, and view the results. Sentences containing problems are highlighted in colors corresponding to the type of error and canned one-sentence explanations of the error can be accessed' (ICICLE, 2008).

Such support with proof-reading learner texts can be offered in different phases of the task process—during the main task and for post-task activities—to encourage students to reflect on their own writing, to notice errors and gaps, or simply selected lexical, morphological, or syntactic phenomena. Natural language processing is well suited to preparing texts for such reflective activities automatically (Amaral, Metcalf & Meurers, 2006). Amaral et al. argue for a task design for ICALL systems which incorporates a sequence of receptive presentation, productive presentation, and controlled practice. Based on an automatic annotation of the text in question through part-of-speech tagging and shallow parsing, the system colour-codes relevant linguistic constructions and makes them more salient, so that students notice them more easily (receptive presentation). In a second step, learners are asked to identify the same constructions in context, for example by clicking on them. Third, they are required to re-order automatically scrambled sentences or to fill in automatically created and evaluated blanks. These little activities are, of course, well known in language teaching, what is new here is the automatic preparation of the text, which means that a learner can freely choose a text for these activities because it will be submitted to a robust linguistic analysis.

It is particularly the provision of additional linguistic information and the increased saliency of constructions with certain features where ICALL can provide support in a variety of different task settings. Scaffolding – the provision of assistance that enables learners to reach communicative goals they would have not reached otherwise – and input enhancement – often extra-linguistic features that enable the learner to comprehend the input better – were shown to have a positive influence on language acquisition success. Both processes are normally carried out with linguistically well-formed texts as (computational) input for the natural language processing analysis and can thus rely on a more consistent, reliable analysis outcome than in the traditional ICALL domain of error correction.

[A] Pre-task activities

As Willis (1996, p. 42) suggests, tasks can be preceded by pre-task activities. Pre-task activities fall into two broad categories: (1) linguistic priming and review and (2) pre-task planning activities. ICALL plays a role in the former, but is hardly suitable to the latter. Its systems can be used to introduce or review task-relevant grammatical constructions and semantic fields. I would not deny that the sequence of pre-task activities with language practice exercises followed by the main communicative task is reminiscent of the so-called 3Ps approach to language teaching methodology – present, practice, produce (PPP) (see Skehan, 1998, pp. 94-95). However, this sequence is supporting student learning, if the form-focused exercises are relevant and subordinate to the task at hand. The task still needs to be central and emphasis is on cognitive processes and not skill-oriented training (see Bruton, 2002).

Some ICALL systems in use concentrate on feedback on and help with morpho-syntactic errors made by learners: The *E-Tutor* (Heift & Nicholson, 2001) accepts input from a variety of beginner to intermediate exercises for German and provides error diagnosis and feedback. The embedding of these form-oriented practice activities as pre-task activities in a task-based design is supported by the system that provides instructions for a variety of tasks and is based on the decision of individual instructors when using the *E-Tutor* with their students. The system consists of fifteen chapters with a variety of learner activities, covers the main grammar concepts of German, and provides learning content for three semesters of university German. In addition to the grammar and vocabulary practice, a number of language learning resources, including pictures, audio and cultural information, are contained in the web-based learning environment.

For Japanese, there is one commercial web-based system, *Robo-Sensei*, developed by Nagata (2009). RoboSensei analyses student input for selected exercises, performs an itemization (separating tokens for later linguistic analysis), performs a morphological analysis, and parses the sentential input syntactically using a context free grammar. The version currently released works for the constructions and the lexicon required by the associated textbook, a web-based version with its own Japanese textbook is in preparation and is able to analyze all grammatical structures taught in the first two years of Japanese instruction (Nagata, 2009).

A system for Portuguese – *Tagarela* – which is similar to the E-Tutor and RoboSensei, uses the metaphor of an electronic textbook, and has been developed by Amaral and Meurers (2008). The system provides re-writing exercises, vocabulary practice, and listening comprehension for which students receive feedback on spelling, morphological, syntactic and semantic errors. Feedback is contextualized through the information of a student model that contains performance information of individual learners and an instructor model which contains information about activity and error types.

Other ICALL developments focus on one or more specific grammatical constructions. Bailin (1990), for example, in his *VERBCON* project concentrates only on analyzing English verbs. Given the base form of the verb, students have to insert the inflected forms into blanks using auxiliaries and inflectional suffixes appropriately. Such an activity with its pure focus on form can only be used in a pre-task activity. How a successful balance of focus on meaning and focus on form can be achieved has been shown in the *SWIM* (See What I Mean) project. The centre of attention for Zock and his colleagues (Zock, 1992) were French clitics. Students choose certain concepts and ideas and answer questions posed by the system. Depending on their answers, the system generates the French sentence with the appropriate clitics, thus making students aware of the positioning and formation of anaphoric references in a French sentence. Such an activity can be easily pictured as a pre-task activity of a task which requires the written use of clitics.

Examples of ICALL systems whose natural language understanding capabilities are employed to focus students' attention on particular constructions include a program which helps learners to practice zero pronouns in Japanese (Yamura-Takei, Fujiwara, Yoshie & Aizawa, 2002), the *TDTDT* project (Pijls, Daelemans & Kempen, 1987), which checks the conjugation of Dutch verbs for morphotactic errors, and the *ALICE* system which specializes in the analysis of temporal conjunctions in Italian, French and English (Cerri, 1989). Although none of these systems was developed based on a TBLT design, with their very specific focus on a particular set of forms, they would lend themselves to an integration in the preparatory phase of a task process, in which the students are introduced to, sensitized for, or simply review a particular, task-relevant construction. Given their very limited domain, such systems are usually very robust in their linguistic analysis or felicitous in their generation. The effectiveness of such systems in the pre-task activities, however, can only be determined if one has information about the particular learning environment and communicative learning task, of which the checking or practice activity is only one small part. High development costs and issues of portability and technology transfer meant that systems which concentrate on specific linguistic phenomena and only function within a certain set of exercises often remained at the research prototype stage.

It is simply not very efficient to build a relatively complex ICALL system which can then only be incorporated in the preparatory phase of a specific task design. The systems with a wider coverage of parser and grammar as well as a substantial set of different exercise types such as build-a-sentence, fill-in-the-blank, dictation, translation that are linked to one or more course curricula and textbooks, the E-Tutor and RoboSensei, are the only intelligent language tutors which have been and still are in use by a large number of students over a number of years for these very reasons. Such systems with larger coverage and sufficient instructional material are very costly in terms of time and effort. Nagata's software, for example, has been under development since the early 1990s, while Heift has been working on her system since the mid-90s.

[A] Future Avenues for TBLT-ICALL

During the thirty years of its existence, ICALL has become a major impetus for tutorial CALL (Hubbard & Bradin-Siskin, 2004) – computer-assisted language learning in a structured, operationalized instructional environment. A turn toward more applied research questions in computational linguistics (ten Hacken, 2003) and a sustained interest in CALL in both modern language technology and tutorial CALL coupled with the improved availability of robust linguistic and computational resources for natural language processing should mean that this positive trend will continue.

As could be seen from the examples given in this chapter, progress in terms of wide-spread and sustained use of ICALL applications in real language learning situations has been slow and sketchy. This is mainly due to the immense complexities of the computational processing of human language and of the nature of language itself coupled with the complexity of foreign language learning processes. However, the examples, even if some of them have just been prove-of-concept systems, also indicate strongly that ICALL has added and will continue to add innovative and interesting facets to TBLT through its challenging task designs and even more so through its capability to analyze student input and observe and support student behaviour during task processing. And the benefits are mutual as successful ICALL projects have profited from a well-motivated task design in two main ways. First, from a computational perspective, a well-defined task design with its clear set of relevant language constructions facilitates the restriction to a linguistic domain which is 'manageable' for a system's natural language processing modules. Secondly, successful projects from the last thirty years of ICALL show that it is possible to reproduce the positive impact of TBLT in student classroom interactions with an intelligent computer as tool and/or tutor, which uses or is embedded in an appropriate tasks design, facilitates successful task completion, and thus supports language learning.

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