The Digichaint interactive game as a virtual learning environment for Irish

Neasa Ní Chiaráin[1] and Ailbhe Ní Chasaide[2]

Abstract. Although Text-To-Speech (TTS) synthesis has been little used in Computer-Assisted Language Learning (CALL), it is ripe for deployment, particularly for minority and endangered languages, where learners have little access to native speaker models and where few genuinely interactive and engaging teaching/learning materials are available. These considerations lie behind the development of *Digichaint*, an interactive language learning game which uses *ABAIR* Irish TTS voices. It provides a language-rich learning environment for Irish language pedagogy and is also used as a testbed to evaluate the intelligibility, quality and attractiveness of the *ABAIR* synthetic voices.

Keywords: interactive language learning games, text-to-speech synthesis, Irish.

1. Introduction

This paper describes the development and some of the evaluations carried out of a prototype interactive platform for Irish language learning, *Digichaint,* which uses TTS voices developed within the *ABAIR* initiative (www.abair.ie) at Trinity College, Dublin. *Digichaint* is one of three distinct prototype CALL platforms (see Ní Chiaráin & Ní Chasaide, 2015, 2016) aligned to current task-based language learning/teaching principles, where (incorporating TTS) the spoken language is central. *Digichaint* explores the potential of interactive speech-based games for Irish language pedagogy and serves as a testbed for evaluating the newly developed TTS voices.

Digichaint was adapted from *The Language Trap* (Peirce & Wade, 2010), an online casual educational game for teaching German to students preparing for the

1. Trinity College, Dublin, Ireland; neasa.nichiarain@tcd.ie
2. Trinity College, Dublin, Ireland; anichsid@tcd.ie

How to cite this article: Ní Chiaráin, N., & Ní Chasaide, A. (2016). The Digichaint interactive game as a virtual learning environment for Irish. In S. Papadima-Sophocleous, L. Bradley, & S. Thouësny (Eds), *CALL communities and culture – short papers from EUROCALL 2016* (pp. 330-336). Research-publishing.net. https://doi.org/10.14705/rpnet.2016.eurocall2016.584

Irish pre-university examinations, using diphone synthesis. *Digichaint* used *The Language Trap* graphics and development framework to design a game suited to a similar cohort of Irish language learners.

2. Motivation

2.1. The Irish language context

Using synthetic voices in interactive learning games may be far more important to the pedagogy of an endangered minority language like Irish, than of a majority language. Irish is spoken as a community language only in limited *Gaeltacht* regions in the West of Ireland, but as the country's first national language, is a compulsory subject taught to school leaving age. One major challenge with the teaching of Irish is the lack of exposure to native speaker models (most teachers are L2 speakers), and there has tended to be an overemphasis on written and grammatical competence.

A further major problem concerns motivation. The dearth of modern pedagogical resources makes it difficult to engage the learner. It is clear that the educational process is important to the long-term survival of the language – not only in terms of its transmission through teaching, but also in fostering engagement with the language. The synthesis-based CALL applications being piloted could contribute, not only in facilitating more extensive exposure to the spoken language and in developing aural/oral skills, but should also help to engage learners, complementing current classroom practices.

2.2. TTS synthetic voices in CALL

TTS has not been widely used to date in CALL (Gupta & Schulze, 2012). As mentioned, the need is not as great in the major languages, given the widespread availability of native speaker models. The lack of TTS takeup probably also reflects the fact that many systems yield relatively poor quality speech output, particularly in terms of prosody, clarity and consistency (Sha, 2010). Evaluations on the use of synthetic speech for CALL purposes are scant, pertain to its use in rather restricted settings, and do not include the gaming environments considered here. In the case of the Irish voices, there has been no formal evaluation to date. Therefore, in *Digichaint,* voices for two main dialects (Connaught and Ulster) are incorporated and evaluated for intelligibility, quality and attractiveness

3. Structure and principal features of *Digichaint*

Digichaint is an interactive guided dialogue that allows students to progress through a virtual world of a hotel and its surroundings. The learner selects the gender/dialect for their own character – male: Connaught Irish / female: Ulster Irish – which were the only choices available in ABAIR at the time. The learner is tasked with seeking the missing half of his/her winning Lottery ticket, mistakingly discarded, but held by one of eight characters in the hotel. To converse with other characters the user selects phrases from a menu of up to four possible options shown on the screen and spoken aloud (Figure 1). The goal is not to reveal one's true purpose to avoid being double-crossed. When the holder of the other half of the ticket is eventually identified, the learner must negotiate how the winnings are to be split. The game can take a great number of pathways as the user controls who to speak to at any given point: the choice of conversational turn determines the subsequent options (868 utterances were created for the game). A fragment of the game's structure is shown in Figure 2. The game lasts approximately 25 minutes.

Figure 1. Screenshot from the virtual learning environment *Digichaint*

Given only two baseline voices in ABAIR, a major challenge was to provide for the extended cast of the game. To differentiate voices, pitch and speed manipulations were carried out. Some manipulations rendered the voice somewhat sinister,

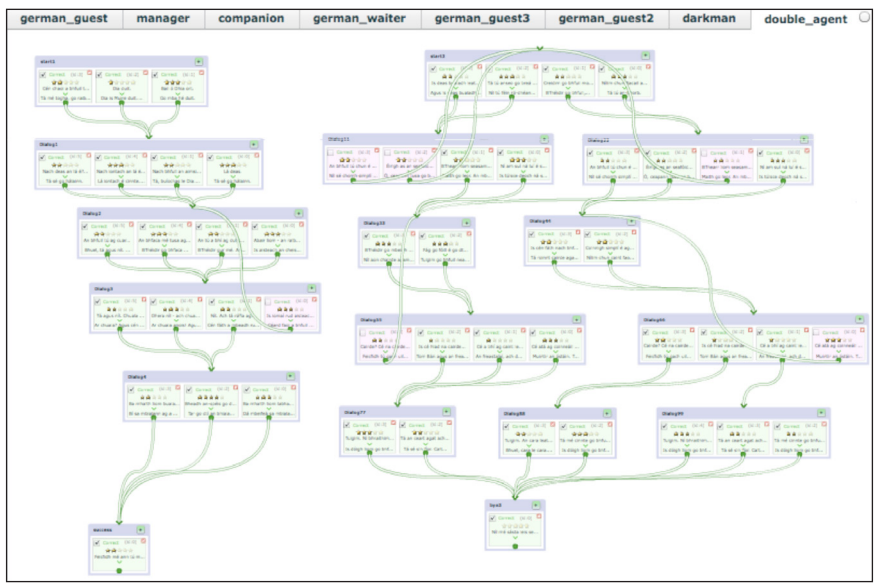
however. While this did not harm the story's narrative, it does appear to impact on the TTS evaluations (see Results and discussion below).

As mentioned in Ní Chiaráin (2014),

> "[t]he game features **linguistic adaptivity**[, i.e.] the language level of the game adapts to the user's language level: as the user chooses more complex structures, the options on offer become more complex, accordingly. **Performance feedback and motivational support** are provided through a particular companion character in the game who, when requested, will tell the player that his/her selections are excellent, good, poor, etc. **Meta-cognitive hints** on how well the player is doing appear as thought bubbles linked to the main character" (p. 83, emphasis added).

115 **dictionary entries**, which give the English translation of particular words and phrases, can be accessed by clicking on underlined words in the text. Learners receive **feedback** at the end on their path through the game, their star rating, words/phrases they looked up in the dictionary, etc., and this information is retained for future revision.

Figure 2. Overview visual representation of a section of *Digichaint* illustrating multiple pathways



4. Evaluation

Evaluation of the TTS voices was carried out online by 250 16-17 year old pupils (182 female, 68 male) in 13 schools nationwide: these included Gaeltacht (rural), Irish-medium (urban), and English-medium schools (both rural and urban). A pre-game questionnaire elicited background details on individual respondents. Pupils then played the game and gave reactions by way of a post-game questionnaire (Likert 5-point scale).

5. Results and discussion

Pupils' opinions on the TTS voices were elicited in terms of the five questions (Ní Chiaráin, 2014) listed in Table 1. Overall, responses to the quality of the voices were positive. 70% *agreed/agreed completely* that the language level was right (Q1): as pupils differed widely in proficiency one could expect their level to affect intelligibility ratings. Q2 sought to establish specific difficulty with *dialect* variation, and surprisingly low numbers reported difficulty. Intelligibility ratings (Q3) were broadly positive: 56% *agreed/agreed completely* that the voices were sufficiently clear to make the speech intelligible (as against 28% *disagree/disagree completely*). Attractiveness ratings (Q4) were rather low, with only 43% rated as *attractive/very attractive* (what might be considered 'attractive' was left open). As some characters had distorted voice quality the low rating was expected. The quality ratings (Q5) are reasonably high at 62%, although the inclusion here too of distorted voices has impacted. The ratings for attractiveness and quality, and even intelligibility, must be interpreted in conjunction with responses to the other two platforms (not covered here) where no voice distortions were included and ratings were considerably higher: *intelligibility* and *quality* both scored 73% and *attractiveness* scored 57% (Ní Chiaráin, 2014).

Table 1. Questions and results for *Digichaint* evaluation

Q1.1 The overall standard of the Irish used in this game is at about the right level for me		
Completely disagree	4	1.6%
Disagree	40	16%
Neutral	30	12%
Agree	130	52%
Agree completely	46	18.4%
Q1.2 If you feel the Irish used is not at the right level, is this because it was…		
Too difficult	54	48.6%

Too easy	57	51.4%
Q2. Did you experience particular difficulties with the dialects that are used in Digichaint?		
Definitely some difficulty	1	0.4%
Probably some difficulty	75	30%
Neutral	44	17.6%
Probably no difficulty	107	42.8%
Definitely no difficulty	23	9.2%
Q3. The synthesised voices were sufficiently clear to make the speech intelligible		
Completely disagree	14	5.6%
Disagree	55	22%
Neutral	42	16.8%
Agree	115	46%
Agree completely	24	9.6%
Q4. Please give your opinion on the attractiveness of the voices:		
Very unattractive	12	4.8%
Unattractive	75	30%
Neutral	58	23.2%
Attractive	92	36.8%
Very attractive	13	5.2%
Q.5 Please give your opinion on the quality of the synthesised voices: to what extent do you think the voices are adequate for the type of game presented here?		
Completely inadequate	3	1.2%
Inadequate	49	19.6%
Neutral	44	17.6%
Adequate	134	53.6%
Totally adequate	20	8%

6. Conclusions

Bearing this in mind, there is broadly positive support for the use of the Irish TTS voices in such interactive platforms. Note that evaluations of TTS are highly specific to the quality of the individual voices and there is great variability across systems. Evaluations capture a point in time: even since these tests, the Irish voices have been improved and we expect that a similar evaluation would now yield higher ratings. Importantly, we now know that the voices are adequate for this application and we now have an evaluation method that will serve for testing the TTS voices as development continues.

Furthermore, evaluations of synthesis quality are relative to the context of evaluation. When proposing to deploy TTS in CALL platforms, evaluations should be carried

out using multiple real-life platforms and real users, rather than relying on laboratory-based, decontextualized evaluations, as are the norm in TTS evaluation.

7. Acknowledgements

Sincere thanks to Dr Neil Peirce and Prof. Vincent Wade of KDEG, Trinity College, Dublin. This work was partially funded at different times by SFI/CNGL, the Department of Arts, Heritage and the Gaeltacht (*ABAIR*) and by An Chomhairle um Oideachas Gaeltachta & Gaelscolaíochta (*CabairE*).

References

Gupta, P., & Schulze, M. (2012). *Human language technologies (HLT)*. http://www.ict4lt.org/en/en_mod3-5.htm

Ní Chiaráin, N. (2014). *Text-to-speech synthesis in computer-assisted language learning for Irish: development and evaluation*. Doctoral thesis. CLCS, Trinity College, Dublin.

Ní Chiaráin, N., & Ní Chasaide, A. (2015). Evaluating synthetic speech in an Irish CALL application: influences of predisposition and of the holistic environment. In S. Steidl, A. Batliner, & O. Jokisch (Eds), *SLaTE 2015: 6th Workshop on Speech and Language Technologies in Education* (pp. 149-154). Leipzig, Germany.

Ní Chiaráin, N., & Ní Chasaide, A. (2016). Chatbot technology with synthetic voices in the acquisition of an endangered language: motivation, development and evaluation of a platform for Irish. In *10th edition of the Language Resources and Evaluation Conference, 23-28 May 2016* (pp. 3429-3435). Portorož, Slovenia.

Peirce, N., & Wade, V. (2010). Personalised learning for casual games: the "Language Trap" online language learning. In *Proceedings of the Fourth European Conference on Game Based Learning (ECGBL 2010)* (pp. 306-315). Copenhagen, Denmark: Bente Meyer.

Sha, G. (2010). Using TTS voices to develop audio materials for listening comprehension: a digital approach. *British Journal of Educational Technology, 41*, 632-641. https://doi.org/10.1111/j.1467-8535.2009.01025.x

Research-publishing.net

Published by Research-publishing.net, not-for-profit association
Dublin, Ireland; Voillans, France, info@research-publishing.net

CALL communities and culture – short papers from EUROCALL 2016
Edited by Salomi Papadima-Sophocleous, Linda Bradley, and Sylvie Thouësny

Typeset by Research-publishing.net
Cover design by © Easy Conferences, info@easyconferences.eu, www.easyconferences.eu
Cover layout by © Raphaël Savina (raphael@savina.net)
Photo "bridge" on cover by © Andriy Markov/Shutterstock
Photo "frog" on cover by © Fany Savina (fany.savina@gmail.com)
Fonts used are licensed under a SIL Open Font License

ISBN13: 978-1-908416-43-8 (Paperback - Print on demand, black and white)
Print on demand technology is a high-quality, innovative and ecological printing method; with which the book is never 'out of stock' or 'out of print'.

ISBN13: 978-1-908416-44-5 (Ebook, PDF, colour)
ISBN13: 978-1-908416-45-2 (Ebook, EPUB, colour)

Legal deposit, Ireland: The National Library of Ireland, The Library of Trinity College, The Library of the University of Limerick, The Library of Dublin City University, The Library of NUI Cork, The Library of NUI Maynooth, The Library of University College Dublin, The Library of NUI Galway.

Legal deposit, United Kingdom: The British Library.
British Library Cataloguing-in-Publication Data.
A cataloguing record for this book is available from the British Library.

Legal deposit, France: Bibliothèque Nationale de France - Dépôt légal: décembre 2016.