The Use of a FileMaker Pro Database in Evaluating Sign Language Notation Systems

Julie A. Hochgesang
Gallaudet University, Linguistics
SLCC3206, 800 Florida Ave NE, Washington, DC 20002 USA
E-mail: Julie.hochgesang@gallaudet.edu

Abstract

In this paper, FileMaker Pro has been used to create a database in order to evaluate sign language notation systems used for representing hand configurations. The database cited in this paper focuses on child acquisition data, particularly the dataset of one child and one adult productions of the same American Sign Language (ASL) signs produced in a two-year span. The hand configurations in selected signs have been coded using Stokoe notation (Stokoe, Casterline & Croneberg, 1965), the Hamburg Notation System or HamNoSys (Prillwitz et al, 1989), the revised Prosodic Model Handshape Coding system or PM (Eccarius & Brentari, 2008) and Sign Language Phonetic Annotation or SLPA, a notation system that has grown from the Movement-Hold Model (Johnson & Liddell, 2010, 2011a, 2011b, 2012). Data was pulled from ELAN transcripts, organized and notated in a FileMaker Pro database created to investigate the representativeness of each system. Representativeness refers to the ability of the notation system to represent the hand configurations in the dataset. This paper briefly describes the design of the FileMaker Pro database intended to provide both quantitative and qualitative information in order to allow the sign language researcher to examine the representativeness of sign language notation systems.

Keywords: sign language, phonetics, phonology, child acquisition, transcription, notation, FileMaker Pro, database

1. Introduction

In this paper, the database tool, FileMaker Pro (a tool well known by sign language linguists, e.g., Boyes Braem, 2001), is used to evaluate notation systems used for representing hand configurations in child acquisition data. Using one dataset of child and adult productions of the same American Sign Language (ASL) signs produced in a two-year span (37 signs, 966 tokens) from a bilingual-bimodal ASL acquisition corpus, the hand configurations in selected signs have been coded using Stokoe notation (Stokoe, Casterline & Croneberg, 1965), the Hamburg Notation System or HamNoSys (Prillwitz, Leven, Zienert, Hanke, & Henning, 1989), the revised Prosodic Model Handshape Coding system or PM (Eccarius & Brentari, 2008) and Sign Language Phonetic Annotation or SLPA, a notation system that has grown from the Movement-Hold Model (Johnson & Liddell, 2010, 2011a, 2011b, 2012). The ID glossing of signs was conducted in ELAN then relevant data was pulled, organized and notated in a FileMaker Pro database created to investigate the representativeness of each system. Representativeness refers to the ability of the notation system to represent the hand configurations in the dataset.

While this paper focuses only on one aspect of the transcription process, the phonetic or phonological form of the hand configuration, this systematic evaluation of notation systems represents an important first step in evaluating current transcription practices in general. Transcription practices have to do with design principles governing how original data is represented in research. The researcher selects a certain set of data, decides how to represent that data and adds the necessary codes to help facilitate analysis. This aspect of research usually does not receive much attention. It is hoped that the same type of investigation will be carried out for other aspects of transcription. In this paper, the methodology is described to encourage the use of similar techniques by other researchers who can then suggest design improvements.

2. Transcription Design

Transcription design helps create a balance in which the researcher is representing the raw data while remaining faithful to the language act (Edwards, 1993). For instance, with child acquisition data, a notation system is expected to represent enough detail about the child production in order to allow the linguist to observe, describe and ultimately try to explain the relevant linguistic data. Faithful (or representative) transcription should adhere to two general design principles: human-readability and machine-readability (Edwards, 1993). Other design principles (Dressler & Kreuz, 2000) include specificity (broad versus narrow), universality (not limited to a single language), consensus (agreement in the field), parsimony (limited number of symbols), conventionality (found across cross-platforms), and extensibility (the ability to add new aspects as needed). The inclusion of these principles serves to make the transcribed data consistent and standardizable and therefore more amenable to analysis and accessible to researchers.

Discussing transcription issues specific to signed languages is of great import now as corpora work becomes increasingly utilized in signed language linguistics. Some linguists (e.g., Pizzuto & Pietrandrea, 2001; Johnston, 2001) have been vocal on issues of transcription perhaps because corpora work has been well underway for their sign languages (e.g., Auslan at

www.auslan.org.au, BSL at www.bslcorpusproject.org, NGT at www.ru.nl/corpusngtuk/). But linguists working with ASL data have been slower to broach these issues, perhaps because corpora work has not been widely undertaken in the United States. This is now changing with the emergence of projects such as creation of ID-gloss databases locally and nationally (Hochgesang, Villaneuva, Mirus, Mathur, Lillo-Martin, Dudis, Bernath, & Alkoby, 2010) and plans to develop an ASL corpus (Dudis, Mathur, & Mirus, 2009).

3. Notation Systems

Representation of language data is successful when another looks at the transcript and can reconstruct aspects of the original language act. Linguists who study spoken languages are able to use a relatively uniform notation system, the International Phonetic Alphabet (IPA), to represent their data, at least at a phonetic level. Phonetic representations allow the linguist to access original forms without having to hear it firsthand. When they do not require a phonetic/phonemic representation of their data, linguists can rely on the written system of the spoken language studied (provided that there is a corresponding written system). This form of transcription for spoken languages is able to relay consistent information about the data observed thereby allowing linguists to effectively understand and discuss data of other linguists. That is, they can reconstruct, more or less, the data in its original state.

Currently, there is not a universal phonetic notation system like the IPA for the representation of signed languages. Instead, the field of signed language linguistics has seen a handful of notation systems proposed to represent phonetic or phonological information. The first was Stokoe notation which was first proposed in the 1960s and widely adopted by other linguists interested in signed languages, although they quickly realized that the first attempt to notate signed languages needed more work (e.g., Johnson & Liddell, 2010). Also, taking into account that the opportunity for cross-linguistic analyses is becoming increasingly more real (e.g., the ECHO project at www.sign-lang.ruhosting.nl/echo//, Crasborn et al., 2007), the usability of Stokoe notation for hand configurations in other signed languages is much diminished. For instance, some handshapes in other languages do not have symbols in Stokoe notation, e.g., the number four in Kenyan Sign Language (KSL) shown in Figure 1.

Figure 1: Handshape of “four” in KSL

To be clear, it is not being proposed that signed language data in corpora always be notated using phonetic notation systems (since the choice of transcription system is dependent on a research project’s aims). Rather, if such systems are used, then these notation systems need to be evaluated by the field in a systematic manner using a specialized tool to enable this investigation.

4. The FileMaker Pro Database

In order to compare and contrast notations of hand configurations as well as analyze codes about those notations, a database was created in FileMaker Pro. FileMaker Pro is a program that allows users to create simple or complex databases (http://www.filemaker.com/products/filemaker-pro/, last accessed July, 2013). This program also allows for the manipulations of layouts and forms, without affecting any original data, which can be advantageous when looking at a dataset from different perspectives as done in this study. In short, the use of this database allows for efficient data entry, searches for specific entries and convenient summaries.

Figure 2 is a screenshot of the layout view in the database, in which all of the fields can be viewed. The fields have been filled out with the details for the second hand configuration in one ASL adult instance of AIRPLANE. As can be seen in Figure 2, in order to identify each token, the following information is included: an English gloss, a screenshot, an instance number, the time in the video session, and the name of the video session. Certain typological information about each token is also notated, marking whether the sign was produced on the right or left hand. It was also observed whether the token occurred in the first or second postural segment (a timing unit in which features like hand configuration, contact, place of articulation, orientation and nonmanual signals are aligned and can be observed (Johnson & Liddell, 2011a). In addition, the token’s phonetic sign type was marked, both the target type (which means how the sign behaves in adult productions) and the child production (which means sometimes the child produced the sign in a manner different from that of the adult form). If the phonetic sign type was “five” (in which the sign is two-handed with different hand configurations where one is dynamic and the other static), a note was made whether the entry represents the “dominant” configuration, in which the hand configuration is dynamic, or the “passive” configuration, in which the hand configuration is static. Using a one-second range, it is noted whether the token was isolated or preceded or followed by other signs. That is, if another sign did not occur within one second of a token, the token was considered to be “isolated”. If another sign occurred within one second, the token was considered to be “not isolated”, in which case noted which sign occurred and whether it was before or after. Finally, additional notes (if any) about the handshape production are included. All of the fields just described provide the user with identifying information about tokens that allow the user to effectively search and organize the database for hand configuration notations and make observations about different notation systems.

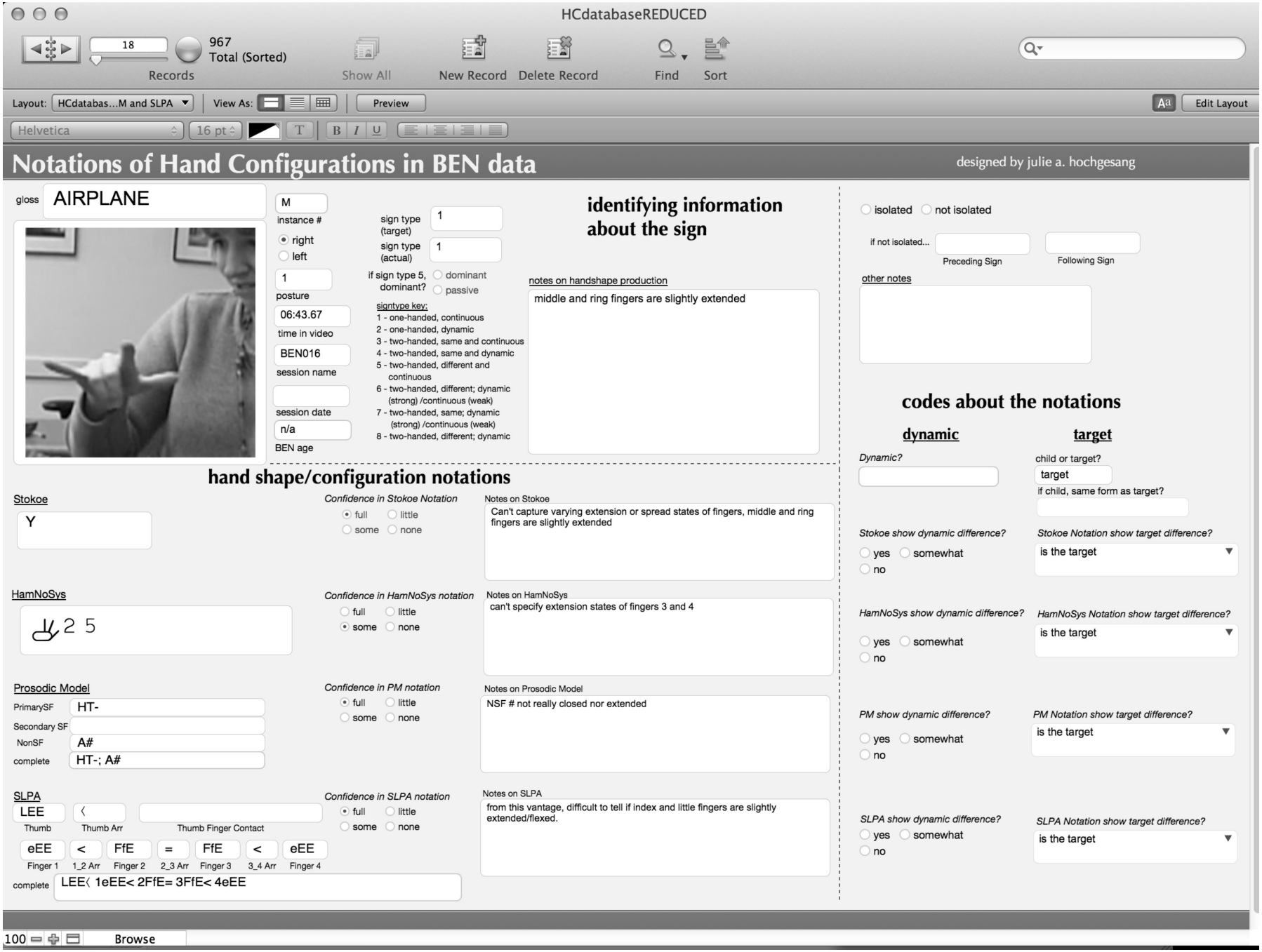

Figure 2: Screenshot of an example record in database

In the hand shape/ configuration notations section (lower left part of Figure 2), fields have been created for each possible section of a hand configuration notation schema in each notation system. There is one field each for Stokoe notation and HamNoSys. For PM notation, there are four fields, one for each "selected fingers" slot (PSF, SSF and NSF) and one for the complete notation. For the SLPA notation, there are 11 fields - one each for the following features: thumb opposability and joint extension, thumb-fingers arrangement, thumb-finger contact, finger 1 joint extension, finger 1 and 2 arrangement, finger 2 joint extension, finger 2 and 3 arrangement, finger 3 extension, finger 3 and 4 arrangement, and finger 4 extension; as well as one for the compete notation. As seen in Figure 2, each token is coded with a handshape label from Stokoe notation (e.g., Y), a hand configuration label from HamNoSys (e.g.,), a handshape label from PM (e.g., HT-; A#), and a hand configuration label from SLPA (LEE{ 1eEE< 2FfE= 3FfE< 4eEE). This layout allows for notations from each system to be easily visible and accessible for the same token.

Separate FileMaker Pro layouts were created for each notation system. This allowed the user to code all of the tokens for one notation system at once. This approach enables full attention to one notation system at a time therefore resulting in more consistency and less interference among the systems. A "cheat sheet" to the codes of each notation system is immediately accessible to the right of each layout for each notation system. This "cheat sheet" information minimized errors in entering codes for each system.

The field "Notes on (name of notation system)" was used to include any observations I had about using the notation systems. "Confidence in (notation system)" field will be described in a later subsection.

5. Representativeness of Notations

In order to analyze the representativeness of each notation system in notating hand configurations, each token in the dataset was coded using each notation system. A summary of the codes and their meanings is shown in Table 1.

Codes	Level of representativeness
Full notation	Representative
[or] notation	Potential redundancy
[?] notation	Not effectively representative
[Q] notation	Not representative

Table 1. Codes for level of representativeness

Notations that were judged to represent the hand configurations accurately and discretely, appear as complete notations, free of any [or], [?], or [Q] codes. This indicates that the notation system is fully representative for that token. If more than one set of notations in the same notation system could represent the same hand configuration, all possible notations were entered with [or] separating each notation. This is an indicator that the notation system contains overlapping symbols (that is, more than one symbol or set of symbols represents the same information) as opposed to discrete symbols, a fact that challenges representativeness. If it was unsure that a notation represented the observed hand configuration, [?] symbol was entered at the end of the notation. This can be either an indicator that the notation system is not effectively representative or that the transcriber could not apply it. If a symbol (or set of symbols) in the notation system could not be found to represent the observed hand configuration, a [Q] symbol was entered. This indicates that the system is not representative in that particular token.

5.1 Examples of notation codes

5.1.1 Full notation

If there was a symbol (or set of symbols) in the notation systems that fully described the hand configuration in a given token, the notation was deemed to be "representative" and received no additional code other than the notation using the labels from notation system. For instance, the hand configuration during the sign for "father" in ASL seen in Figure 3 was notated as [5] in Stokoe notation since it matched the dictionary description of the symbol, "spread hand; fingers and thumb spread like '5' of manual numeration" (Stokoe et al., 1965, p. xi).

Figure 3. Child production of ASL sign FATHER

5.1.2 [or] notation

For those hand configurations in tokens where more than one notation could be used, all possible notations were included along with an [or] separating them. For example, the HamNoSys symbols [ ] or [ ] both seem to represent the same hand configuration on the right hand in this child production of the ASL sign for "ball", shown in Figure 4.

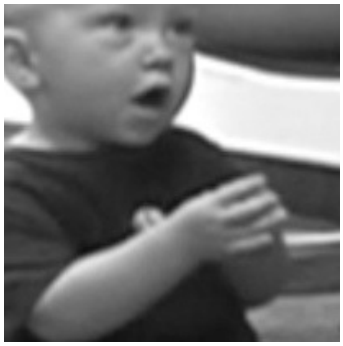

Figure 4. Child production of ASL sign BALL

Both base symbols signify that the fingers are not spread, the bending operator (the line above the base symbol) signifies that the fingers are bent (at the base joint), and the thumb symbol (the line sticking out of the bottom of the base symbols) signifies that the thumb is extended and opposed. The only apparent difference is that [⊃] is a thumb combination handshape which should be used when there is the potential for thumb-finger contact. Regardless of this difference, it still stands that it appears these two notations can represent the same hand configuration, thus receiving the [or] code.

5.1.3 [?] code

If it could not be determined whether a symbol was appropriate for the hand configuration in a given token, a [?] followed the notation. For example, with Stokoe notation, the hand configuration in the ASL sign glossed as "where" in Figure 5 did not entirely match any description in the dictionary.

Figure 5. Child production of ASL sign WHERE

The closest description is "index hand; like 'g' or sometimes like 'd'; index finger points from fist" (Stokoe et al., 1965, p. xi). While the child's index finger is extended creating an "index hand", he does not exactly have a fist. His little, ring and middle fingers are somewhat flexed and the thumb is not flexed at all. This means his hand configuration does not exactly match the description. As a result, the hand in this token was coded as [G?] because there was no exact match between the handshape and a description. In cases like these, the closest approximate notation is used along with a [?] in the notation.

5.1.3 [Q] code

Finally, if it was unclear how to select notation symbols in any system (or rather assign the appropriate codes to the appropriate slot for either PM or SLPA) for representing a hand configuration in a token, a [Q] code was assigned to that token. For example, the first postural segment in this child production of ASL "dog" shown in Figure 6 has been notated as [Q] for PM.

Figure 6. Child production of ASL sign DOG (first postural segment)

Some tokens received [Q] in only one slot and others in two slots.

5.2 Notation Representativeness Codes

Essentially representativeness here means the ability (as measured by four codes developed for this database) to notate the state of the hand in chosen signs (37 ASL signs) from the study's corpus (a total of 966 tokens). In Table 2, a summary of the results pulled from the database after coding and proofing the codes is provided.

	Full code	[or]	[?]	[Q]
Stokoe	586	199	163	18
HamNoSys	859	80	16	11
PM	719	20	216	11
SLPA	966	0	0	0

Table 2. Summary of representativeness codes

Counting the total number of each type of code per notation system provides some insight on their effectiveness as a representative notation system. The results from this kind of analysis will allow the researcher to identify cases where hand configurations might have been inaccurately transcribed, especially in the highly atypical hand configurations that are common in early child acquisition corpora. Of course, codes alone do not give sign language researchers a full picture of the representativeness of a notation system. For example, some notation systems do not treat the thumb separately from the fingers (Stokoe, for example). To compensate for this, additional notes were provided.

Based on the number of codes and examination of additional notes, it appears that Stokoe notation is not an adequate system for representing hand configuration data; HamNoSys is generally representative of the data; PM is mostly representative of the data; and SLPA is more fully representative of the data.

The representativeness codes [?, or, Q] seem to be spread out through the entire dataset. This is interesting because one may predict that there would be more problem codes for the earlier signs of the child where highly atypical productions are to be expected. This does not seem to be the case since the codes appear to be evenly spread out throughout the twenty sessions that the sign tokens were pulled from. Furthermore, almost half of the tokens for the mother had some problem code. This is unexpected since it is assumed that the adult tokens would provide less of a challenge for any notation system.

6 Transcriber's Confidence Rating

It is difficult sometimes to ascertain representativeness when it is actually the transcribers themselves who are unsure how to apply the appropriate notation code to the appropriate hand configuration. This uncertainty can come from the transcriber's unfamiliarity with the system or the quality of video data. This information was captured by using a rating scale called the "transcriber's confidence". The four options in this scale were: "full", "some", "little" or "none". This information is to be entered after notating each token. The "transcriber's confidence" rating allows the user to double-check the notations for obvious errors and to provide some measure of the transcriber's activities.

Transcriber's confidence is not intended to signify that the transcriber is satisfied with the notations themselves but satisfied with their own understanding of the notation system and ability to apply the notations appropriately to the observed hand configurations (somewhat like a measure of the straight-forwardness of the system). Basically, the higher the ranking, the more confident the transcriber is that they understand how to use the system. The lower the ranking, the less confident the transcriber is that they understand the system. Table 3 provides a summary of the transcriber's confidence rating available in the database from the study cited in this paper.

	Full	Some	Little	None
Stokoe	522 (54%)	344 (36%)	88 (9%)	12 (1%)
HamNoSys	245 (26%)	407 (42%)	234 (24%)	80 (8%)
PM	449 (47%)	385 (40%)	94 (10%)	38 (3%)
SLPA	738 (76%)	226 (24%)	2 (~0%)	0 (0%)

Table 2. Summary of confidence ratings

In short, the transcriber is most confident in their understanding and application of SLPA. Stokoe notation is a distant second while PM and HamNoSys are close contenders. These rankings are probably the result of a combination of factors: personal ease of understanding the system, access to training materials, and experience in using these systems.

It must be noted that the notion of confidence ratings may interact with the notion of representativeness (explored earlier in this paper). While the confidence rating is intended to be a measurement (somewhat subjective) of the transcriber's reactions to whether the notations are the appropriate ones for the observed hand configurations, this confidence is undoubtedly affected by representativeness in general, the quality of the video and the signer's productions (the more unusual, the more tricky it is to notate). First, confidence ratings are higher when there are less [?] and [or] codes in the notations. [Q] codes were usually connected with slightly higher confidence ratings (that is, they were marked as "little confidence" rather than "none") since the transcriber was relatively sure that the notation system in question did not have the notation symbols needed to represent the data. Finally, it appears that the confidence rating seems to fluctuate depending on the type of hand configuration. That is, higher confidence rankings seem to occur with typical, expected hand configurations. The significance of this would be an ideal question for further investigation in a future study.

Despite these issues and the subjectivity of the transcriber's confidence measurement, these data still provide useful information regarding the understanding and eventual use of each notation system. Transcribers are actual humans who come to the task of transcription with varying degrees of aptitude (some are better at staring at the computer screen and observing information for hours on end than others as well as recalling the appropriate symbols for the observed data), training (some may be experienced transcribers with hundreds of transcripts under their belts and others may not know that even standard written language is a form of representation itself), or prior knowledge (some may have already taken classes relevant to the transcription task and others may have just been newly hired because of their fluency in a certain language). These ratings may help principal investigators or lab managers prepare for the training of their transcribers.

Principal investigators and/or lab managers (whoever trains the research assistants to do transcription) could incorporate transcriber's confidence ratings in order to help evaluate and measure the transcribers' understanding of the chosen notation system. This evaluation could be a part of the learning process. If the transcribers can describe where they are confident and where they are not, this can help target problem areas in the use of the notation system that are probably problematic for others too. For makers of notation systems, these confidence ratings can be beneficial in the sense that the ratings can help refine their systems.

7 Conclusion

The database described in this paper is a valuable tool for assessing notation systems. However making sense of the data can be difficult. For example, there is a great deal of information to be processed with each SLPA hand configuration notation string. This requires a high amount of concentration and only a few can be processed at the same time. This deters the analysis of large datasets without the help of machines and algorithms. For example, the database used in this study is a flat one - that is, it does not employ a relational database design (e.g., Crasborn et al., 2001). Setting up a different database design may allow us to take better advantage of the SLPA notations as well as the rest of the data.

In short, testing the representativeness of each notation system can be done by using the same dataset through using a systematic analysis enabled by technologies like ELAN and FileMaker Pro. The resulting data can be then used in the decision of which system to pick and even for revising current systems. As Miller (2001) says, "to maximize a notation's usefulness, a permanent process of discussion and revision is thus necessary" (p. 11). Observations resulting from the use of these notation systems are key in the attempt to understand the patterns governing the acquisition and use of language. In any case, such a evaluative process should be part and parcel of the scientific study of language.

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