

Describing spatial layouts as an L2M2 signed language learner

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This study explores the L2M2 acquisition of Norwegian Sign Language by hearing adults, with a focus on the production and use of depicting signs. A group of students and their instructors were asked to respond to prompt questions about directions and locations in Norwegian Sign Language, and their responses were then compared. An examination of the students' depicting signs shows that they struggled more with the phonological parameters of orientation and movement, rather than of handshape. In addition, they used fewer depicting signs than their instructors, and instead relied more on lexical signs. Finally, students were found to struggle with the coordination of depicting signs within the signing space and in relation to their own bodies. It is hoped that the findings from this study can be used to inform future research as well as curricula development and pedagogy.

Keywords: depicting signs, classifier predicates, Norwegian Sign Language, L2 acquisition, M2 acquisition

1. Introduction

Over the last decades, many countries have experienced a positive change in attitudes and perceptions towards deaf people and their signed languages. This has been coupled, in some cases, with increased governmental support for deaf people to access public and private, social, cultural, and political life through signed language. Consequences of these changes may in part explain why the numbers of hearing adults learning a signed language are increasing—as there is now a need for a range of proficient signing professionals, such as interpreters, teachers, and social and healthcare workers. Hearing parents of deaf children also make up an important learner group, and, it could be argued, their access to quality signed language teaching and learning is essential for their deaf child's well-being.

If anecdotal numbers hold up, we may be in a position to claim that in many places, the largest learner group of a signed language is hearing adults, who have a spoken first language, rather than say, deaf children. In Norway for example, it is estimated that every year around 30 children are born deaf (Forus 2012). This figure can then be compared to the 100 or so hearing students taking their first Norwegian Sign Language class in the higher education system every year, as well as students taking courses provided by other types of institutions such as The Norwegian National Association of the Deaf, high schools, and Statped (The national service for special needs education in Norway).

Unlike deaf children who may learn signed language naturally during the course of their childhood, many hearing students are learning in time-constrained, classroom settings. For example, students admitted into a Bachelors program for Norwegian Sign Language interpreting are not required to have any prior knowledge of Norwegian Sign Language. This means that they have three years to become fluent users of Norwegian Sign Language, and during the same short time period, they are also expected to become competent simultaneous interpreters. This example makes it clear that both qualitative and quantitative research is needed to inform the development of a set of best practices in signed language pedagogy. In

addition, the creation of knowledge-based curricula and reliable descriptions of the acquisition process, including the progression of developmental milestones are necessary. Although not much work like this has been done in Europe, there is a gaining momentum (e.g. Alberdi, Leeson & Salami 2013; Leeson, Alberdi & Brown 2013, as well as work funded by the Council of Europe in the recently completed PROSIGN project and the recently started program Promoting excellence in sign language instruction).¹

However, for many signed languages there is still a striking lack of research on how hearing adults learn them. This may in part relate to the comparably short history of linguistic research on signed languages more generally. There have also been technological and methodological issues that have made several lines of research difficult to get off the ground. This means that even today, many signed languages remain under-described. A lack of knowledge and documentation about how native signers use a particular signed language will obviously present challenges to linguists wanting to undertake studies in second language acquisition, as there will be no baseline with which to make comparisons.

Research that has been done to date on signed language acquisition has to a large extent focused on how deaf children acquire a signed language as a first or second language (e.g., Boyes Braem 1990; Petitto & Marentette 1991; chapters in Morgan & Woll 2002; Bogaerde & Baker 2005; Beuzeville 2006). There is no doubt that such research is essential and paramount for the promotion of (deaf) children's rights and development. It also provides much needed knowledge about how children acquire language within a variety of environments, informing and contextualizing the generalizability of findings from language acquisition research more broadly.

In addition to these historical, and current, justifications of research focus, we now see a very real need to examine adult hearing *L2M2 acquisition*—that is, the acquisition of a second language that is expressed primarily through a different modality than one's first language (see Chen Picher 2011 for more on this term). Each year, more and more hearing adults take up learning a signed language. Deaf communities and the research community have a role in shaping how the teaching and learning of signed language happens. A recent volume on the teaching and learning of signed languages came about in an attempt to address some of the current gaps in knowledge, and “as a contribution to the development of an applied sign linguistics literature” (McKee *et al.* 2014:3). Currently, in many countries, instruction is often based on an instructor's anecdotal knowledge and gut feelings. Such indicators, based in the instructor's intuition, often do not reflect wider patterns of use (Biber & Conrad 2011; Cresdee & Johnston 2014). They also cannot reflect developmental patterns and acquisition factors, as there is not enough research on this yet.

This study attempts to take into account these historical and methodological challenges by being both explorative and preliminary. However, it also works to contribute knowledge about L2M2 acquisition that reflects current limitations and needs. Specifically,

1. <http://www.ecml.at/ECML-Programme/Programme2012-2015/ProSign/tabid/1752/Default.aspx> and <http://www.ecml.at/ECML-Programme/Programme2016-2019/SignLanguageInstruction/tabid/1856/language/en-GB/Default.aspx> (accessed 27 February 2017).

the project examines the L2M2 acquisition of Norwegian Sign Language by hearing adults with Norwegian (or in one instance, Swedish) as their first language. The analysis presented here builds and expands on Nilsson & Ferrara (2015, 2016) by focusing on the production and use of depicting signs, a type of partly lexical sign (see the section on depicting signs below), during elicited, but spontaneous, responses in Norwegian Sign Language. These responses are compared to responses to the same prompts produced by three of the students' deaf instructors. By comparing the student data with the instructor data, we aimed to mitigate, to some extent, the fact that Norwegian Sign Language is still under-described.

In the following sections, relevant background will situate and provide context for the current study and its findings. Data collection, annotation, and analysis will then be described, before presenting a general overview of the data. This will be followed by more specific findings related to the depicting signs produced by the students and instructors. First, an overview of the non-target phonology observed in the students' productions is provided. Then we summarize the students' use and non-use of depicting signs in comparison with their instructors. Finally, we shift focus to the struggle learners have with coordinating and placing depicting signs in space, as parts of larger sequences of language production. By examining how these signs are used in longer stretches of actual language use, we highlight the complexity of real-time, spontaneous interaction and suggest that such settings should be considered more in hearing L2M2 signed language research.

2. L2M2 signed language acquisition and depicting signs

2.1 L2M2 acquisition of lexical signs

Investigations into L2M2 acquisition of a signed language began with a cluster of studies on American Sign Language (ASL) acquisition in the mid-1980s, which lasted until around the mid-1990s. These early studies mainly focused on how hearing adults learn and recall single signs within controlled, laboratory settings (Mills & Weldon 1983; Mills 1984; Fuller & Wilbur 1987; Hoemann & Blama 1992; Lupton & Fristoe 1992; Hoemann & Keske 1994). At that time, there was less emphasis on how students produced or comprehended signs, with one exception being an investigation into the development of non-manual behavior in ASL by both deaf children and hearing adults (McIntire & Reilly 1988).

Further investigation into how L2M2 learners produce and perceive signs began in the 2000s and continues today. One of the earlier studies, conducted by Mirus, Rathmann and Meier (2001), found that naïve and beginner signers produce signs with more proximal joints, whereas deaf signers tend to distalize sign production. Another study by Rosen (2004) investigated student production/phonology errors in a classroom setting. While not going into the details of his findings, he concludes that both perception errors and issues with motor dexterity account for the data. However, Chen Pichler (2011) challenges his analysis with another experimental study on sign production, focused on handshape, by naïve signers of ASL. She accounts for the errors within her data, along with a lack of errors, by bringing in concepts from L2 acquisition research—namely transfer and markedness. She comments that

even with the modality differences between English and ASL, English speakers still have experience with co-speech gestures, which are often produced with handshapes that also exist in ASL and thus could be sources of transfer when they are learning ASL.

Several more studies in recent years have continued to focus on the acquisition, production, and perception of single signs. For example, Bochner, Christie, Hauser and Searls (2011) examined the perception of single ASL signs by L2M2 learners in an experimental setting. They found that movement contrasts between signs were the most difficult to perceive, while contrasts of location were easier to perceive. A study of British Sign Language (BSL) L2M2 acquisition by Ortega and Morgan (2015) showed that students have the most difficulty with a sign's handshape, followed by movement, orientation, and finally location. However, they also found that students' articulation accuracy improved with training. Another study found that hearing signers have greater production variability in their signs, as compared to deaf, native signers (Hilger, Loucks, Quinto-Pozos & Dye 2015). The early theme of iconicity in L2M2 acquisition has again been taken up by Baus, Carreiras and Emmorey (2013) who found that iconicity helps lexical memory in new signers, but not in proficient signers. In another line of research, Willoughby, Linder, Ellis and Fisher (2015) present a classroom study that examined handshape errors made by students of Auslan (the signed language used in Australia) and how teachers give feedback on such errors. They analyzed 51 lexical signs produced with errors, and showed that students struggled the most with the handshape and then the movement of signs, and that more complex signs were more error-prone, similar to the findings from Ortega and Morgan (2015).

2.2 Depicting signs

Whereas the above-mentioned acquisition studies focus almost exclusively on the production, perception, or learning of single lexical signs—the current study attempts to investigate how hearing adults acquire and use depicting signs within longer stretches of spontaneous discourse. Thus, in this section, depicting signs are introduced, with the help of some examples from Norwegian Sign Language. Then, in the next section, two L2M2 acquisition studies on depicting signs are reviewed.

Much debate exists within the literature regarding how to best theoretically model the signs here called *depicting signs*. While a detailed theoretical debate is not the goal of this study, most accounts today cluster around two main positions. These signs are either described as complex assemblies of different (bound) morphemes and are regarded as fully linguistic signs (e.g., Supalla 2003), or they are considered to be complex signs that integrate both conventionalized and non-conventionalized elements (e.g., Liddell 2003). We use the term depicting sign, adopting the view that depicting signs are partly lexical signs that express their meaning through conventional and less conventional features (Liddell 2003; Schembri, Jones & Burnham 2005; Johnston & Schembri 2010). These signs are also iconic, and they are often positioned and moved meaningfully through the signing space.

Depicting signs form a core part of a signed language's productive lexicon and can express a range of meanings. While some researchers categorize depicting signs according to

their handshape (often called classifiers), we align with those who categorize depicting signs based on their generalized meanings in context (e.g., Liddell 2003; Johnston & Schembri 2007; Johnston 2016). The categories of depicting signs considered here can be summarized under the following subtypes: signs depicting the movement of an entity (DSM); signs depicting the size, shape and extent of an entity (DSS); signs depicting the location of an entity (DSL); and signs depicting the handling of an entity (DSH). Prototypical examples of each of these categories from Norwegian Sign Language are presented in Figure 1. More examples will be presented in later sections, as produced by both students and instructors.



Figure 1. Types of depicting signs with examples from Norwegian Sign Language

2.3 L2M2 acquisition of depicting signs

There have been few studies investigating the use of depicting signs by adult hearing learners. One, conducted by Marshall & Morgan (2014), examined the acquisition of “entity classifiers” in locative and distributive constructions by 12 adult learners of British Sign Language (BSL). The participants had been learning BSL between one and three years at the time of the study. Entity classifiers were defined as “the handshapes that signers use to represent different

classes of objects...” (Marshall & Morgan 2014:3). Signs that are partially composed of an entity classifier are considered depicting signs here, and depending on the instance, could represent the categories of signs depicting location (DSL), signs depicting size and shape (DSS), or signs depicting movement (DSM).

Marshall & Morgan (2014) use experimental methods in a laboratory setting to elicit responses from participants within short, controlled contexts. Both the production and comprehension of depicting signs was examined. For the production task, the participants were asked to watch a computer screen where a sequence of two images appeared. Then the students were asked to explain what happened using BSL. These responses were then analyzed against native signer responses to the same stimuli, looking for errors in handshape, location, movement, and orientation. They report that over 70% of the student responses contained a depicting sign, but that these often contained errors. Handshape errors, in the form of substitutions and omissions, were the most frequent followed by errors with orientation and then location. They conclude, “...it appears that learners of BSL are generally aware that they need to use entity classifiers for encoding locative and distributive relations, but they have difficulty in doing so using the conventions that the language requires” (Marshall & Morgan 2014:9). These findings differ slightly to studies on the acquisition of lexical signs, which report handshape and movement to be the main difficulties (Ortega & Morgan 2015; Willoughby *et al.* 2015).

In another recent study, Boers-Visker & Bogaerde (2015) investigated the use of space, which included depicting signs, produced by five hearing students of Dutch Sign Language (NGT) during a proficiency interview and a narrative re-telling. This data was collected two times—at the end of the students’ first and second year respectively. Their findings show that students do produce depicting signs already after their first year, but almost exclusively during the narrative task.

These initial studies indicate that students are able to produce depicting signs, but that this use is not yet fully developed. Marshall and Morgan (2014) show that phonological errors are common, even in controlled settings. Boers-Visker & Bogaerde (2015) show that use may be limited to certain text-types—perhaps with students being more practiced in using depicting signs during storytelling.

2.4 Summary of research as impetus for the current study

The studies reviewed focus on hearing students learning how to sign, often during their college years. They virtually all focus on the production or perception of single signs and their phonology (although see McIntire & Reilly 1988 for a study on the acquisition of non-manuals and Boers-Visker & Bogaerde 2015 who look at the use of space). With a few exceptions, the studies have been conducted as laboratory experiments in controlled settings, and often with naïve signers rather than students actually enrolled in classes or programs to specifically learn a signed language.

This review indicates a need for investigations into other, more complex aspects of signed language development (e.g., syntax, discourse structure, etc.) in L2M2 settings, as well

as the use of more naturalistic data. The current study attempts to address this need with a preliminary and exploratory study on the acquisition and use of depicting signs in Norwegian Sign Language, as these signs are anecdotally said to be particularly difficult for learners to master. The interaction of depicting signs within the signing space with depicting and other types of signs will hopefully also provide an initial account of how beginner signers handle more these complex structures.

3. Methods

3.1 Participants

For this study, 12 students and three instructors of Norwegian Sign Language were recruited as participants. The students came from a second-year class in a three-year Bachelor's program in Norwegian Sign Language interpreting at a university in Norway. All students are female and reported Norwegian as their first language, except for one who has a Swedish background. In addition, the students have had many years of English instruction at school, with a few having also had study abroad opportunities. Only two students reported having experience with Norwegian Sign Language before entering the program (although, it should be mentioned that these two students were still beginner-level signers upon starting the program).

At the time of the study, the student participants had completed a year and a half of the full time Bachelor's program. During their first two semesters (the first year), the students had access to 12-16 hours a week of Norwegian Sign Language instruction (although attendance is not counted or obligatory). In the third semester, targeted signed language instruction occurs roughly two hours a week, with additional practice during interpreting classes, as well as during approximately three weeks of practicum that happens out in the community (focused on both signed language communication and interpreting). At the time of the study, most of the students (8/12) reported using Norwegian Sign Language less than three hours a week outside of the classroom. Two students report between five and six hours, and two students reported between eight and ten hours a week.

The students' primary Norwegian Sign Language instructors were three additional participants in this study. Two of the instructors are men and they were both born deaf. They learned Norwegian Sign Language during early childhood when they started attending a deaf school. The third instructor is a woman and she became deaf as a teenager. Her signing exhibits higher degrees of contact with Norwegian. All three instructors use Norwegian Sign Language in their daily life and are active members of the Norwegian Deaf community. They also work in a multilingual workplace, where Norwegian Sign Language is often used for face-to-face interaction.

3.2 Data elicitation and collection

The data for this analysis are a set of spontaneous, extended responses in Norwegian Sign Language to two prompt questions, listed below.

1. How do you explain how to get to the new campus from the old one to someone who has never been there before? Either by bus, walking, or driving.
2. Can you please describe the third floor of the building where you have classes? For example, where do you find the large and small teaching rooms, the social area, etc.?

One of the Norwegian Sign Language instructors posed these questions to the student participants. The questions were selected with the aim of eliciting what is generally described as the “meaningful use of space.” This general expression captures the ability of signers to associate meanings with areas of space in their immediate surroundings. In the context of the current study, the meaningful use of space entailed the signing space being conceptualized topographically, either scaled down or more normal sized, so that signs placed and moved within this space are understood as having physical relationships, which then are associated with the relevant referents.² For example, question 1 was designed to prompt the participants to give step-by-step instructions for how to walk, drive, or take the bus from one location to another. Question 2 targeted the participants’ ability to describe spatial layouts and relationships between spaces and/or objects. To varying degrees, the responses to these prompt questions were expected to include the use of depicting signs arranged in spatially meaningful ways, as well as other types of signs.

All questions and responses were filmed with one high-definition video camera focused primarily on the student. During the elicitation, the instructor and the student were the only two people in the room. The researchers were present outside of the room if needed, however, and would check the recording equipment between elicitations. The researchers also maintained the schedule and worked with the other students while they were waiting. The instructor was free to repeat and re-word the questions if needed, and the students were also allowed to ask for clarifications, although these options were not always exercised. After the questions were answered, the student moved on to another elicitation task, which targeted interpreting skills; data that is not considered here.

During the first viewing of the recordings, it became clear that the prompt questions were quite challenging for the students. For one, it appeared that many students did not know how to answer the question(s), because they were unfamiliar with the city or the locations targeted by the questions. Some students also misinterpreted the questions. For example, several students responded to question 1 with answers in the spirit of “I take the bus.” These responses do answer the question, though the students did not interpret the question as we had intended. In some of these instances, the instructor did not always attempt to re-direct the student’s response. Thus, while we report below on whether or not the students produce a target response to the stimulus questions, these responses do not necessarily speak to the students’ overall ability to comprehend or produce Norwegian Sign Language.

2. Of course, signers can also associate meanings to areas of space without invoking topographical relationships, such as with tokens (Liddell 2003).

In addition to recording the students' responses, responses produced by the three Norwegian Sign Language instructors were also recorded. The instructors were posed the same questions listed in 1 and 2 by the researchers. Their responses were used as a baseline for comparison to the students' productions.

3.3 Annotation

Annotation of the student and instructor data was completed using ELAN,³ a computer program developed at the Max Planck Institute of Psycholinguistics in Nijmegen, The Netherlands. ELAN synchronizes video segments with annotations that are created on user-defined tiers (Crasborn & Sloetjes 2008). Annotations were discussed, proofed, and amended over time across multiple passes by the two authors. In addition, a Norwegian Sign Language instructor (who did not participate in the study) was consulted on all of the depicting sign annotations as well as annotations for non-target phonology.

First, the student and instructor data was tokenized for single signs, including lexical signs, pointing, fingerspelling, and non-conventionalized signs, e.g., constructed action. Depicting signs were also identified and further tagged, generally following the conventions used for the Auslan Corpus (Johnston 2016). The code prefixes first introduced above in Figure 1 were used to identify depicting sign subtypes. An additional sub-type, glossed DS?, was also used, which indicated that there was uncertainty (on the part of the annotator(s)) regarding what the signer was trying to depict with the sign. Following the sub-type prefix, a handshape code is tagged, followed by the meaning of the sign in context, e.g., DSS(GC):ROAD-EXTENDS in Figure 1. Two-handed depicting signs received a gloss for each of the hands to reflect each hand's contribution to the sign as a whole. For example, the glosses DSM(2):MAN-RIDES-HORSE and DSM(B):HORSE-MOVES in Figure 1 indicate that the signer produces a two-handed sign depicting the movement of entities. The signer produces a 2-handshape on the dominant hand to depict a man riding a horse, and a flat hand (B-handshape) to depict a horse on the non-dominant hand.

We note that although many depicting signs can simultaneously depict elements that fall under different subtypes, e.g., a sign depicting a location may also include details about size and shape, we assigned subtype during the data annotation phase based on an interpretation of the sign's primary function within an utterance. For example, in Figure 1, the sign glossed DSL(B)CAR-LOCATED-AT was interpreted within the particular utterance to primarily depict where the car was located, even though the sign's handshape also gives details about the size and shape of the car. This is different to the two-handed sign glossed DSS(GC):BUILDING-EXTENDS-UPWARDS/ DSS(GC):BUILDING-EXTENDS, which was interpreted in context to show how high a building rose (which was important to the development of the joke being told), rather than say where the building was located, even though the placement of the sign in the signing space does include some detail about location.

The annotation of depicting signs also took into consideration the observation that lexical signs often resemble depicting signs (e.g., Klima & Bellugi 1979; Cuxac 1999;

3. Please see <http://www.lat-mpi.eu/tools/elan/> for more information regarding this free annotation software.

Johnston & Schembri 1999; Janzen 2012). Thus, during the segmentation and glossing phase, annotators were tasked with identifying a particular token of a sign as a lexical sign or a depicting sign. In this study, we relied on an interpretation of the token in context: was the sign to be interpreted as a depiction of some event or was it to be taken as a token of a type, with its default, idiomatic meaning (Johnston & Ferrara 2012)? This decision was also influenced by the sign's level of "elaboration" (such as additional non-manual behavior, lengthened durations, etc.), as well as any possible participation in a larger depicted sequence.

After the initial segmentation and identification of signs was completed, the students' production of depicting signs was revisited. Additional annotations were made when a depicting sign exhibited non-target phonology. Four tiers for each the dominant and non-dominant hand were created to tag depicting signs that exhibited non-target handshape, orientation, location, and movement. These annotations are subjective by nature, because we can never be certain what the student's target sign was in the moment. If it seemed that one or two parameters could be altered to produce a more native-like sign, these were tagged. However, as we will see from the findings and discussion below, often the entire sign appeared to be misplaced or off-target, and possible corrections in these situations could only ever be hypothetical. Thus, although we present figures on non-target phonology as a way to compare the current study's data with previous work, the main goal of our findings will be to illustrate that students are struggling with more than just a sign's phonological parameters as they try to depict scenes in a way that make sense during extended, spontaneous discourse.

As a way to explore these other types of challenges, we also created a set of tiers grouped under the general heading of "coordination." Annotations made on these tiers attempted to identify periods where students had difficulties coordinating the behavior of their two hands, in regards to timing, space, or the combination of different types of signs. These annotations were an exploratory exercise—a way to begin a consideration of possible relevant factors in L2M2 signed language production. We will now present some of the findings based on these annotations and present some detailed examples that we hope will highlight possible directions for further research, which can be used to inform signed language pedagogy and curriculum development.

4. Depicting signs across the instructor and student data

4.1 General findings

4.1.1 Difficulty answering the questions and general indeterminacy in the student data

Although the prompt questions were chosen to elicit depiction and the meaningful use of space, which is seen in the instructors' responses, the students' responses were much more varied. For question 1, six of the 12 students did not produce a targeted response nor use space meaningfully. Five of the students did not produce any depicting signs during their responses. Question 2 had a better targeted response rate. Only two students did not provide a targeted response nor use space meaningfully. One of these students also did not use depicting signs.

Before presenting findings related mostly to the accuracy of the students' signing, we would like to briefly mention observations of fluency, so as to give an initial impression of the data. Overall, the students exhibited a somewhat high degree of uncertainty in relation to their production of depicting signs. Of the total 263 depicting sign annotations on the two hands, for example, 19 (7%) were tagged as indeterminate, indicating that a sign could not be interpreted for a meaning or form, 32 (12%) were tagged as false starts, and 18 (7%) had some other questionable element related to the meaning of the sign. In addition and more generally, students signed at a slower pace and had longer pauses between signs than their instructors (Nilsson & Ferrara 2016). They also looked away to think at a much higher rate (Ferrara in preparation). We experienced that these disfluencies in the students' signing sometimes affected the coherence of the students' depicted scenes. We mention them here add context to the findings reported below.

4.1.2 Distribution of sign types and depicting sign subtypes for both groups

To begin an exploration of the data, the distribution of fully lexical signs, depicting signs, pointing, non-conventionalized signs, and fingerspelling was calculated for the student and instructor data respectively. As can be seen in Table 1, the distributions for the two participant groups are quite similar in many respects; compare the similar percentages of pointing, non-conventionalized signs, and fingerspelling.

Table 1. Sign type distributions in the student and instructor data based on annotations on the dominant hand gloss tier

Sign Type	Students		Instructors	
	Number of tokens	Proportion of total signs	Number of tokens	Proportion of total signs
Fully lexical signs	963	71.65%	271	61.31%
Depicting signs	145	10.79%	93	21.04%
Pointing	133	9.90%	49	11.09%
Non-conventionalized signs	40	2.98%	11	2.49%
Fingerspelling	21	1.56%	16	3.62%
Indeterminate category	42	0.67%	2	0.45%
Totals	1,344	100%	442	100%

However, the students and instructors diverge in their use of depicting and fully lexical signs. The instructors produce more depicting signs and fewer lexical signs as compared to the students. A calculation of the normalized frequency per 100 signs shows that the instructors average 21 depicting signs and 61 fully lexical signs in their responses, whereas the students produce 11 depicting signs and 72 fully lexical signs. From these figures, we see that students rely more on fully lexical signs during their responses than instructors, who make more use of depicting signs. These figures support the overall impression of the student data summarized by a Norwegian Sign Language instructor who commented that students appear to be “thinking in Norwegian” during some parts of their responses—with signs representing translation equivalents to Norwegian formulations. Future research, that particularly includes

a larger number of native signers, could target this initial impression with more robust statistical methods.

In addition to the students depicting less frequently than their instructors, the two groups also differed in what type of depicting sign they used the most. Table 2 summarizes the relative frequencies and distributions of depicting signs across sub-types for the students and the instructors.

Table 2. Relative frequency and distribution of depicting sign subtypes by students and instructors

Depicting sign subtype	Students		Instructors	
	Dominant (n=145)	Non-dominant (n=110)	Dominant (n=93)	Non-dominant (n=42)
DSS	20.7%	26.4%	12.9%	45.2%
DSM	19.3%	8.2%	47.9%	23.8%
DSL	38.6%	45.5%	33.3%	28.6%
DSH	3.4%	4.5%	3.2%	0.0%
DS?	17.9%	15.5%	1.1%	2.4%

We see that students most often depict the location of entities, regardless of the hand used (see the example in Figure 4). This contrasts with the instructors who depict the movement of entities most on their dominant hand and size and shape of entities on their non-dominant hand. A subsequent pass of the data suggests that the instructors' two-handed depicting signs may express figure-ground configurations and topic-comment structures, with a synchronization of the two hands. A similar analysis of the student data revealed that such types of constructions were more difficult to identify, because the two hands did not always seem to be working in concert, and hinted at a struggle to coordinate the hands in space and in timing, two issues that are elaborated upon in the following sections.

The distribution of depicting sign subtype also suggest that the students more often described static environments with entities being located and described (e.g., the location of a room, or the shape of a straight road) whereas the instructors seemed more concerned with producing descriptions as if they were moving through a scene, and described locations and entities as they would encounter them from their own perspective (e.g., giving directions as if driving the route themselves). This appears especially true for the responses to question 1 about how to get from the old to the new campus. In this way, the depicting signs produced by the students and instructors relate to the perspective and vantage point they take on their depicted scenes. A parallel study being conducted on the same data set is currently examining this topic in depth (Ferrara in preparation).

4.2 Non-target phonology in the students' depicting signs

Next, a phonological analysis, focused on the basic sign parameters of handshape, location, movement, and orientation, was conducted on the students' depicting signs, as a way to relate to previous research. The students' depicting signs were compared with those produced as part of the instructors' responses, which provided some sort of baseline for target forms. An

additional Norwegian Sign Language instructor was also recruited to go through the data. From this initial analysis, we found that students do have trouble selecting, producing, and manipulating depicting signs during spontaneous discourse. Eleven of the 12 students in the study produced at least one depicting sign with a non-native-like parameter.

As the figures in Table 3 show, for the dominant hand, orientation was the most challenging parameter. For the non-dominant hand, location was more problematic. These findings reflect, in some way, the elicitation tasks given to the students. First, there were many depictions of roads and hallways, and these instances elicited a number of signs with non-native-like orientation (illustrated by the example in Figure 2). In relation to the locations of signs, it was found that students often produced signs too high or outside the neutral signing space, e.g., when depicting the third floor of the teaching building, students often attempted to depict a scaled-down “map” of the floor, while simultaneously placing signs at shoulder-height or higher (one instance of this is shown in Figure 4). These instances were judged as non-native-like by a Norwegian Sign Language instructor who commented that this type of depiction should be lower down in the signing space (cf. Emmorey, Tversky & Taylor 2000). Thus, single depicting signs produced during these sequences were often tagged for non-native-like location (as reported in this section). However, taken together, these misplaced signs suggest that students have difficulty knowing where to stage these types of depictions in the signing space (which we take up further below). These findings differ to studies investigating phonological errors in lexical signs, which report that handshape and movement are the most problematic (Ortega & Morgan 2015; Willoughby *et al.* 2015). However, they do align with Willoughby *et al.*'s (2015) observation that more complex signs are more error-prone, as many depicting signs can be considered complex constructions.

Table 3. Numbers of tokens of non-native-like parameters produced as parts of depicting signs on the dominant and non-dominant hands by the students

Phonological parameter	Dominant hand non-native-like phonology		Non-dominant hand non-native-like phonology	
	<i>Tokens</i>	<i>Relative frequency</i>	<i>Tokens</i>	<i>Relative frequency</i>
Orientation	23	32.9%	8	17.0%
Location	15	21.4%	19	40.4%
Handshape	13	18.6%	9	19.1%
Movement	19	27.1%	11	23.4%
Totals	70	100%	47	100%

The findings here also differ from the findings reported in Marshall and Morgan (2014), who also investigated the production of depicting signs by beginner signers. From their analysis, handshape was the most problematic parameter. However, comparison is difficult, because the Marshall and Morgan study only examined the production of locatives and distributive plurals (which are considered here to be potential instances of the subtypes DSL, DSS, and DSM), in a constructed, laboratory environment. This differs from the data analyzed here, which elicited signs depicting a wider range of meanings in spontaneous discourse.

An example of a sign produced with a non-native-like orientation can be seen in the top row of Figure 2. Here, the student depicts a person at the entranceway of the floor with classrooms, and then proceeds to depict a hallway that extends to the right. We draw your attention to the final sign produced, which is outlined in black.

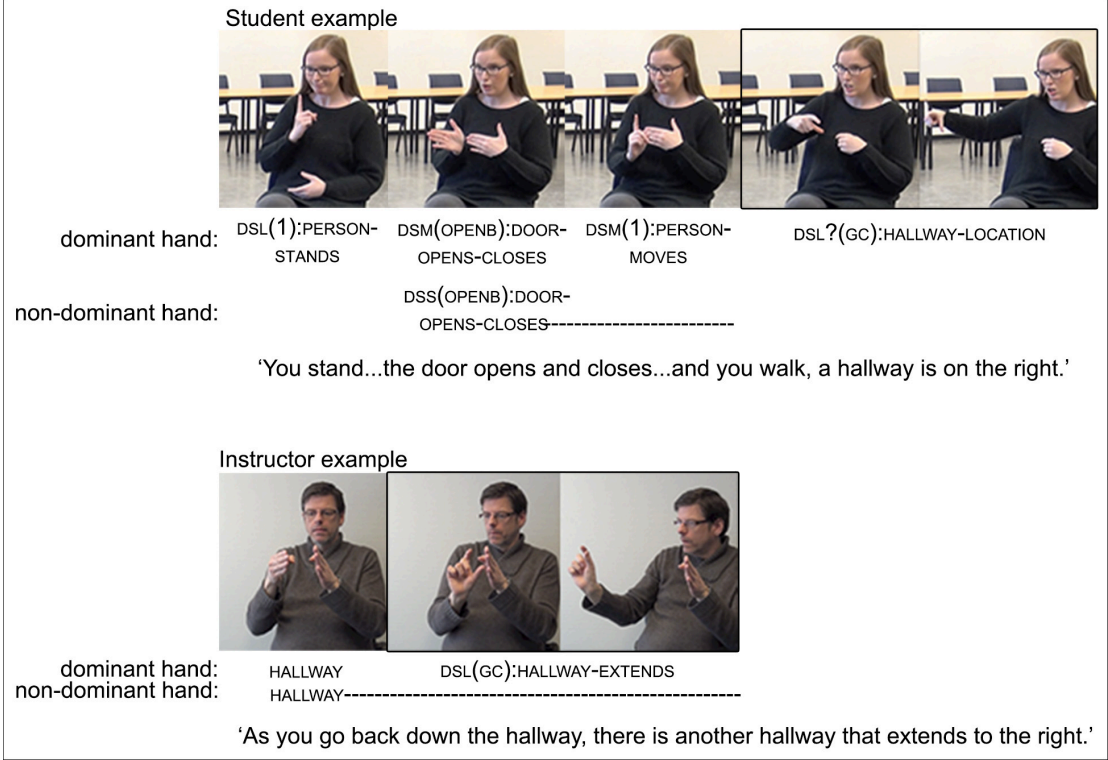


Figure 2. A student and an instructor depict a hallway extending to the right of the entranceway

When compared to how the student’s Norwegian Sign Language instructor depicts a hallway, shown in the bottom row of Figure 2, we see that the orientation of the hand is different. While the instructor’s palm is orientated in a neutral or even slightly supine position, the student uses a more prone orientation of the palm. Such a prone orientation is not observed in any of the instructors’ responses. An additional instructor also explained that for hallways it is more common to have a neutral/supine orientation. For these reasons, this sign was tagged for non-native-like orientation.

Although it is clear students struggle with the form of their depicting signs, e.g., 35.9% of the depicting signs on the dominant hand were tagged for non-native-like phonology, this seems to be only part of what is going on. Even when a depicting sign is produced with a non-native-like handshape or orientation, we often observe that one can nevertheless understand it. An example of this was illustrated in Figure 2, where the student has her hand orientated in a prone position, while it seems more common to use a neutral position with the wrist extended (as the instructor in the same Figure does). Even with this non-native-like orientation, however, one understands that the student is depicting the hallway that leads to some classrooms.

With this consideration in mind, we move on to other types of issues that appear in the students’ signing, which may be more problematic for successful communication. In

particular, we examine the challenges students face to create coherent spatial maps over a longer stretch of spontaneous discourse. These challenges, we suggest below, concern the choices students make regarding depicting signs as well as the coordination of multiple, independent articulators. We present each of these in turn below.

4.3 Depicting signs vs. alternatives

During discussions with an additional Norwegian Sign Language instructor about the student data, comments were less about phonological errors and more about how students seemed to struggle with when and where to use depicting signs and which types of depicting signs were appropriate for this setting. For example, several of the students produced signs with an extended forefinger, depicting a person moving or walking (see the student's signing in Figure 2). However, in descriptions of floor layouts, such signs are unexpected, and therefore proved confusing. Instead, the Norwegian Sign Language instructor suggested that it would be more effective to just describe the rooms and spaces in relation to each other. In fact, that is precisely what the instructors who participated in the data collection did—they simply described rooms and spaces as they would encounter them while “moving around the floor,” also indicating this with their gaze. They never depicted a person walking around the floor. There were also a number of instances commented on by the instructor where students tried to either depict a scene when lexical signs were a more natural choice or where lexical signs were used when a depicting sign would work better—indicating that students do not always know when depicting signs are appropriate.

In half of the students' signing, and for one student in particular, non-native attempts to depict with otherwise lexical signs were observed. By this, we mean that in some cases a student would place a lexical sign in a non-canonical location, prompting us to interpret the sign within the topographical depicted space. Although, researchers have observed that deaf, native signers can do this (e.g., Cormier, Quinto-Pozos, Sevcikova, & Schembri 2012; Johnston & Ferrara 2012; Zwitserlood, Perniss & Özyürek 2012; Perniss, Zwitserlood, & Özyürek 2015), we see that students often choose forms that are difficult to place in non-canonical positions or were deemed unnatural by a Norwegian Sign Language instructor. An example comparing the signing of a student and an instructor helps to illustrate these, often awkward, forms. In Figure 3, both the student and the instructor depict several windows positioned adjacent to each other. The student chooses to repeat the lexical sign for “window” several times, each placed next to each other in the signing space. The instructor, however, first produces the lexical sign for “window,” and then proceeds to produce depicting signs showing the adjacent distribution of several vertical flat surfaces.

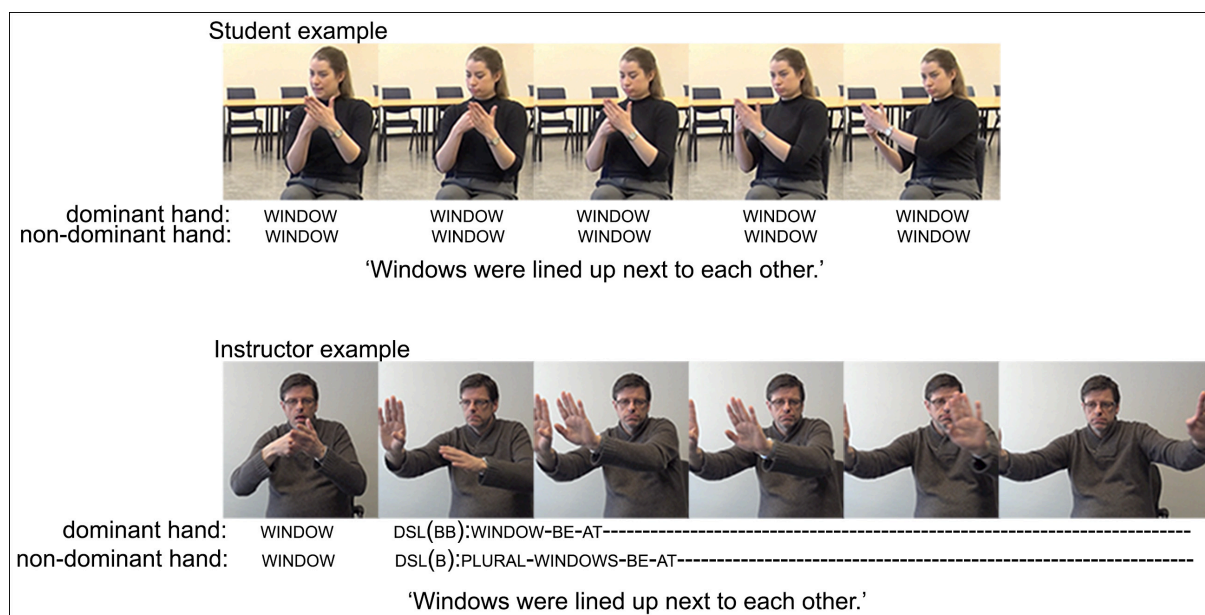


Figure 3. An attempt by a student to depict with a lexical sign, compared to a depiction of a similar scene by an instructor

These examples illustrate some of the choices students encounter as they try to give directions and describe locations. They must make choices regarding whether to use a depicting sign or not, and then subsequently decide on which form could be appropriate given the context as well as where in the signing space to produce it. While the signs they produce can be considered non-native-like, they are an indication that some students know they should depict, and are willing to do so, even if they may not be sure of the correct form.

4.4 The coordination of signs in the signing space and in relation to each other

In addition to decisions regarding whether or not to use a depicting sign and what an appropriate form could be, students also to varying degrees had issues with the physical coordination of their hands and the placement of signs in the signing space. This aligns well with some of the observations by Ortega and Morgan (2015), who found that the participants in their study articulated one-handed signs more accurately than two-handed, and that body-anchored signs were articulated more accurately than those produced in signing space. As part of the analysis for this exploratory category, problematic moments concerning the production and placement of signs in the signing space and the positioning and coordination of the two hands in relation to each other were identified. Examples of each are presented in the following sections as a way to foreground some of the other more nuanced challenges L2M2 learners face in their acquisition and use of depicting signs.

4.4.1 *Placing signs in the signing space*

First, students sometimes have trouble trouble coordinating their depicting signs in the signing space. For example, students sometimes produce depicting signs too high in the signing space, or even what could be considered outside the signing space. Some of these

instances appear to result from extended periods of depiction where the student builds up a depicted scene, and seems to either misjudge the size needed for the depiction or even “runs out of room,” if you will, forcing them to either move their upper body or move their depictions further outside the neutral signing space.

The example in Figure 4 illustrates this type of problem. Here, during a response to question 2, a student explains how different areas on the third floor are arranged. She first depicts how the social area and some classrooms are positioned next to each other. Then she produces another sign that depicts the location of the computer lab. However, this sign is produced quite high in the signing space (higher than her right hand is located), and she also actually physically leans backwards to make room for the sign, which ends up almost under her chin (see the two middle images, outlined in black, in the top row in Figure 4).

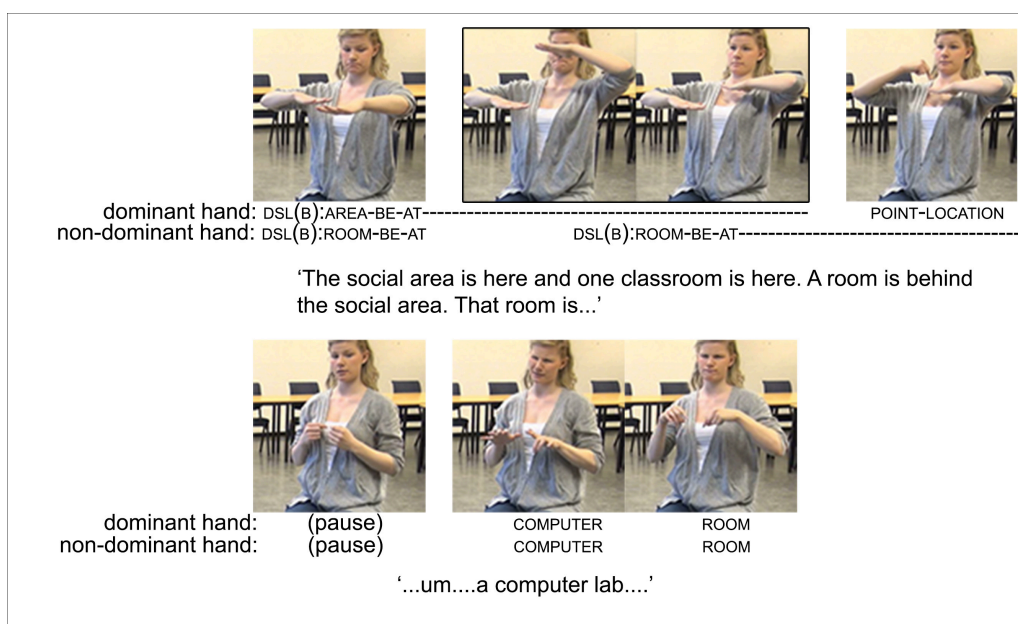


Figure 4. A student producing a depicting sign outside the neutral signing space

This example and several others like it indicate that students struggle with planning the production of longer, complex depicted scenes. Students are able to produce single depicting signs more-or-less appropriately, but the integration of these signs into longer periods of signing in the signing space with other depicting signs appears to be more of a challenge.

4.4.2 Coordinating and positioning the hands in relation to each other

In addition to problems with coordinating depicting signs within the signing space, some students also faced problems coordinating their hands in relation to each other. Instances of this involved students crossing their arms for periods of time, miss-positioning depicting signs in relation to perseverated signs, or combining two signs in a non-native-like way. Students also were observed to leave their non-dominant hand in place for long stretches of time, without making use of it.

Going back to the example presented in Figure 4, we see that the student has positioned the sign depicting the location of the computer room higher than the sign depicting the social area, which is not what one would expect to be the case in a floor of a typical building. Another student, during her description of the floor with classrooms, first depicted a person standing. Then she proceeded to depict a hallway around and below the person—thereby seemingly suggesting that the person was standing near the ceiling.

In yet another example, which is illustrated in Figure 5, a student first locates her classroom with a pointing sign that moves a short distance downward. Then she depicts the social area that is located just outside the classroom. The result is a simultaneous production of a pointing sign and a sign depicting an area (the final image on the right outlined in black in Figure 6). This combination was considered awkward by two Norwegian Sign Language instructors. A more native-like production might include use of either pointing or depicting signs on both hands.

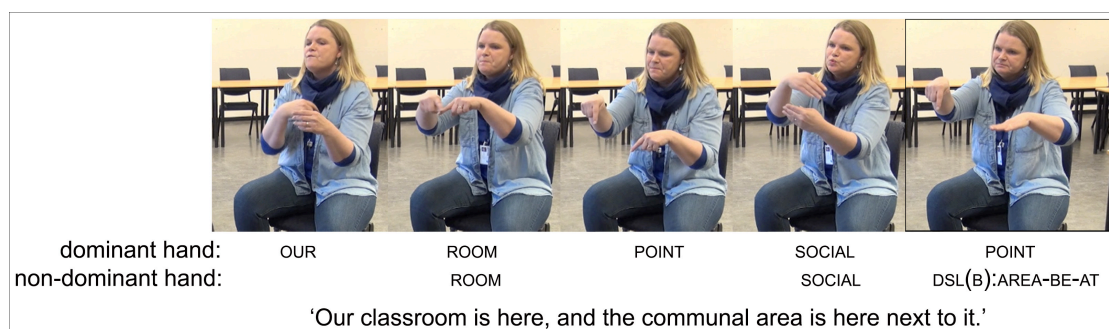


Figure 5. An example with a pointing sign and a depicting sign produced together in a non-native-like way

The examples presented above reveal some potential coordination issues that students have with their depictions. A larger data sample of both native and non-native Norwegian Sign Language will be needed to verify these initial observations. Whether or not the frequency of these types of incoordination are significant or not, and how they pattern into an acquisition process, will also require a larger set of systematically collected L2M2 learner data. Finally, a more nuanced account of how signs interact with each other and how depicted scenes are built up over time in L1 discourse is needed, which can facilitate future analyses of L2M2 signing.

5. Making sense with depicting signs and L2M2 acquisition

This exploratory study indicates that the acquisition of depicting signs by hearing adults is complex and multifaceted. First, to align with previous work on signed language acquisition, we showed how students often produced depicting signs with non-target phonology. The findings here were different to those of a previous experimental study on depicting signs in British Sign Language, which found that students most often have problems with handshape (Marshall & Morgan 2014). In the present study, orientation and movement were more problematic.

We suggested, however, that non-target phonology does not appear to be the students’ main struggle with these signs. Upon observing a depicting sign in isolation, it was often

possible to comprehend to some extent what the student was trying to depict. At the same time however, when taken as a whole, the students' responses were frequently difficult to understand. This led to further examination where several other issues were revealed. We found that the L2M2 learners tended to rely more on lexical signs than on depiction and often merely located entities in the signing space. They did this while producing a scaled down version of the areas they described, instead of depicting the areas as if they were moving through them, which is what their instructors tended to do. The students also seemed to have trouble coordinating the use of depicting signs over longer periods of discourse, especially across extended depicted scenes. There was a tendency to place signs too high in, or even outside of, the signing space, and students would, at times, "run out of room," as it were. That is, students had trouble coordinating their two hands in relation to each other as well as within the signing space. We also showed examples where students struggled with knowing when to produce depicting signs, as well as what types of depicting signs were appropriate for this setting.

The findings from this study demonstrate that while students attempt to use depicting signs, they do so less frequently than their instructors and they struggle to make sense. Further understanding of how native signers depict complex scenes will help us to contextualize and map the acquisition of this skill by L2M2 learners. More detailed descriptions of when and how depicting signs are used are therefore needed and this, in turn, can then inform signed language pedagogy and curriculum design. For example, students may need to be more systematically exposed to depicting signs in a variety of settings, not only during story-telling (as also indicated by Boers-Visker & Bogaerde's 2015 work). They may also need more explicit instruction regarding how to deploy these signs over extended periods of depiction—addressing how depicting signs relate physically and semantically to other signs and spaces in the discourse. Activities that encourage students to spontaneously express these types of meanings may help them to manage these types of constructions in more naturalistic settings. Metalinguistic activities examining the contrast between the use of lexical and depicting signs could perhaps also be helpful, along with activities targeting students' own productions. We would also like to encourage a broader focus for future L2M2 acquisition research, from single signs to other aspects of signed language structure and use, to help improve pedagogical practice.

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