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## **Developing a Bilingual Online Glossary of Science Signs: An Evaluation**

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### **1. Overview of talk**

During 2007, a deaf project team worked to find 250 scientific signs for English words used in Scottish secondary schools. The participants were Deaf, fluent in British Sign Language from a young age and with scientific knowledge at degree level or above. In this paper we discuss the process and the dilemmas we faced as we worked to make definitions in BSL.

First we will briefly discuss the position of deaf children who use BSL in the education system in the UK and different approaches which have arisen for disseminating specialist sign vocabulary. Then we will describe the project at Moray House in Edinburgh to produce an online glossary of science signs with definitions in BSL. We will explore issues which arose about sign language and about technical issues of handshape access. Finally we will describe the evaluation which we are currently involved with and our plans for further work to expand the dissemination of technical signs.

### **2. Deaf education in UK**

At the moment, more deaf children are being mainstreamed in hearing schools than in the past, 82% in Scotland (ADPS Data 2002). At this point, we cannot say if this will affect their signing fluency or if they will merge their BSL with English. Deaf children today won't develop fluent BSL in the same way as they did thirty years ago when most went to residential schools. In those days a proportion of the children were Deaf from Deaf families and could transmit the language horizontally to their peers. Nowadays with most deaf children mainstreamed, the numbers gathered together in resource-based schools are often low, for example ten pupils is common. This means it is less and less likely that there will be a pupil who is from a Deaf family and who can pass it on to his / her

peers. You need to have on average twenty deaf children gathered together before you have the chance that one of them will have BSL as a first and fluent language transmitted vertically from their parents. As a result of teaching deaf students in FE over the past 15 years I can see that most deaf school leavers have had very little contact with BSL, and their language has often been gained from teachers of deaf children who themselves have very low levels of BSL skill.

### *Teaching methods*

As you know, sign language was used in Deaf schools before Milan, but after 1880, the oral method began and continues to be used in the UK. Oral methods were used in the UK from the late 18<sup>th</sup> century. The Braidwood family which set up the UK's first deaf school in Edinburgh in 1760 used a combined method that in effect was quite like sign bilingualism: speech and lipreading for some pupils, BSL for all when interacting with Deaf staff, and a lot of input of English via fingerspelling. Sign languages are still used in schools, but a number of regional variations have developed because sign language was not officially allowed in schools so pupils used it in secret.

For many years, 'Teachers of the Deaf' have been specially trained to teach deaf children. Some of them do learn some basic sign language, but what level is this? The Scottish and English governments have decided that CACDP BSL level 1 is enough for teachers of deaf children. Someone learning a new language can get to this level after a year of studying for two hours a week. Not all countries have taken the same approach. For example in Sweden teachers of deaf children are expected to have 500 hours of learning Swedish sign language before they start to teach deaf children. The reason why it is seen as unnecessary in the UK is that in Britain there is still hostility to sign language and a belief that if parents try hard enough they can teach their deaf children to talk.

This leaves teachers of deaf children in a difficult position: many want to improve their signing skills, but very few employers help them to do this, and it is difficult to become fluent in a language while working full time.

### *Communication Support Workers in UK deaf education*

In the UK Communication Support Workers work in mainstream schools, interpreting between teachers and deaf children; but do

they have knowledge of specific subject signs? And what is their average level of communication skill? A survey in 2002 revealed (O'Neill et al) that the modal level of BSL skill for communication support workers in the UK was approximately equal to a C at GCSE, approximately the same as four years of high school language study. Interpreters in the UK don't start learning how to move between languages to interpret or translate till they have reached fluency at degree level in the language. But CSWs try to do this in classrooms across the UK every day, without any training in how to interpret. It is not their fault they haven't had training, but the effect is that they often slip into teaching roles, or try to keep order in the classroom, or because their BSL skills are not well developed they are unable to voice over what the deaf pupil is signing. This further isolates the deaf child and takes away their independence in the classroom.

### **3. BSL vocabulary for specialist areas – different approaches**

Different languages have varying amounts of technical vocabulary. Historically BSL hasn't developed many scientific technical terms because from 1880 Deaf people were systematically excluded from the education system. Since the early 1990s when Disabled Students Allowance became available, Deaf people were able to attend university and work with sign language interpreters in lectures. Three of the 12 Deaf informants on this project were educated orally but were bilingual, they used BSL in their social lives but they used spoken and written English at work as scientists. Where Deaf people are involved in scientific related areas of work, there does exist technical vocabulary but this may not necessarily be shared with many other BSL users. There are many Deaf people working in science-related fields, but they don't necessarily discuss their work with other BSL users. For example I know several Deaf people who work as dental technicians; but they work in isolation in hearing workplaces and they don't discuss their work when they go to the Deaf club. Deaf printers, on the other hand, do often work in groups, for example at government factories, so they discuss their work between themselves and there is a fairly large collection of technical signs in BSL for printing processes. When I worked in Further Education I was involved in a project to collect printing signs from Deaf printers.

An important issue to consider is what BSL users do when there isn't a technical term. The language makes use of features of the productive lexicon. That is, the language draws on visual features of

the situation or on visual metaphors to create a new term. This term may actually be a collection of signs in a sequence. Over time, if the term is used, it may be adopted more widely and it may gradually become simplified and parts of it reduced or moved to more neutral space.

Look at this example, for example of a sign for a non-terminating decimal:

<http://www.ssc.education.ed.ac.uk/bsl/bslnont.html#start>

This came from the previous pilot project where Dr Mary Brennan worked with Gerry Hughes. This is not a practical technical term, but it uses the humour and many BSL features. In time it may be reduced to something which is more conventional and briefer.

Another example in BSL is the sign for FAX. Initially it was signed with great detail, as it was a new piece of equipment and not all people watching would know how it worked. As everyone now knows, the sign has become conventionalised and simplified. (Demonstration of early and present day sign for FAX).

BSL doesn't necessarily form compounds in the same way as spoken languages do, yet it is very influenced by English because it is surrounded by the stronger language. For example another recent collection of science signs is on the Wolverhampton University website. These signs have been collected by an interpreter who used deaf people and interpreters as her informants. On the Wolverhampton science site we see signs for Architect and Designer which use the signs: TECHNICAL-DRAWING/PERSON; DESIGN-PERSON.

<http://tinyurl.com/3oby58>

BSL users would not adopt this rather English approach to compounding. For example a BSL user may sign: JOB WHAT? DESIGN. English influences the BSL lexicon as English speakers sometimes want BSL to have exactly parallel morphology, similar to the -er ending on the end of doctor, designer, driver. BSL just does it in a different way.

In our preparation for our project we were also able to turn to the very valuable work carried out by Harry Lang and associates here at NTID (Lang et al 2006) which raised issues about how easy compound signs were to understand.

#### **4. Project aim and funding**

The aim of the project was to create 250 science signs at intermediate level, split into three different areas of science; Chemistry, Physics and Biology, with around 80 signs relating to each subject. This did not just involve the development of new signs - the project aimed to create new signs, definitions in full BSL and fingerspelling patterns. A similar website on mathematics was established a few years ago by the late Dr Mary Brennan and Gerry Hughes, who is one of our team.

The science signs glossary project was funded by the Scottish Government: we had £25,000 for one year with a target of producing 250 signs and definitions. Two members of staff from the Scottish Sensory Centre contributed one day a week of their work time to the project – they are already funded by the Scottish Government. The SSC exists to provide continuing professional development for teachers of deaf children and teachers of visually impaired children.

This project was not the first of its kind to be online; aside from the mathematics one, we have found some science signs websites based in Dundee and Wolverhampton, although they are not exactly aimed at intermediate level standard. The Wolverhampton site was providing signs only, with English but not BSL definitions, and aims to support deaf students at university level. The Dundee site, which is no longer on the internet, was aimed at school students and again provided signs only, with a lot of influence from English. We know that some native BSL users were involved in the Wolverhampton signs, but there is no method published on their website. The Dundee site, as far as we know, was produced by a hearing interpreter and some teachers of deaf children. The interpreter was fairly fluent in BSL.

Another vocabulary project in the UK is run by a hearing teacher of deaf children called Cath Smith. She works with individual deaf people and has devised or gathered vocabulary for different school subjects using books and line drawings to record them.

Part of our project's aim was to create signs for words/concepts rather than using initialised ones based on the first letter of the word or concept. The Dundee website features a number of initialised signs, which requires more concentration on lipreading.

For example, the signs for *exothermic* and *endothermic* are both based on the letter E with specific lip patterns. This is particularly difficult for deaf children to cope with – they are being given English words pretending to be BSL. The vocabulary doesn't show the productive features of the BSL lexicon. As deaf children at secondary school go from subject to subject they come across more and more initialised, English influenced vocabulary. For example, E for Evaporation, for Energy, for Effect..... etc.

One of the reasons why it was important for us to create or find standard signs for vocabulary is that in Scotland deaf children are allowed to take their exams in BSL. This is very unusual - in the rest of the UK deaf pupils are allowed to watch a teacher sign the exam questions in BSL, but the technical terms have to be fingerspelt in English. The Scottish Qualifications Authority (SQA) adopted the policy of allowing deaf children to watch the exam questions in BSL and also to give their answers in BSL. This subtly changes the purpose of much of secondary deaf education. Whereas in England teachers of deaf children focus on teaching the English words for technical terms, most of which are not known by the pupil, in Scotland it now becomes important to develop the deaf pupil's confidence in understanding and using the correct technical sign. Centres told the SQA that their pupils couldn't take a centrally produced exam paper on DVD in BSL because not enough technical vocabulary existed in BSL. This meant that the quality of the BSL the deaf pupils is receiving in exams is very variable. SQA would like a more standardised solution, so they have been very pleased with the development of a standardised set of vocabulary for subject terminology. It is likely that SQA will pilot centrally produced BSL exam DVDs soon.

## **5. Assembling the team**

We will explain briefly about why they were part of the team:

- Gerry Hughes: involved in the mathematics project and a school teacher of deaf children;
- Dr Audrey Cameron (PhD in Chemistry): a school teacher of hearing children;
- John Denerley: Owner of a wildlife park, Deaf from a Deaf family.
- Mary Frances Dolan (BA in Biology): a school teacher of deaf children

- Dr Mike Fox (PhD in Chemistry): a chemistry researcher;
- Derek Rodger (BA in Biology): a school teacher in London, originally from Scotland.;
- Claire Leiper (BA in Biology and English) a freelance trainer;
- John Brownlie (BA in Physics) – a multimedia specialist working with a Deaf organisation;
- Dr Colin Dunlop (PhD in Physics): an astronomy researcher.
- Gary Quinn ( MA in Linguistics): sign monitor for the project

All of the people above are Deaf. Eileen Burns (a teacher of the deaf who has a BA in Physics) was also involved; she is hearing but has a lot of experience in working with deaf children in schools. The team was assembled by Rachel, who had previous experience on a similar project about maths and IT signs and definitions with a company called Microbooks. For that project she got together a group of Deaf people who had subject knowledge and who had used BSL from before the age of eight, ie they were fluent in the language. For this project some people did not fulfil this criteria but they had developed fluent BSL as adults and they had extensive subject knowledge. Rachel had previously found that Deaf people from Deaf families seemed to find the process of using the productive lexicon to generate new technical signs easier and quicker than other Deaf people who had learnt BSL from the age of five and upwards. However, we need more evidence for this. Next time we will film our discussions.

## 6. Method of work

**First stage:** We collected English terms which we thought there should be a sign for from teachers of deaf children and from the Scottish Government curriculum advisor for science.

**Second stage:** We collected and listed existing signs from the Dundee and Wolverhampton websites.

**Third stage:** The existing signs were shown to the subject group, who discussed them and decided which ones to keep.

**Third stage:** The existing signs were brought into the group to see how they could be improved and how new signs could be created, using the placement of visual features such as lungs, intestines, etc. At this stage we asked the group members if they already used a different sign or signs for this concept.



**Fourth stage:** the group worked together on the new signs by looking at the definition of each word and creating draft signs to check if they were happy with them and that they were not mistaken for other signs or did not affect the grammar of BSL.

**Fifth stage:** we made a definition for the sign, using information from group members and text books / the internet.

**Sixth stage:** we put the definition and sign on the internet site for group members to check. Sometimes we had not included everything in the definition so some were refilmed.

**Seventh stage:** we translated the definitions into English and added pictures or diagrams.

The Chemistry group decided they would like to show some lab examples to illustrate the signs in use in a real context. Dictionaries usually have examples of sentences with the word being used; we decided we would like examples of experiments because this would be an additional educational resource for deaf children.

## **7. Issues that arose about language planning**

The project led to a number of interesting discussions and issues being raised:

7.1 While making the film to define each word, a number of signs were not quite covered, so the smaller group that was filming quickly decided on new signs. After most of the science signs were subject to long discussions and eventual agreement from the larger group, is it acceptable that a few signs were just brought up while filming their definitions? We probably shouldn't have allowed this to happen because it didn't meet our own rules for how we wanted to work.

7.2 There was also a debate regarding definitions; should the group follow a textbook exactly, or should we create our own definitions, as long as they included the same important information? Some group members were more affected by the power of the textbook than others. Some of the initial definitions

needed to be refilmed because they didn't contain enough technical information, they were only partial definitions.

7.3 As mentioned previously, there are a number of regional sign variations in Scotland. I call this '*schoolisation*', because deaf children learnt sign language from their peers at residential school at first, and when it was forbidden, they therefore created their own communication, which led to more regional variation in the 20<sup>th</sup> century. However, in the late 20<sup>th</sup> century and this century it may be somewhat different because deaf children now see their teachers using signs in an English grammar base and they often learn very English-influenced signs. Deaf school children now rarely meet people who can use BSL fluently apart from, if they are fortunate, occasionally a child who has Deaf parents. So today many deaf teenagers start college with extremely delayed BSL and little English. Many are semilingual.

So, is this science signs project a way of standardising BSL? Will it affect regional variation? Deaf adults are proud of their regional signs. We tried as far as we could to record variants where several signs already existed: for example *electricity*.

7.4 We found that the technical terms were popping up in the definitions quite a lot; we were using one technical term to help define another. We thought this was a good thing, because it allows deaf children to gradually build up a network of concepts which are inter-related. This should allow deaf children to teach themselves ideas through the internet. But we noticed that we didn't always use the technical terms we had collected enough in the definitions of the other signs. We could have checked to make sure we did this more.

e. It was interesting to see the morphology and sign-roots which arose from the BSL technical terms. For example in Chemistry, the movement from left to right as a chemical reaction was part of the following signs: CHEMICAL-CHANGE, CHEMICAL-REACTION, ENDOTHERMIC, EXOTHERMIC, NON-REVERSIBLE, PHYSICAL-CHANGE, PRODUCT, REACTANT, REVERSIBLE.

Another sign family is: MASS, WEIGHT, DENSITY.

And: VEIN, ARTERY, HEART.

These BSL morphological sign families are not related to English and they arose spontaneously because of the visual nature of BSL's productive lexicon.

7.5 For many signs there was a lot of debate over the sign to use, and we often changed our mind. We put the draft sign up on the website, then we reviewed it and often changed it again after consultation with other BSL users. So for example the original sign for INVERTEBRATE was (show example – animal backbone is horizontal) but after discussion with deaf pupils at St Vincents school for deaf children, Gerry Hughes, who was leading the Biology team, persuaded the group that this sign would be better (backbone is vertical, with a negative marker after). Perhaps it could be argued that children should not be the people who decide on a technical term, but when Gerry showed them the sign we originally agreed they didn't understand it. It's true in spoken languages that words are largely arbitrary and don't have iconic features, but in BSL many signs are visually motivated either by what they look like, or metaphorically. In other spoken languages when there is language planning going on for technical terms, for example in Gaelic or French, it is often old experts who decide. In our project deaf children helped us to decide.

There was a lot of debate about the sign for ENZYME too. There was an already existing sign which came from a previous project on biotechnology. The Biology group came up with three possibilities which we will show now. It could be in the future that this sign conventionalises to a simpler form.

7.6 We mentioned earlier the influence of English on sign formation on the Wolverhampton site ( DESIGN-PERSON to be like designer). We didn't want to assume that there was going to be a one to one map between the languages. It is common for one language to have one term and another language two terms for the same thing. Initially we had two signs for HABITAT, depending on whether we were discussing a plant or an animal. For some reason, this 2:1 mapping changed to a 1:1 mapping. We aren't sure how that happened. We thought afterwards that we should have recorded our discussions in BSL so that we could track the changes that developed. Some of the BSL terms had two different variants

depending on whether we were adopting an internal, structural view or an external, common sense view. So the signs for SOLID, LIQUID and GAS in their everyday sense are this (already existing signs) and when we are signing about their internal structure and what the atoms are doing, we sign them like this:

## **8. Handshape access**

The team had originally wanted to give bilingual access to the online dictionary, that is, as well as A to Z access as you can see on this web page we wanted to try to provide handshape access.

<http://www.ssc.education.ed.ac.uk/bsl/mathshome.html>

The BSL dictionary, published in 1992, is organised by both handshape and alphabetical order. If a Deaf person can remember a sign, they can use a sequence of handshapes to decide on the dominant handshape and then to specify more detail about the hand orientation to arrive at the sign. Then the Deaf person can look up the English translation of this sign. The BSL / English dictionary was pioneering in the UK in allowing handshape access. The problem was that nobody knew the handshape sequence and teachers of deaf children were not taught how to use the dictionary in this way. So I suspect it was largely not used. On the internet, however, it should now become much simpler to do.

At Heriot Watt university, where Gary works, a similar project called SLIP has been addressing this issue recently so we hope to be able to learn from their experience (Wilson & McDade, 2008)

But we simply didn't have the financial backing or the technical programming skills to achieve this in this project. In fact, as it is so little understood, and because deaf education is not in the hands of Deaf people, it is quite hard to explain to teachers and funders why we want this bilingual feature to be in our online dictionary.

## **9. Launch and reception of the project**

On January 18<sup>th</sup> this year we launched the science signs glossary at Moray House in the University of Edinburgh. We had over 60 people attending, with 40 children from 12 different schools and resource bases. Many of these children had never seen so many Deaf adults together in one place before, and certainly not in a position of authority leading discussion about a school subject in BSL. Our honorary professor of deaf education, Marc Marschark launched the project with a speech which referred to an early British Deaf Scientist, John Goodricke. We had an extremely enthusiastic reception from the children and the teachers, and good coverage in the UK press too.

### **10. Evaluation of the project: preliminary results**

We are now in the process of evaluating the science signs project and its impact in the hope that we can improve our method and develop the project into more subject areas. We have put out a questionnaire for teachers and Communication Support Workers. We are interviewing children about how they are using the website and also the project members to review our method of work.

So far the teachers' comments have been overwhelmingly positive. We have found that teachers of deaf children are integrating the definitions into their teaching and also encouraging deaf pupils to use the website at home for self study purposes.

It is interesting to see that a few teachers of deaf children have made negative comments about the glossary: one teacher said that the signs would be too much of a help to deaf children in an exam situation. She also commented that the English translations were too difficult for her pupils to read. We think these comments show the underlying tension and suspicion that still exists in many ways between some Deaf people and educators of deaf children. We hope to investigate more about deaf-hearing attitudes, both positive and negative, as part of our evaluation of the project.

We will be putting our rationale in BSL on the Learning Teaching Scotland website so that teachers can understand more about the process we went through to collect and create new technical terms. Responses so far from the Deaf informants have agreed that it was a very enjoyable process, full of debate and very hard work. As a team we don't want to impose our signs on BSL users, but we hope some may be used more widely.

## **11. Further expansion of the glossary**

When we have finished the evaluation and the Learning Teaching Scotland report at the end of July, the project team will start to look for further funding to continue the project. We would like to continue with maths and science and to build these subjects until we have enough vocabulary to cover the concepts needed for Standard Grade. This is the Scottish exam taken at the age of fifteen. After that we want to work with the exam board SQA to pilot centrally produced exam papers in BSL, then move onto other subjects such as History and Geography. We know that there are many suitable Deaf informants in the area of History because of the very active Deaf-run British Deaf History Society. They have been researching and discussing history using BSL for over 15 years, so they have already been using many of the terms we will want to collect for sources of evidence and historical events.

Our aim is to raise funds so that we have one full time Deaf project worker who will use Deaf community contacts to assemble a suitable project team from Deaf informants for different subjects, and continue the method of work we have devised so far. It will be a long term process to get BSL vocabulary for the whole of the school curriculum on the internet. We want to do this so that deaf children can learn independently in a visual way and build their BSL skills. Ultimately we hope that the UK governments will value the contribution of Deaf teachers more in deaf education and open up more pathways for them to become teachers of deaf children more easily.

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