

Navigational Acts and Discourse: Fostering Learner Agency in Computer-Assisted Language Learning

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Abstract: Fostering learner agency is a primary goal of Integrative Computer Assisted Language Learning, a type of CALL (Warschauer, 1996) that encompasses networked learning and multimedia, including hypermedia. Although navigation has been a focus of attention in some more established CALL scenarios such as Intelligent Computer Assisted Language learning (ICALL) systems in second language acquisition (SLA) research, much less focus has been on more emerging CALL scenarios such as augmented reality, amongst others. Therefore, if learner agency is to be fostered, identifying how it manifests is important. This study focuses on 'directional agency' (Knight, Barberà and Appel, 2017) which is agency exercised in relation to navigational acts during language learning tasks. Using our own case study data as a starting point (where learners carry out navigation as part of the tasks), the paper draws attention to the somatic acts of navigation while using spoken language as part of the multimodal experiences learners can face. A specific literature review was carried out on other current and emerging CALL scenarios that were considered as cases in order to survey the presence of intentional navigational acts and talk, explore and understand it as a phenomenon in the field and to refine directional agency as a construct. Results suggest that directional agency is present across other CALL scenarios and task types; directional agency can be shared across learners and technological features; there are multiple forms of navigation including embodied navigation and whole or partial human body navigation that can occur in the same task. Navigational acts can accompany learner-learner talk and they can also form part of learner-computer 'talk'. Learners and computers can act as "semiotic initiators and responders" (Coffin and Donohue, 2014), resembling sequential turn-taking of talk so that both learners and digital technologies can be understood as potential actors in the task discourse.

Keywords: learner agency, Computer-Assisted Language Learning (CALL), task-based language learning, talk, navigational acts

1. Introduction

Computer assisted language learning (CALL) has become increasingly diversified and sophisticated, encompassing not only online instruction but also gaming, synthetic environments, digital sensory environments, simulations and augmented reality (González-Lloret, 2017a). These current and emerging CALL scenarios potentially signal a shift away from fixed and static learning experiences that has characterised much of formal language learning that could be said to be a sedentary experience: predominantly involving sitting, listening to the teacher and/or other students and perhaps moving around the class. Original CALL technologies gave face-to-face language learning an additional means for language learning, namely the computer with which the search for and study of applications for it became a research focus (Levy, 1997). This included research on pedagogical tasks such as role-plays and information-gap (information swap) where learner talk is a main objective (e.g. oral interaction) or a secondary one (e.g. collaboration).

However, with many current and new technologies used in CALL, such as mobile phones and augmented reality eyewear, learner navigation is a prominent feature within or outside of a screen and suggests movement of some kind. Despite this, a predominant focus in second language acquisition (SLA) research is the oral or written language produced by learners. While this is arguably logical, some researchers suggest that research in the SLA field reflects what Block (2013, p.56) calls "the lingual bias". While learners' speech as a semiotic mode has been a main focus, there is a lack of research on the impact of multimodal communication in online classrooms (Hampel and Stickler, 2012) and mode in task-based learning in general (Gilbert, Manchón and Vasylets, 2016). The possible result of this for SLA research may mean that the study of navigation processes in tasks, where learners need to utilise their motor and sensory systems as part of their intentional movements, can be overlooked.

Navigation can be considered part of the somatic mode: “relating to the body, or affecting the body” (Somatic: Mirriam Webster, 2017) and which can fall within the research on mode in the field of SLA. Because of the expanded use in CALL to include mobile devices as well as eyewear technologies, research on talk-in-interaction while moving has been made more relevant in SLA (Thorne, Hellermann, Jones and Lester, 2015). Understanding more deeply about learners’ navigational acts and its relationship with talk may help task designers and teachers to foster learner agency in future tasks and give insight into task based learning that requires movement for navigation and considers its impact on language learning.

For this reason, this study seeks to further explore how learners are navigating with current and emerging technologies in language learning tasks. In particular, the relationship between navigation and talk because oral interaction that involves collaborative, recursive, turn-taking, is central in SLA theory as it is believed to lead to gains in language acquisition (de la Colina and Mayo, 2007). We are interested in learners’ agency in the task process that pertain to learners’ navigational choices and actions. This is to further understand, develop and refine the construct of learners’ “directional agency” (Knight, Barberà and Appel, 2017) identified as a phenomenon in our own data, which we will subsequently come to. We aim to understand how directional agency may appear in different tasks, with different digital tools and CALL scenarios.

First we revisit our own data from a synchronous computer-mediated communication scenario (SCMC), a type of CALL where navigation can form part of tasks and which is the starting point of this study. We then review recent studies in SLA task-based CALL language learning events that encompass a range of current and future CALL scenarios focusing on talk and navigation, which form part of a systematic literature review. We then report on the results of the analysis using a social semiotic multimodal perspective, rather than a solely linguistic one, because it is “a theoretical perspective that brings all socially organised resources that people use to make meaning into one descriptive and analytical domain” (Bezemer, et al., 2012, p.1). By analysing how navigation alongside speech works (or does not work) together in the task process, we attempt to take into account the “lingual bias” (Block, 2013, pp.56) in SLA research. In doing so, we bring into focus learners’ navigational acts pertaining to the somatic mode, carried out by learners in pedagogical tasks.

2. Background

The background for this study starts with our own data on learner agency in task-based CMC that used an audioconferencing tool to facilitate peer-peer spoken interaction. The learners were adults on a language learning course of English in a 100% virtual university. Using a case study approach, Knight, Barberà and Appel (2017) found that learners could not only exercise different types of agency pertaining to speech, but were also making choices about navigation and acting on those choices with the audioconferencing tool, which in turn, was deemed another type of agency. This was called “directional agency” and this type of agency was identified as being physical in nature but also involving speech. Subsequent studies (Knight and Barberà, 2016; Knight, Dooly and Barberà, 2018a; 2018b) found that depending on the navigational trajectories of learners, learner talk about navigational aspects of the task (as a topic of talk) either became part of the talk between learners during the pedagogical task or was absent from their recorded talk. This outcome depended on whether learners allowed the interface to sequence them while talking in the target language of English or not. From these results, three main conclusions in relation to navigation during these tasks were concluded.

The first was that learners could reconfigure the officially designed navigational route. Learners could create their own “lines of desire”, an architectural term used by Luckin and Du Boulay (2003, p.1) applied to technology use, that refer to the paths people make, that are often shortcuts ignoring the given route. The “lines of desire” can also change as learners accommodate new content and changes in the environment. In this sense, learners can agree or disagree with an official route or navigational pathway and create their own path instead.

Secondly, learners were not only negotiating the task content orally between themselves through oral turn-taking, but they were also negotiating physically with the technological tool by navigating differently to the sequence intended by the designer (Knight, Dooly and Barberà, 2018a). Thirdly, in addition to talk with their peer, learners were also communicating non-verbally with navigational icons or screen-based resources (e.g. clicking on ‘next task’ and ‘close’ buttons/screen-based resources) and that this communication resembled an initiation/response sequence, typically attributed to oral speech (Knight, Dooly and Barberà, 2017b). Navigation therefore, could not only form part of the oral discourse as a topic of talk with their peers

but navigation with screen-based resources, such as a pop-up, could form part of non-verbal initiate/response sequences with learners, which was understood as a form of multimodal turn-taking (Knight, Barberà and Dooly, 2017b).

3. Theoretical Framework

3.1 Learner Agency

Fostering learner agency is a primary goal of Integrative Computer Assisted Language Learning (Integrative CALL), a type of CALL that encompasses networked learning and multimedia, including hypermedia (Warschauer, 1996). Agency in this study is understood as “the capability of individual human beings to make choices and act on these choices in a way that makes a difference in their lives” (Martin, 2004, p.135) and which is socio-culturally, contextually and interpersonally mediated (Mercer, 2011). In order to carry out intentional actions, learners can use their motor and/or sensory systems (Bandura, 1999) and/or language (Austin and Urmson, 1962). Pedagogical tasks, such as role-plays, information-gap or quests carried out through technology, typically require learners to receive or produce language (spoken or written) as well as mediate with various visual, textual and/or audio screen-based resources. With respect to navigating during tasks, learners may also be required to use whole body (walking) or partial body movements (e.g. hand, click, pointing a device) to achieve task goals.

As aforementioned, “directional agency” (Knight, Barberà and Appel, 2017, p.276) was identified as pertaining to learners’ choices and acts pertaining to navigation and speech. This type of agency is described as being “physical interaction with technology accompanied by spoken interaction”. It is defined as “choices preceding and accompanying physical moves made by learners to e.g. navigate, check or submit answers either individually or collectively using non device related technological features” and as having characteristics involving “individual (physical) interaction” and “joint negotiation (speech/written)”, (Knight, Barberà and Appel, 2017, p.290).

3.2 Navigation and Task-based CALL

Gallistel (1990) defines navigation as “the process of determining and maintaining a course or trajectory from one place to another” (Gallistel, 1990, p.35). A central question in many studies about e-Learning environments is how navigation affects learning (Armitage, Wilson and Sharp, 2004). In CALL research, a main focus on navigation has related to Intelligent Computer Assisted Language Learning (ICALL) systems and hypermedia, (Tsirigia and Virvou, 2001; Heift, 2002 and Amaral and Meurers, 2011). However, more recent studies in CALL highlight other ways of navigating shaped by the scenario, the task and the tools being used. These include interface and net-based navigation in CMC, whole-body navigation with mobile devices, and virtual navigation in virtual environments. These scenarios underscore the potentially shifting relationship learners may have with navigation during tasks across different CALL scenarios.

The studies now presented pertain to navigation and talk identified in four CALL scenarios that arose out of a systematic literature review. The review was added to with results from our own studies using SCMC audioconferencing. These reflect four current and emerging task-based scenarios namely audio and video SCMC, virtual environments, digital sensory environments, simulations and augmented reality. The criteria for the selection of these specific studies are outlined in the methodology section of the paper.

3.3 Synchronous Computer-Mediated Communication (video and audio) tasks, talk and navigation

In audio and videoconferencing tasks, navigation can accompany learner-learner spoken interaction. Using videoconferencing, Guth and Helm’s (2011) study of three tasks using Skype for telecollaboration showed that in some tasks, learners switched from the skype window to an internet browser or kept other tools open on the screen at the same time. In audioconferencing, Levy and Kennedy (2004) highlighted the affordances of an audioconferencing tool to allow two people to browse through web sites together and see the same on-screen material as they talked. Satar and Özdener (2008), in a study of CMC voice chat mention that learners could press buttons to connect and disconnect (which we consider part of navigational processes). In audioconferencing CMC, Appel, Robbins, Moré and Mullen (2012) focused on how navigational features of a tool facilitated spoken interaction, might guide the conversation and act as a scaffold. Also with the Tandem tool, Knight, Barberà and Appel (2017) found that learners could orally negotiate navigational aspects of tasks through CMC and this negotiation can find its way into the spoken discourse of the task between learners.

Knight and Barberà (2016) also found that learners carried out non-verbal communication with navigational screen-based resources directly (e.g. clicking on a pop-up, which invited learners to 'close'). Learners therefore, not only communicated with their peer orally but communicated through clicking somatically with screen-based resources. Knight, Dooly and Barberà (2017b) taking up the notion by Coffin and Donohue (2014, p.28) of learners as "semiotic initiators and responders", found that navigational screen-based resources could invite learners to be non-verbal semiotic responders through the clicking of a (navigational) resource. Navigational screen-based resources were understood as initiating and/or responding to learners and this non-verbal communication with the navigational screen-based resources resembled the sequentiality of talk so that such sequences could be understood as a form of multimodal turn-taking.

3.4 Virtual environments, talk and navigation

Studies on task-based virtual environments that mention navigation and talk include studies by Zheng, Young, Wagner and Brewer (2009) who discussed moving and talk within a virtual gaming quest. Learners coupled their chat with working (through their avatars) towards a common goal. The control of the instructor was also often negotiated between collaborators. Jauregi, Canto, De Graaff, Koenraad and Moonen (2011) also highlighted that students communicated synchronously with native speakers in the target language while undertaking action together in a *Second Life*, 3D virtual world.

3.5 Digital sensory environments, talk and navigation

Seedhouse (2017) outlines the development of a digital sensory kitchen environment where learners acquire language skills by cooking and interacting with a digital smart kitchen that recognizes learners' movements and uses of utensils. Park and Seedhouse (2017) focused on the kitchen's use for vocabulary learning. The computer gave learners verbal instructions while they were carrying out the task, which the authors likened to satellite navigation while driving a car. The digital system aided by digital satellite signal data, tracked learners' progress in the task and provided timely context specific feedback. Whereas sensors were applied to kitchen objects, the instructions of the task came through a tablet and graphical user interface. Learners could also input information into the system by pressing a number of buttons which meant they could navigate the graphical user interface (GUI) going back, repeating, request help, pause, check where they were in the recipe amongst others.

3.6 Simulations and Augmented Reality, talk and navigation

Whereas digital sensory environments can imply whole body navigation (e.g. walking), simulations and augmented reality can include whole body navigation as well as virtual navigation, whereby a virtual screen-based thing or person is moved through navigation. The latter typically involves arms, hands and fingers of learners, which is partial body movement.

A study by Perry (2015) on a quest-based learning and augmented reality via mobiles for university students showed how using Global Positioning System (GPS), a university could transform into a virtual francophone world, where students could interact with characters, items, and media as they improved their language skills and discovered their campus. An augmented reality and interactive storytelling platform was used to create a virtual narrative treasure hunt (quest). At each location, players interacted with virtual characters that directed them or gave them quests with clues or options to further the storyline. These interactions took place either in the form of written text or audio and video recordings to which the student had to respond. Quests also involved challenges ranging from taking pictures of specified objects, to collecting virtual objects, to exploring locations on the map. Groups or individuals could select a variety of options to make their own learning path. Slusareff and Boháčková (2016) took a games-based approach to mobile learning, where game interaction was based on the multimedia content triggered by locations or QR codes; when the player approximated to the area of marked GPS coordinates or read a hidden QR code, the application signalled (vibration and sound) that there was new content. Afterwards, players could shift the story through interactive interviews consisting of image (mostly virtual characters connected with the place), text and multiple choice where a player could answer and thus unfolded a customized version of the story. The branching (that allowed for different instructional sequences) empowered players in partly choosing their path and storyline but all possible branches resulted into a unique ending. The players could navigate themselves as well with compass – the augmented reality tool adding a layer to the smartphone camera that showed direction and distance of other locations.

Thorne, et al. (2015) focused on the ways that small groups used digital technology as they moved through a physical environment in order to accomplish a quest-type task during a mobile augmented reality game play. The game was available on one mobile digital device (an Apple iPhone) that was shared by three players as they negotiated a set of point-to-point route finding tasks. The single device was oriented towards by group members in different ways, via talk-in-interaction, as they accomplished the game activity. The practices for talk-in-interaction, included gaze, postural alignment and deictic expressions, and were used by the participants to maintain their constitution as a group, to accomplish a shared visual focus on the single device, and to explicitly transfer the device from one player to another. A distinctive feature was that only one participant in a group of three was carrying a mobile device, which created a dynamic in which the group, together, would orient toward the device. Each small group needed to coordinate their interpretations of the instructions for the activity and their movement around the university campus. The instructions for the activity were available on the device and the device featured a GPS networked map.

4. General Objectives

The main aim of this paper is to further explore the relationship between navigation and talk in four current and emerging CALL scenarios in language learning tasks to see if the phenomenon of directional agency appears in these. We aim to know if and how talk occurs in these scenarios within a broader notion of discourse to include non-verbal communication with the screen or technologies. We are also interested in whether Coffin and Donohue's (2014) notion of semiotic initiations/responses can be used to characterise this discourse. An additional aim is to understand how meaning may be being negotiated beyond the lingual, as this is an important focus in SLA research. We want a deeper understanding of the phenomenon involving talk and navigation in tasks across CALL scenarios in order to extend, develop and refine the construct of directional agency. Therefore, our research question is as follows:

RQ1 Is there evidence of directional agency manifesting in other recent or emerging task-based language learning CALL scenarios that involve talk, and if so how?

5. Methodology

The study uses a cross-case analysis rationale in order to see if there is transferability of the phenomenon found in our cases across other studies. These studies are considered cases after a process of selection from a systematic literature review which we subsequently describe.

First we undertook a conceptual review of directional agency in order to have a basis as a specific framework to work from, based on navigational acts and talk identified in our own studies. We then carried out a systematic literature review which is the most appropriate research method to provide a reliable overall picture of studies to comment on, extend, or develop theory (Baumeister and Leary, 1997) and to formulate an overarching conceptualization (make a point, rather than summarizing all the points everyone else has made (Sternberg, 1991). However, the two major problems with this method applied to this study were that we were focused on a phenomenon that had only been recently identified and given a name as well as the fact that we were working within a research field with "a lingual bias" (Block, 2013, p.56). For these reasons, studies were not focused on or reporting the phenomenon we were interested in. Another challenge was that the term pedagogical "task" has a very specific meaning and criteria in SLA but at the same time it is a word that is commonly used as a synonym for "activity" or "project". Therefore, the specific literature review needed to be undertaken by someone who was an expert in the SLA field and more specifically, task-based learning. As a base for the systematic review, we used a pre-existing literature review carried out by such an expert in the field of task-based language learning and technology, namely González-Lloret (2017a). This review of current and emerging CALL scenarios was presented at an International conference on Task-Based Language and Teaching in 2017 and included 1) Computer Mediated Communication (CMC), 2) digital sensory environments, 3) simulations and augmented reality and 4) virtual environments, 5) online gaming, 6) online instruction and 7) intelligent computer-assisted language learning (ICALL) systems (appendix A). These last three were omitted from our systematic literature review. Based on personal correspondence with González-Lloret, we established that the literature selection was based on task-based learning and technology and the studies selected by González-Lloret were ones that actually included pedagogical task rather than class activities (even if they said they were or even if they did not call them so) (González-Lloret, 2017b). From this selection, we then took a progressive focusing approach, which was refined by Stake (1981). This approach involves observation of the site, further enquiry, beginning to focus on the relevant issues and then seeking to

explain. We used the model developed by Sinkovics and Alfoldi (2012), focusing on four steps: 1) choosing a sample and context (concerned with moving the research out of theory into the field); 2) data collection and preparation; 3) data analysis and comparison with theory and 4) discussion and write up.

The sample we chose was based on four CALL scenarios from González-Lloret's original review. We included two scenarios which she deemed future CALL scenarios because we wanted to include tasks that were using the newest technologies (digital sensory environments and augmented reality). We also included our own CALL scenario (CMC) and then one more (virtual environments). The context was formal language learning scenarios that used a task-based learning approach mediated with some form of digital technology. The data collection and preparation consisted of first looking for studies that mentioned navigation but where navigation was not the main focus. We included studies after 2009 to the present date but included studies before then if the search results added some value to the current study. We then focused on learner talk. We initially focused on tasks for spoken interaction but given that many tasks involved a number of language skills e.g. speaking and writing, we left that aspect open, and therefore included all studies that mentioned learner talk. However, we soon realised in the collection stage that learners were not the only ones talking. Although directional agency was originally conceptualised as encompassing learner talk in the original construct, we expanded the inclusion of studies that made reference to include just talk, reasoning that learners may be responding to computer-generated talk. This was also based on our own ongoing work that found that learners responded to computer-generated textual requests in tasks, which could be considered 'initiations' (Knight, Dooly, Barberà, 2017b). Different task types were included in the review because we were interested in the transferability of the phenomenon. Based on this inclusion/exclusion criteria i.e. talk and navigation, each study was read and selected by the main researcher. Books were also included so the chapters and indexes were scanned for mention of navigation and talk. We added other studies to the selection namely those that had led up to and formed part of our own studies on talk, navigation and agency including Appel, Robbins, Moré and Mullen's study (2012) on navigation and interface versions. Data analysis involved creating a table as a data display (Yin, 2009) for analysing the studies. This was used to support an analysis as to how the studies in the field compared with aspects of the original definition. We also included whom/what the talk was emerging from which we link to initiation/response sequences that are implied (i.e. learners-learners or computer-learner interaction). In addition, we read the studies in order to understand how meaning negotiation may be being made verbally and non-verbally in tasks. The results of this process helped to shape the original construct of directional agency, leading to a revised version of the construct, which is presented at the end of this paper.

6. Results and Discussion

The research question pertains to whether there is evidence of directional agency manifesting in other recent or emerging task-based language learning CALL scenarios that involve talk, and if so how.

Before presenting the results, we review the original definition of Directional Agency as defined by Knight, Barberà and Appel (2017, p.290). Directional agency is "learners' choices and acts pertaining to navigation and speech" including "physical interaction with technology accompanied by spoken interaction". It was defined as "choices preceding and accompanying physical moves made by learners to e.g. navigate, check or submit answers either individually or collectively using non device related technological features". The characteristics involved "individual (physical) interaction" and "joint negotiation (speech/written)".

In our analysis we compare aspects from the original definition with the selected studies identified from the four CALL scenarios namely 1) its nature; 2) the physical interaction with technology accompanied by spoken interaction; 3) choices preceding and accompanying physical moves made by learners in the navigational process and 4) that it could be carried out individually or collectively using non device related technology.

Results suggest that directional agency appears to be present across different CALL scenarios but the construct needs to be refined in the light of its application to other CALL scenarios.

6.1 The nature of directional agency

The physical moves to navigate in CMC scenarios typically takes place with human hands and fingers. This is evident in studies on CMC with audio whereby learners click on a screen-based resource/button to look at answers to tasks (Appel, et al., 2012 and Knight, Barberà and Appel, 2017). Learners click on pop-ups that

require closing or click on buttons to move learners on to the 'next task' (Knight and Barberà, 2016) or interface page. Learners browse through websites together (Levy and Kennedy, 2004) implying website and webpage navigation. Learners switch from windows to an internet browser or keep other tools open on the screen at the same time in videoconferencing (Guth and Helm, 2011). Learners click to connect and disconnect in voice chat (Satar and Özdener, 2008).

The physical nature in virtual environments is evident in learners working through (moving) their avatars toward a common goal as described in the study by Zheng, et al. (2009) and undertaking virtual action together in the form of avatar-embodied interaction (Jauregi, et al., 2011). Moving avatars such as running or flying involves clicking the keys on a keyboard so while the nature is physical it is at the same time embodied (pertaining to the human body) in nature.

In digital sensory environments, learners can move around a physical learning space (kitchen) as well as press navigational buttons to input information into the system (Seedhouse, 2017) therefore highlighting the physical, whole-human body being part of navigation. This also occurs in simulations and augmented reality scenarios, whereby physical moves to navigate can also take place with the whole body, as suggested in studies by Perry (2015), Slusareff and Boháčková (2016) and Thorne, et al. (2015). Learners need to walk from one place to another, stopping at different points to then move on to another place once again.

The nature of learners' agency across these scenarios is carried out through the relationship between the learner/s body and the tool/s used. The physical nature encompasses human hand-based navigation based on the assumption that hypertext, browser navigation and moving avatars typically occurs in this way. It also encompasses movement of the human whole body in relation with the tool as the tool navigates the body (e.g. through being held or being pointed) in a trajectory, as well as the embodiment of humans represented virtually and moving virtually as avatars. These navigational moves are not necessarily carried out in isolation from each other but may run parallel with each other in a task, such as moving an avatar (through human hand-based navigation) to move an embodied 'you' or walking in a physical space while also navigating with a screen or other system.

While the nature of directional agency may be experienced physically by learners, learners' intentional navigational moves appear intrinsically inter-connected to tool use. Therefore, directional agency can be considered both physical and digital in nature.

6.2 Physical interaction with technology accompanied by spoken interaction

Many studies noted spoken interaction between learners, alongside physical interaction with technologies for navigation. In a digital sensory environment, learners move themselves around the kitchen (Seedhouse, 2017) whilst responding to verbal instructions from the computer.

In a simulation and augmented reality scenario, Thorne, et al. (2015) found that the talk between learners was used to share a focus on the device and to explicitly transfer the device between players as well as their oral negotiation of a route from point-to-point. In a virtual environment, Zheng, et al. (2009) found that coupled with learners having to negotiate the moving of the avatars, they also had to orally negotiate the controlling role of the instructor between collaborators. What this result points to is that learner-learner talk or computer-learner talk for navigational purposes may be multi-layered, either centring on the navigation of the device and/or resources on the screen and/or centring on the navigation of the person. In addition, the spoken interaction for navigation also may accompany physical interaction between learners, such as the transferring of a device. What these studies have in common is the oral negotiation present between learners about what to do with different objects (e.g. devices, avatars, navigational buttons, themselves) in the navigation process; the negotiation of the route in the process. These results concur with Zheng, et al. (2009) proposal that interaction, actions and movement are negotiated towards learners' goals.

Furthermore, other studies mention how the 'talk' can be carried out by a computer, both verbally to learners as identified in studies by Seedhouse, (2017), Jauregi, et al. (2011) and textually, as in studies by Jauregi, et al. (2011) and Knight, Dooly and Barberà (2018c). In addition, computers can talk to learners through movement (such as vibration and sound) as identified in the study by Perry (2015) or through a pop-up as found by Knight, Dooly and Barberà (2018c). This physical interaction with technology can be understood as initiation and

response sequences: a form of discourse involving a mixture of verbal and/or non-verbal (e.g. textual, vibration and sound) communication.

We identified how the computer can initiate a response by one or more learners in a number of studies. In a digital sensory environment (Seedhouse, 2017) the computer's clues and options were given through virtual characters connected with the place. In an augmented reality game (Slusareff and Boháčková, 2016), learners could respond with multiple choice. In an augmented quest game with mobiles, virtual characters could direct learners and give verbal instructions that were text, audio or video bases so that learners could physically carry out the task (Perry, 2015). In a CMC task with audioconferencing, pop-ups and navigational screen-based resources initiated learners' response to close a pop-up through physically clicking on it (Knight and Barberà, 2016 and Knight, Barberà and Appel, 2017).

In the light of these findings, it appears that while the original premise for directional agency was based on the fact that spoken aspects can accompany or precede navigation and is the case in many studies, the definition should change in three main ways. Firstly, with respect to who is doing the 'talk': that the spoken interaction is occurring between computer-learner not just learner-learner. Secondly, that other forms of communication should be included in the interaction (e.g. vibration and sound from QR codes, oral instructions from a virtual character). As we can see from many of the studies, the computer can talk/communicate so that the learner/s physically move/s themselves. It is not just that the device or screen-based button/resource can be moved by the learner in some way (e.g. pressing, clicking).

6.3 Choices preceding and accompanying physical moves in the navigation process

After comparing the studies, we identify that learners' choices and physical moves do not only pertain to navigation of screen-based resources (e.g. virtual buttons or hyperlinks) alongside partial body navigation (hand/finger) as initially conceptualised. In addition, learners' can make choices and act on these with their whole physical body and/or embodied versions of themselves. In addition, learners pointing devices in different directions as an initiation requiring a technological response can also be considered a navigational act. This results leads us not only to modify the definition in this aspect but also to see how its application can be expanded.

6.4 Being carried out individually or collectively using non-device related technological features

While studies attest to individuals, pairs and groups in carrying out directional agency through technologies, what it did not encompass was that in many studies the technologies are not only digital tools for navigational purposes but they could also act as protagonists or digital "others" (Raudaskoski, 1999) through the actions of giving instructions/clues etc. in the task process. In addition, we found that directional agency can be carried out through both non-device related features (e.g. screen-based buttons/resources) as originally proposed, as well as devices or extensions of a device (e.g. mobile phone and QR codes or keyboards).

As a consequence of the results, the original construct of directional agency has been refined through its application with other CALL scenarios and our understanding of the phenomenon has deepened. We now propose that directional agency is both physical and digital in nature, but also has verbal and/or non-verbal communication accompanying or preceding it, which is necessary for navigational purposes to be carried out. Directional agency involves intentionality, which may be apparent in the choices and physical moves of learners to navigate or check progress in the navigational trajectory. The intentionality of digital tools is also evident in the messages given to learners (e.g. through instructions from virtual characters or pop-ups instructing learners to close them) as well as where the technologies take learners to (a specific virtual page or a specific physical place). It can be carried out individually or collectively by humans and may also include other digital actors. Navigational choices may be able to be negotiated by learners using a range of verbal and non-verbal modes. Navigational acts can be understood as momentary events such as a click on a hyperlink or a larger trajectory of navigating from one place to another with several steps along the way. The physical or physical/virtual moves that form part of it can involve human, embodied partial body (such as pressing a key on a keyboard) or whole body human or embodied movement (such as walking in virtual or non-virtual environments) along a trajectory.

7. Conclusions

The study has sought to identify, explore and understand the phenomenon of directional agency. This was in addition to further exploring the relationship between navigation and talk and understanding the relationship through a multimodal lens. Directional agency was found to be present across other task types and CALL scenarios but as a construct it needed to be refined. We found that directional agency can be shared across learners and digital technologies and that multiple forms of navigation can occur in the same task. Results suggest that agency is not individual but part of a system of action and it implies negotiation which is not only linguistic but multimodal.

Coffin and Donohue's (2014, p.28) notion of "semiotic initiators and responders" has been key in understanding directional agency as a shared system between learners and technological aspects of tasks. While we found that the initiation/response sequence was useful in characterising what we have come to understand as human-human and human-computer, multimodal turn-taking in task discourse involving navigation, the sequence needs further research in order to study the sequences in greater depth.

Finally, the initiations and responses identified in the studies are not necessarily mechanistic but rather, appear to involve some form of negotiation including oral negotiation between learners, physical negotiation between computer and learner and/or embodied virtual negotiation between avatars. Given that meaning negotiation is an important research area in SLA theory and research, further research is needed in order to understand how meaning negotiation in CALL scenarios is carried out multimodally, not just linguistically. These multimodal negotiations may also give further insight into how learner agency or types of agency can be carried out (or not) by learners in order to foster agency in future CALL and non- CALL scenarios for optimal language learning.

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Appendix A: Literature review of four CALL scenarios presented by González-Lloret (2017) that formed the basis for the systematic literature review

1) Audio and video Computer Mediated Communication (CMC) and telecollaboration	Bueno-Alastuey, 2013; Granena, 2006; Loewen and Isbell, 2017; Loewen and Wolff, 2016; Satar and Özdener, 2008 and Yanguas, 2010. Levy and Kennedy, 2004. Müller-Hartmaan (2000); Furstenberg 2001; Helm, 2015; Guth and Helm, 2011; van der Kroon, Jauregi, and Jan, 2015; O'Dowd, 2016 and Van der Zwaard and Bennick, 2014; Sadler and Dooly, 2016; Guth and Helm, 2010; Lewis and O'Dowd, 2016; O'Dowd, 2016;
2) Digital sensory environments	Preston, Balaam, Seedhouse, Kurhila, Kotilainen, Rafiev and Olivier, 2015; Seedhouse, 2017; Seedhouse and Knight, 2016
3) Simulations and augmented reality	González-Lloret, 2003; Perry, 2015; Reeder, 2010; Santos, Taketomi, Yamamoto, Rodrigo, Sandor and Kato, 2016; Slusareff and Boháčková, 2016; Salak and Cakir, 2015 and Thorne, Hellermann, Jones and Lester, 2015.
4) Virtual environments	Canto, de Graff and Jauregi, 2014; Ganem-Guttierez, 2014; Hampel, 2010; Sadler, 2009, 2012; Sadler and Dooly, 2016; Zheng, Young, Wagner and Brewer 2009 and Jauregi, Canto, de Graaff, Koenraad, and Moonen, 2011; Milton, Jonsen, Hirst and Lindenburn, (2012).