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FALSE FRIENDS IN THE MULTILINGUAL MATHEMATICS CLASSROOM

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Words with mathematical meanings may be used differently in different dialects of a language. These may be false friends, sounding alike, but with different meanings or scope of usage. In Australia, many Indigenous children speak Aboriginal English but are taught in Standard Australian English. A study into spatial language in a remote Indigenous community in northern Australia has revealed that children of Iwaidja speaking parents use English spatial terms in ways that more closely resemble the spatial language of their parents than Standard Australian English usage. The words have closely related meanings in the different dialects of English but have different domains of applicability in terms of spatial frames of reference. To support student learning of Standard Australian English and of the mathematics register, teachers may need to appreciate how their students’ conceptual consistency differs from their own.

Language, Spatial Cognition, Indigenous Education

The difference between the formal mathematics register (Halliday, 1978) and the everyday language of students is a recurrent issue in mathematics education. Differences in scope and precision of terms can confuse students (Schleppegrell, 2007). This paper considers a further complexity of this situation, when there are dialectal differences between the language of the teacher and the student, and when these dialectal differences are the result of different language backgrounds. A word that has a standard everyday use and a specific mathematical use may also have a somewhat different meaning in another dialect of the same language. I use the concept of the false friend to illustrate the invisibility that this difference can take. This paper give examples of some of these false friends found in the mathematics classroom of a small remote school in the Northern Territory of Australia. It will present techniques from cognitive linguistics to assist teachers to identify them and make suggestions for how to use this understanding.

ABORIGINAL ENGLISH AND FALSE FRIENDS

In language learning, a false friend is a word in the target language which sounds like a word in the language of the student, perhaps stemming from a common historical origin, but which has a different meaning (e.g. see Procter, 1995). These false friends can be hard to master even when they are pointed out, for the learner will automatically assign to the word the familiar meaning, and will need to consciously and repeatedly overwrite this meaning in their own mind.

Where differences in vocabulary or grammar are obviously different between dialects, or in language learning situations, teachers are more likely to be aware of the difference. The
trouble with the false friend is that it fits into an existing place in the language, and it is possible to continue through a conversation or interchange for sometime without the participants realising that they are talking about different things. Hearing an unfamiliar grammatical construction or an unknown word, the other person may ask themself “what does the speaker mean by that?” With a word or phrase that appears familiar, the listener gives meaning to it and responds in an automatic manner, without the process of response being conscious. With the false friend, the meaning interpreted by the listener is different from the meaning the speaker intended.

Even when one becomes aware of a false friend, habitual patterns of response can be difficult to overcome. I will give an example drawn from personal experience. In Brazil, as in many countries, the doors to public buildings are often labelled *puxe* ‘pull’ and *empurre* ‘push’. The Portuguese word *puxe* is pronounced similarly to the English ‘push’ with an unstressed schwa vowel at the end: “push-ə”. Despite knowing consciously that *puxe* means ‘pull’, in Brazil my automatic reaction on reading *puxe* is to push. I have found that I need to go through several conscious steps in order to correctly open the door. I have to stop and say to myself “it means the opposite of what I think it means, what do I think it means?” Once I have thought ‘push’ to myself, I search for its opposite ‘pull’, and only then am I able to open the door correctly.

Aboriginal English is a spectrum of dialects spoken by Indigenous Australians. Some speakers of Aboriginal English also speak Indigenous Australian languages while some of them speak only Aboriginal English. Speakers may or may not also be competent in Standard Australian English. Some words in Aboriginal English acquire meanings that are related yet distinctly different to their meanings in Standard Australian English. Some of the implications of this for the legal system have been documented (Eades, 2000). One notorious example is the word ‘kill’ which in Aboriginal English can mean ‘strike deliberately’. This can cause difficulty in a court when a speaker of Aboriginal English is asked whether they intended to ‘kill’ someone. In answering yes, they may be saying that their intention was to hit but not to murder (Cooke, 2002).

Important mathematical terms can also have different meanings or scope of application in Aboriginal English and Standard Australian English. In schools where the teachers are non-Indigenous Standard Australian English speakers, they may very well be unaware of the different meanings their students are giving to the terms. Students may then be perceived by their teachers to be in error or as failing to learn. The students themselves may not be aware of what mistakes their teachers think they have made, leading to confusion and estrangement in the learning environment.

**MATHEMATICS EDUCATION AT MINJILANG COMMUNITY**

Some of these differences from Standard Australian English have been observed in the Aboriginal English spoken by Indigenous students in a remote school in the Northern Territory. At Minjilang Community on Croker Island, Aboriginal English is spoken alongside Indigenous Australian languages which include Iwaidja, Kunwinjku and Mawng. The variety of Aboriginal English spoken at Minjilang has been influenced by these Australian languages.
The teachers in this school are speakers of Standard Australian English. Most of them have limited experience and understanding of Australian Indigenous culture and language. The teachers all see language, specifically the difference between their own and the children’s, as an issue or barrier in the mathematics teaching and learning environment. This is despite the fact that they recognise their students’ language strengths in the oral acquisition of mathematical knowledge over the written. The teachers tend to perceive their students as having language difficulties in mathematics.

There is little accessible material for teachers in this school on the languages spoken by their students, including the dialect of English. Most of the teachers stay only a year. They spend their year trying to quickly acquire some knowledge of their students and environment. The lack of linguistic and cultural knowledge of their teachers is one of the major educational difficulties that the students face.

Attempting to address this gap in knowledge on the part of the teachers, the study from which the data in this paper is drawn has been investigating mathematical language in Iwaidja, the language of the Traditional Owners of Croker Island. The aim has been to better inform teachers about the mathematical understandings that their students are bringing to school. Specifically the study has been investigating uses of spatial frames of reference in small scale space. Spatial frame of reference refers to how a language locates objects in a horizontal plane and is described in more detail below.

THE RELATIVE AND INTRINSIC FRAMES OF REFERENCE

Spatial frame of reference is a subsection of the language of space. It describes how things are located with respect to each other (Levinson, 2003). Important terminology used in the literature includes the distinction between figure and ground. The figure is a salient object, potentially moveable, and the ground is a reference object with respect to which the figure is located (Talmy, 1983).

In the intrinsic frame of reference, the location of the figure is described with respect to a part or facet of the ground. For example, “the pen is beside the cup”. The description is scene internal, and can be rotated with respect to the viewer and the wider world without the description being invalidated. Key English terms are front, back and sides. However, if the ground object is rotated, the description is invalidated. The intrinsic frame of reference seems to be the only one that is present in all languages and is generally the first acquired (Levinson, 2003).

In the relative frame of reference, the point of view and body of the speaker are used to relate the figure to the ground. For example, “the pen is to the left of the cup”. Key English terms are in front of, behind, to the left of and to the right of, where these are from the speaker’s perspective. In this reference frame, the ground object can be rotated and the same description hold. However, if the viewer or whole scene rotates, it is invalidated. Terminology used in this frame of reference is often derived from the intrinsic. In “my left hand”, left is intrinsic, but in “the pen is to the left of the cup” it is not the cup’s own left we are talking about, it is a zone that has been projected from the speaker.
There is a third frame of reference in this typology, the *absolute*, where the location of the figure is described in relation to a fixed direction or landmark. For example, “the pen is to the north of the cup”. While the absolute frame of reference is extensively used in Indigenous Australian languages (e.g. see Levinson & Wilkins, 2006), it is not discussed in this paper.

The analysis presented below involves differentiating between the relative and intrinsic frames of reference in situations where they reinforce each other, where they contradict each other and where only one is applicable.

**THE MAN AND TREE GAME**

The study is ethnographic in approach, combining extensive observation in the school, practitioner research as a part-time teacher in the school, teacher interviews, elements of action research and document analysis with a set of targeted cognitive linguistic quasi-experimental tasks. These tasks are linguistic ‘games’ in which two people separated by a barrier have to describe and match spatial stimuli (Cognitive Anthropology Research Group [CARG], 1993). These games were conducted with both adults and children.

The task from which these data are drawn is a card matching barrier activity for two participants. The task was designed to elicit use of spatial frame of reference in speech, and to demonstrate preferences in frame of reference use. It has been widely used in several variations with different language groups in different parts of the world (e.g. Levinson & Wilkins, 2006; Pederson et al., 1998) and offered thus a strong basis for cross-linguistic comparison.

The stimuli were two identical sets of 16 cards which showed photos of a small toy man and tree. Each photo showed the same man and tree in a different spatial arrangement. The Director chose one card at random and described it to the Matcher. The Matcher, who had the cards laid out before them, tried to find the matching card. The Matcher was free to ask questions at any point. The game continued for as long as required to match all the cards.

The set of 16 cards used was developed by Ann Senghas to show all possible arrangements of the man and tree in the horizontal plane at right angles (Terrill & Burenhult, 2008). Thus the man can be situated behind, in front of or on either side of the tree and he can be looking at the tree, facing away from it or have it at his side. As all the cards can be described using more than one frame of reference, the speakers’ choices indicate both language specific and individual preferences.

Finding that the current cohort of school aged children were no longer acquiring Iwaidja as a first language, this task investigated children’s uses of spatial frame of reference in (Aboriginal) English and in Kunwinjku. The English data showed that some children’s use of key English locational terms such as ‘front’ and ‘back’/’behind’ more closely parallel the use of related terms in Iwaidja and in Kunwinjku than their use in Standard Australian English.

In Iwaidja these terms have applications that are more strongly related to the scene-internal orientation (intrinsic) of faceted objects than in Standard Australian English, where the viewer perspective (relative) is preferred. Some of the students of Minjilang Community demonstrate a preference for a scene-internal application of these key terms over the Standard...
Australian English interpretation. These false friends are terms which some of their teachers have identified as presenting particular difficulties.

The task was conducted with four pairs of children speaking Iwaidja and English, and with five of these children paired with caregivers (parents/grandparents), speaking Iwaidja. The card set was reduced for use with some of the child participants to six, ten or 12 cards.

The data reported here compare the adult caregivers’ use of two key terms in Iwaidja with the children’s use of comparable English terms, both in English sentences and mixed into Kunwinjku sentences.

The Iwaidja terms focussed on are wurdaka ‘in front, first, go before’ and warrwak ‘behind’. Wurdaka is a verb and warrwak is an adverb. They both have temporal as well as spatial meanings, so that wurdaka can mean ‘earlier’ and warrwak ‘after, later’. The English terms are ‘in front’ or simply ‘front’ and ‘behind’ and ‘back’ in the sense of ‘at the back’. For an earlier discussion of adult to adult use of the Iwaidja terms see Edmonds-Wathen (2011).

ADULT DIRECTED USE OF FRAME OF REFERENCE

Wurdaka ‘in front’ and warrwak ‘behind’ were used by all except one of the caregivers directing their children in this task. As in English, these terms can have a relative meaning as well as an intrinsic. However, in Iwaidja the intrinsic sense is much stronger than in English. The following examples show the scope of the uses of these terms. The cards described in the examples are shown in Figure 1. The examples in Iwaidja, and in the following subsection in Kunwinjku, have been glossed with a word by word English translation, followed by a free translation. The example references show the name of the card as given in Terrill and Burenhult (2008).

Figure 1. Man and Tree Images (Anne Senghas version)

In card R11, described in example (1), both the intrinsic and relative senses of the words are valid and the senses thus reinforce each other.

Caregiver 1: Arlirr ari wurdaka kani, awurdaka, (1–R11)
tree it.stands in.front here TOWARDS.in.front
janad ari warrwak.
he he.stands behind
‘The tree is here in front, to the front, he is standing behind.’

The man is behind the tree both from his own perspective, and from that of the viewer. Since the intrinsic and relative frames of reference reinforce each other, the actual frame of reference used by the speaker is ambiguous.
The intrinsic sense only can be seen in the use of *wurdaka* and *warrwak* in example (2), describing card R24.

> Caregiver2: *Warrkbi wurdaka, arlirr warrwak.* (2 – R24)
> man in.front tree behind

“The man is in front, the tree is behind.”

In this context, no relative interpretation of these words is possible since from the viewer’s perspective they are beside each other. The relative sense only, of proximity to the speaker, can be seen in the example (3), describing card R31.

> Caregiver1: *That arlirr ari wurdaka and janad* (3 – R31)
> that tree it.stands in.front and he
> ari warrwak.
> he.stands behind

“The tree is in front and he is standing behind.”

For the same card, an intrinsic use of these words is also possible, with the opposite meaning, as in example (4).

> Caregiver3: *Warrkbi artbung ari wurdaka, arlirr* (4 – R31)
> man again he.stands in.front tree
> bingkan warrwak.
> it.comes behind

“The man is in front again, the tree comes behind.”

While the uses of these terms in examples (1) and (3) parallel the uses of similar terms in Standard Australian English, the uses in examples (2) and (4) are very unlike Standard Australian English usage.

**CHILD DIRECTED USE OF FRAME OF REFERENCE**

Examples are given from seven of the children. Six of these children have an Iwaidja speaking parent and either an Kunwinjku speaking parent (Child2, Child3, Child5, Child6) or Mawng speaking parent (Child1, Child4). They generally speak Kunwinjku or Mawng in the home. Child7 speaks only English. Their ages ranged from 8 years 3 months (Child1) to 12 years 2 months (Child 2 and Child7).

In Examples (5), (6) and (7) the relative and intrinsic frames of reference reinforce each other so while it is ambiguous which frame of reference the child is using, the meaning is easy to interpret for the English speaker. They show the same use of frame of reference as the adult example (1) for the same card, R11.

> Child1: The man is back and the tree is front. (5 – R11)
> Child2: A person behind a tree facing towards me. (6 – R11)
> Child3: *Nungka back and kanan that gundalk* (7 – R11)
> him back and he.looks that tree
> kadi front.
In example (5), Child1 uses ‘back’ and ‘front’ without prepositions. This use is fairly typical of Aboriginal English. In example (6) Child2 uses ‘behind’ in a much more Standard Australian English sentence. Example (7) is in Kunwinjku with English ‘back’ and ‘front’ mixed in, as well as the conjunction ‘and’ and the demonstrative ‘that’. Although the actual frame of reference used is ambiguous, the attribution of ‘back’ and ‘front’ in this example is not ambiguous at all. Some of the children also used ‘back’ and ‘front’ in ways that were unambiguously relative, as in example (8). This is like the use of *wurdaka* and *warrwak* in example (3) for the same card, R31.

Child4: The tree is front, the man is back. (8 – R31)

Other children used the terms about the same card in ways that were unambiguously intrinsic, as in examples (9) and (10). These are like the adult example (4).

Child2: He’s in front of the tree. (9 – R31)

Child3: Bininj *kadi* front and that *gundalk* man he.stands front and that tree *kadi* back. it.stands back

‘The man is standing in the front and the tree is standing in the back.’

Child2 was partnered with Child7, the only child who does not speak one of the local Indigenous Australian languages. When it was Child7’s turn to direct the task and he was describing R31 to Child2, there was some debate between the two about ‘front’ and behind’, as shown in example (11).

Child7: Now the person, is this on the front or behind? Behind. A person behind the tree ...

Child2: I kn.., it's in front but I know what you mean.

Some of the children also used the terms intrinsically about cards such as R24 and R42 in which the man and tree stand on the across-axis of the card, and from the viewer’s relative perspective are beside each other. Examples (12) and (13) are thus like the adult example (2).

Child5: He's facing front and the tree facing front again. (12 – R42)

Child 6: The tree behind the man. (13 – R24)

Example (12) includes an instance of *ascribed orientation*. Although the tree has no facets, it acquires a facing direction from its association with the man. This was common throughout the study, and occurred with both adults and children. In general the ascribed orientation of the tree was the direction that the man was facing, although in some cases where the man was looking at the tree, they were described as “looking at each other.”

**DISCUSSION**

The children’s language shows features of Aboriginal English with which the teacher is likely to become familiar quite quickly. For example, the omission of prepositions in examples (5),
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(8) and (12), or of the copula verb ‘is’ in (12) and (13). Examples (5) – (8) show uses of ‘(in)front’ and ‘back’/‘behind’ that are similar in scope to how these words are used in Standard Australian English. However, examples (9) – (13) show uses that are quite different. While some such as example (13) might be permissible, these uses are unlikely and would generally need to be qualified. These examples show more similarity with the ways wurdaka and warrwak are used in Iwaidja than with the ways these words are used in Standard Australian English.

The children use ‘(in)front’ and ‘behind’/‘back’ in contexts that are strongly intrinsic, paying more attention to the front and back of the toy man in the cards, and his position with respect to the tree, than to his position from their own viewpoint. In examples (12) and (13), the Standard Australian English manner of describing the man and tree would be to use ‘beside’, from the speaker’s viewpoint.

Although the children were using English, and English words in Kunwinjku sentences, their uses of these words paralleled the uses of their parents and grandparents directing them in Iwaidja. It is likely that the scope of similar words in Kunwinjku resembles Iwaidja rather than English, although this has not yet been formally investigated. The children appear to be learning meanings for English words that have mathematical meanings such as ‘(in)front’ and ‘behind’/‘back’ by transferring the meanings from Iwaidja and Kunwinjku. This privileging of the intrinsic frame of reference may reflect a cultural value just as the emphasis on the use of the relative frame of reference in English may reflect an egocentric cultural value as well as linguistic privilege.

The difficulty for teachers who speak only English is that they are unlikely to be aware of how the children’s uses of these words differ from the Standard Australian English. The teachers think that they know what in front and behind/back mean in English. In this case, in front and behind/back are our false friends. The teachers know the Standard Australian English meanings of these words so deeply, so automatically, that they are likely to perceive some of the children’s uses of these words as “wrong”. The meanings of these words are closely related to ‘before’ and ‘after’, which are documented as difficult for Indigenous Australian language speaking children in the mathematics classroom, particularly in their uses with number (Edmonds-Wathen, 2011; Graham, 1988)

The children however, will have difficulty in understanding why some of their uses of these words are considered wrong by their teachers and why others are accepted. In many cases how they use and respond to ‘in front’ and ‘behind/ back’ will concord with the understanding of the teacher. But in other cases they will be told that they are wrong. Because the differences in context are so subtle, the teachers’ criticism can seem random to the student. The students’ understanding can also seem random or unconsolidated to the teacher, although they are in fact demonstrating conceptual consistency.

Even a gesture can be a false friend. When Indigenous people in the Northern Territory are using their hands to show the size of a fish they have caught, they show the width of it, the fatness of it. To a teacher who thinks they are showing the length from head to tail, the gesture seems to show a much smaller fish. To the Indigenous person who sees a non-Indigenous
person show the length of a fish they have caught, the gesture can seem to be a ridiculous exaggeration.

Instead of assuming that they know what their students mean, teachers in this context need to do what I do in front of a door that says *puxe*. They need to say to themselves: “Stop. I think I know what this student means, but they mean something else. What they mean is . . .” And they need to keep on doing this until they are able to understand what the student is saying.

Of course, it is often part of the role of the teacher to teach the standard version of the language used in the classroom. This is certainly the case in Australia. Teaching the standard version of a language then overlaps with teaching the mathematical register. Teachers themselves use everyday words that also have mathematical meanings. They don’t tell students that the everyday meaning is wrong, they tell them that in mathematics the term has a special meaning. With dialectal differences, there is a more of a tendency for teachers to regard non-standard varieties of a language as “wrong”, “poor”, or “bad”. They need to understand that dialectal differences are simply different, and then try to understand the nature of the difference.

Then teachers will be in a position to be explicit about the differences between Aboriginal English and Standard Australian English with their students. For example, when Child2 says about the man in R31, “he’s in front of the tree,” the teacher could reply, “yes, he’s in front of the tree *from his perspective*. From mine, he’s behind the tree.” And elaborate with the explanation that in Standard Australian English, it is the speaker’s perspective that is assumed unless an intrinsic perspective is explicitly specified.

**CONCLUSION**

Research tools from comparative cognitive linguistics were used to elicit the differences described here between Standard Australian English and the Aboriginal English spoken at Minjilang and gain an understanding of the children’s mathematical language. Children’s use of certain spatial terms were found to more closely parallel spatial frame of reference use in local Indigenous Australian languages than Standard Australian English. These linguistic techniques have thus far been little applied in the mathematics education context, but offer a rich opportunity to investigate links between language and cognition. Because the false friends described here are so subtle they can be difficult to identify solely through classroom observation.

Nevertheless in the classroom teachers might look for patterns of use mathematical terms that don’t seem to them to be consistent. They may very well be consistent from the students’ perspective. Teachers might also think about cultural values and how they might inform linguistic patterns. It is also extremely important that teachers do not dismiss dialectal differences as “bad” speech if they want to engage their students into appreciating different ranges of meaning for terms in both standard varieties of the language of instruction and in the mathematical register.
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