What can bilingualism tell us about grammatical development in Down syndrome?

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Overview

• Introduction to bilingualism
• Effects of bilingualism on language and cognitive development in Down syndrome (DS)
• Grammar in French/English bilingual with DS: a first comparison of tense vs. non-tense morphology in both child’s languages
• Clinical implication and challenges to conducting research on bilingualism in DS – audience participation encouraged!

Bilingualism

• Definition: ‘regular use of two (or more) languages’ (Grosjean, 1992)
• Prevalence: over half of the world’s population is bilingual (Grosjean, 2010) – out of a necessity or choice. In some countries (Canada, Montenegro) there are more than one official language – a right.
• Multiple factors influence the course of bilingual language development, resulting in different bilingual outcomes - simultaneous vs. sequential bilinguals; balanced bilinguals vs. majority/minority language-dominant bilinguals.

Exposure: timing and amount

• Differences in timing of exposure: simultaneous vs. sequential bilinguals – before the age of 3 or 4, or before starting school.
• Differences in amount of exposure: language dominance in one language is a result of greater exposure, fluidity common.

Social context: majority vs. minority language

• Majority languages are widely spoken, valued by the society and institutionally supported by government and education system (e.g. French in Quebec, Canada; Albanian in Ulcinj, Montenegro).
• Minority languages are not supported in the same way, and often have low sociolinguistic status – lack of support may result in the loss of minority L1. Exceptions: a language may have a minority status, but is widely spoken in the community: e.g. Spanish in Miami.

Bilingualism modifies developmental trajectory

Important effects on language development, metalinguistic awareness, literacy, nonverbal cognitive ability, especially executive function

(see Bialystok, Craik & Luk 2012 TIC, for a review)

Effects of bilingualism on language development

• Early developmental milestones comparable in monolinguals and bilinguals (Paradis, Genesee & Crago, 2011)

Grammar:

• Different rates of progress influenced by amount and quality of exposure, resulting in different outcomes of proficiency
  • morphosyntax in bilinguals reported to be comparable to monolinguals in dominant language (Paradis et al 2007; Gutierrez-Clellen & Simon-Cereijido 2007).
  • simultaneous bilinguals usually show equal mastery, while sequential bilinguals may take time to catch up with monolinguals
Effects of bilingualism on language development

- Vocabulary:
  - Slower rate of development
  - However, when both languages are considered, young bilingual children's total vocabularies are comparable to those of their monolingual peers
  - Vocabulary distributed across different settings - school vs. home (Patterson, 1998; Thordardottir et al, 2006; Unsworth, 2016).

Cognitive effects of bilingualism across the lifespan

Executive function:
- Is maintained better by bilinguals in older age: bilingualism protects against the decline of these cognitive processes in elderly adults, who show improved memory (Schneider & Marian, 2012) and better executive function (Bialystok et al, 2012).
- Bilingualism delays onset of different types of dementia: bilinguals developed dementia 4.5 years later than the monolingual patients (Alladi et al., 2013; Bialystok et al., 2007).

Bilingualism in Down syndrome

Can individuals with DS become bilingual?

What are the effects of bilingualism on language and cognitive development in DS?
- Does bilingualism slow down the already delayed language development in DS?
- What are its effects on different aspects of language skills - e.g., vocabulary - a relative strength, vs. grammar - a relative weakness?
- Can bilingualism enhance language and cognitive skills in DS, e.g., executive function, and protect against effects of aging?

Information is crucial to allow parents to make informed choices whether to encourage children with DS to be bilingual.

However, many parents are advised to limit their input to majority language only (Kay-Raining Bird et al, 2005; Genesee, 2015).

- Problematic for parents who are not proficient in the majority language - parents cannot provide a good model, or may communicate less effectively and reduce affective displays when using a non-native language (Wharton, Levine, Miller, Breslau & Greenspan, 2003).
- Negative social consequences for children who cannot communicate in languages important in their life contexts (Cleave et al., 2014).

Sparse literature on language and cognition in bilingual DS

Case studies:
- Papagno & Vallar (1995); Vallar & Papagno (1993); Woll & Grove (1996).

Group studies of simultaneous bilinguals in Canada (French/English):
- Kay-Raining Bird, Trudeau, Thordardottir, Sutton & Thorpe (2005);
- Feltmate & Kay-Raining Bird (2008);
- Trudeau, Kay-Raining Bird, Sutton & Cleave (2011)
- Cleave, Kay-Raining Bird, Trudeau & Sutton (2014)

Group study on sequential bilinguals in the US (Spanish/English):
- Edgin, Kumar, Sano & Nadel (2011)
Language and cognition in Down syndrome: sequential bilinguals (Edgin, Kumar, Spano & Nadel 2011)

28 monolinguals with DS, 13 sequential bilinguals with DS (L1 Spanish, L2 English), age range: 7-18, mean age: 13. Different amount and length of exposure to L2. Measures tested:
- vocabulary in English (L2), parent report of language comprehension and production in L2.
- executive function skills

**No group differences on vocabulary, language comprehension or cognitive measures**

Do only simultaneous bilinguals benefit from these cognitive advantages? Is the sample too heterogeneous, amount and length of exposure not controlled for? Individual differences in L1 (L1 Spanish wasn’t tested)?

Kay Raining Bird and colleagues

Participants: simultaneous French/English bilinguals with DS in Francophone Canada, matched on non-verbal MA to TD monolinguals or bilinguals, and monolinguals with DS.
- Cleave et al (2014): DS bilinguals were able to learn novel words as well as TD bilinguals
- Trudeau et al (2011) longitudinal study: parent reports of expressive and receptive vocabulary of French/English bilinguals (English dominant) showed an improvement in vocabulary in both languages over 3 years, though English improved more rapidly
- Kay-Raining Bird, Trudeau, Thordardottir, Sutton & Thorpe (2005) and especially Feltmate & Kay-Raining Bird (2008) investigated vocabulary and grammar in more detail

Note: overlapping participants, small samples – difficulties with recruitment

Language in Bilingual DS: Feltmate & Kay-Raining Bird (2008)

- Most detailed study, focusing on vocabulary and morphosyntax in both French and English in 4 simultaneous bilingual children with DS, each matched individually to a monolingual DS and a bilingual TD child on non-verbal mental age: 4 'triads', with 12 participants in total
- CA of children with DS (BL and ML): 5-8; CA of TDs: 2;04-3;05.
- Included measures of IQ, receptive vocabulary, receptive grammar and a conversational language sample:
  - for English: Index of Productive Syntax (IPS), number of words, NPs and Verbs (lexical vs. copula) and nine grammatical morphemes: present progressive, regular past-tense, third person singular, irregular past, plural -s, possessive -s, articles a and the, auxiliary verbs, and copula verbs.

TD BILINGUALS PERFORMED BETTER THAN BOTH MONOLINGUALS AND BILINGUALS WITH DS.

NO CONSISTENT DIFFERENCES BETWEEN MONOLINGUAL AND BILINGUALS WITH DS

→ difficult to interpret the data of bilinguals vs. monolinguals with DS:
  - one bilingual DS consistently outperformed her monolingual triad match, one monolingual DS consistently outperformed her bilingual triad match, and two monolingual children performed similarly to their bilingual matches.

Explained as the result of differences in language input
Bilingualism in DS
- The limited evidence so far suggests that simultaneous and sequential bilingual children with DS are not disadvantaged by exposure to more than one language. However, it is still far from clear:
  - whether there are any consistent differences in the mastery of grammar between bilingual and monolingual children with DS.
  - whether there are any advantages in being bilingual when acquiring grammar of languages typologically similar or different to English.
  - whether the results of these studies can be generalised to the UK, considering the differences in sociolinguistic status of L2 languages in Canada, US and UK.

Why focus on tense
- Developmentally early on, so a good predictor of language delay/impairment
- Often focus of intervention
- Important for both theory and practice: difficulties with tense argued to be a clinical marker of SLI (Rice, 2003)
- Successful acquisition of tense is a stepping stone towards development of comprehension and production of complex sentences and grammar in general.
- Relatively easy to assess – different methods exist.
- Useful to look at bilingualism: many languages have clear ways of marking tense.

It's complicated: past tense vs. past time
In complex sentences, past events can be expressed using a verb form which is not in the past,
I saw her cry.
*I saw her cried.
I wanted to run.
*I wanted to ran.
Or events that will happen in the future are expressed through verbs in the past participle form, as in passive:
The building will be repaired by the owners.

Tense
- Encodes time of an event with reference to speaking.
  past ────── now ────── future
past: He worked hard. He ran fast.
present/future (non-past): She works hard. She leaves tomorrow.

Note: contrast between regular vs. irregular forms:
Regular: work – worked, lift – lifted
Irregular: run – ran, leave – left.

It's complicated: Tense, Aspect, Agreement
- Agreement: main verbs and auxiliaries agree with subject, thus some forms are marked for both tense and agreement at the same time:
  She runs. She has run. (3rd person singular).
  We go. We are going (2nd person plural).
- Note: Aspect (Perfective vs. Progressive) is marked on the participle of the main verb (sleeping, slept), not the auxiliary (is, has).
  Mary is sleeping. Mary has slept.
  (Common mistake to analyse slept as past tense!)
**Tense markers: summary**

BOUND grammatical morphemes attach to the main verb:
- 3rd person singular present ‘-s’; past tense ‘-ed’

FREE grammatical morphemes stand on their own:
- auxiliaries and copulas: am, are, is, was, were, has, have
- Participles are not marked for tense: going, gone

**Acquisition of tense in typical development**

Young children have difficulty producing correct tense forms: between the ages of 2 until about 4 they often produce verbs in bare or infinitival forms, omitting the ‘-s’ and ‘-ed’ inflections, or producing participial forms:

- I popping balloons. (Nina, 2;0)
- Her have a big mouth (Nina, 2;6)
- Patsy need a screw. (Patsy, 3;3)

natural production data from CHILDES

**Other phenomena that co-occur with tense difficulties:**

Accusative subjects and missing subjects

a. When using a non-tensed form, children often use ungrammatical pronoun subjects (in Accusative case form, instead of Nominative):
   *Her fall down.

b. When using a non-tensed form, children omit subjects:
   *___ want cookie.

→ Important implications for therapy – targeting tense may have beneficial effects on case and subjects errors (Cox & Perovic, in prep)

**Terminology: bare/infinitive/non-tensed/non-finite**

**Grammatical morphology in monolinguals with DS:**

is there a crucial impairment in tense?

Poor performance on tense reported:

But: the results are inconclusive on whether all grammatical morphology is equally impaired or whether tense is disproportionally affected:
- only tense impaired - O’Neil & Henry
- Tense and non-tense morphemes impaired - Ring & Clahsen; Eadie et al
- most studies had issues with sampling/matching

**The current study**

**Goal:**

- to investigate mastery of grammatical morphemes in both of the child’s languages

More generally, to investigate the effects of bilingualism on the development of vocabulary, complex grammar and cognitive functioning in DS – relying on data from both languages, to inform intervention approaches (there are currently no intervention studies on bilingual DS - Kay-Raining Bird et al, 2016)

**Participants:**

6 children recruited since Jan 2016, 5 bilingual and 1 monolingual child with DS, aged 6-14 (recruitment ongoing).

Three children unable to complete testing, one was excluded due to mosaic DS, one child did not produce any tensed verbs.

→Complete data collected from GH, aged 13;8, a French/English simultaneous bilingual boy, with English as his dominant language. Belgian mother, British father, younger sibling – exposed to French and English from birth. Clear speech and intelligible in both English and French.
## Standardised measures

<table>
<thead>
<tr>
<th>English</th>
<th>French</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-verbal Reasoning</td>
<td>NVA</td>
</tr>
<tr>
<td>Phonological Memory</td>
<td>Digit Span (CELF-4) Digit Span (N-ELI)</td>
</tr>
<tr>
<td>Phonology</td>
<td>Non-word repetition (ELOLA)</td>
</tr>
<tr>
<td>receptive vocabulary</td>
<td>Digit Span (CELF-4) French adaptation of SPVIS (ELOLA)</td>
</tr>
<tr>
<td>expressive vocabulary</td>
<td>Digit Span (N-ELI)</td>
</tr>
<tr>
<td>Receptive Grammar</td>
<td>KBIT Matrices</td>
</tr>
<tr>
<td>Expressive Grammar</td>
<td>TROG-2 Adaptation of Token Test (ELOLA)</td>
</tr>
<tr>
<td>Receptive Syntax</td>
<td>Sentence Repetition (ELOLA)</td>
</tr>
<tr>
<td>expressive vocabulary</td>
<td>Formulated sentences (CELF-4) Reciting sentences (CELF-4) Word structure (CELF-4)</td>
</tr>
<tr>
<td>Narrative</td>
<td>Narrative: The Berthen Bus Story (ELOLA)</td>
</tr>
<tr>
<td>Pragmatics</td>
<td>Children’s Communication Checklist –2 (CCC-2) Social Communication Questionnaire (ELOLA)</td>
</tr>
</tbody>
</table>

## Experimental tasks

### English morphemes under investigation: tense vs. non-tense

<table>
<thead>
<tr>
<th>Type</th>
<th>Morpheme</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>NNS</td>
<td>Auxiliary be</td>
<td>The man is walking</td>
</tr>
<tr>
<td>NNS</td>
<td>Copula be</td>
<td>She is a teacher</td>
</tr>
<tr>
<td>NNS</td>
<td>3rd person singular -s</td>
<td>He takes hoses</td>
</tr>
<tr>
<td>NNS</td>
<td>Irregular past tense</td>
<td>He ate the entire cake last night</td>
</tr>
<tr>
<td>NNS</td>
<td>Present progressive -ing</td>
<td>They are playing</td>
</tr>
<tr>
<td>NNS</td>
<td>Plural -s</td>
<td>His shoes are shining</td>
</tr>
<tr>
<td>NNS</td>
<td>Prepositions</td>
<td>The biscuits are on the table</td>
</tr>
</tbody>
</table>

### French morphemes under investigation: tense vs. non-tense

<table>
<thead>
<tr>
<th>Type</th>
<th>Morpheme</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>NNS</td>
<td>Past auxiliary avoir (passé composé)</td>
<td>Il a parlé à son père</td>
</tr>
<tr>
<td>NNS</td>
<td>Copula être</td>
<td>La dame est une maîtresse</td>
</tr>
<tr>
<td>NNS</td>
<td>Vouvoyer (vous-forms)</td>
<td>Le tire a changé les noms des clients</td>
</tr>
<tr>
<td>NNS</td>
<td>Irregular verbs present tense</td>
<td>Les enfants s’amusent dans l’autobus</td>
</tr>
<tr>
<td>N-NS</td>
<td>Determiners (number)</td>
<td>Les enfants (les enfants)</td>
</tr>
<tr>
<td>N-NS</td>
<td>Prepositions dans/là</td>
<td>Il va dans le bus / Il va à la maison</td>
</tr>
</tbody>
</table>
Obtaining obligatory contexts for English and French tense and non-tense morphemes

- No spontaneous speech or a narrative (Bus Story or Frog Story) was possible to obtain from GH.
- Tense vs. non-tense morphemes in English and French were analysed from utterances produced in two probes (3rd person singular and past tense ‘–ed’) of Test of Early Grammatical Impairment (TEGI, Rice & Wexler 2001), and 2 sentence repetition tasks: CELF 4 and LITMUS (Marinis et al, 2015).
- Minimum of 4 obligatory contexts for each morpheme (Perelis et al 2003).

Patterns observed:

- Observed difficulty with 3rd person singular in English, GH’s dominant language, but no other tense morphemes. More difficulty for tense overall in French, his weaker language (different to Canadian English/French speakers).
- Non-tense morphemes are not problematic in either language: plural, prepositions, progressive ‘-ing’.

- It seems as if GH has little difficulty with tense morphology in English, except for the 3rd person singular (the most difficult inflectional morpheme, combining both agreement and tense, one of the latest to appear in TD children, Brown 1973).
- This is in contrast to the (younger) DS bilinguals in Feltmate & KRB (2008).
However:
The 100% accuracy on past tense –'ed' is misleading: only two obligatory contexts for this morpheme.

GH consistently avoided using sentences requiring –'ed'; in the TEGI, instead of attempting simple past tense, he repeatedly produced periphrastic forms: for 'climb', he produced: 'She is climbing on the ladder,' rather than the target 'She climbed'.

However, excellent performance on English auxiliaries and copulas suggests that tense, and grammatical morphology, are not an overarching problem for GH.

Tense somewhat more problematic than non-tense morphemes, especially in weaker language, French, though no firm conclusions due to limited number of obligatory contexts

### Problem: English morphemes – small number of obligatory contexts for crucial morphemes

<table>
<thead>
<tr>
<th>Type</th>
<th>Morpheme</th>
<th>N° of Obligatory Contexts</th>
<th>Percentage accurate productions</th>
</tr>
</thead>
<tbody>
<tr>
<td>TNS</td>
<td>Auxiliary be</td>
<td>5</td>
<td>100%*</td>
</tr>
<tr>
<td>TNS</td>
<td>Copula be</td>
<td>16</td>
<td>100%*</td>
</tr>
<tr>
<td>TNS</td>
<td>3rd person singular –'ed'</td>
<td>6</td>
<td>80%</td>
</tr>
<tr>
<td>TNS</td>
<td>Irregular past tense</td>
<td>2</td>
<td>100%*</td>
</tr>
<tr>
<td>NL: TNS</td>
<td>Present progressive –'ing'</td>
<td>11</td>
<td>95.5%*</td>
</tr>
<tr>
<td>NL: TNS</td>
<td>Plural –'s'</td>
<td>2</td>
<td>100%*</td>
</tr>
<tr>
<td>NL: TNS</td>
<td>Plural</td>
<td>15</td>
<td>100%*</td>
</tr>
</tbody>
</table>

### Results: French morphemes

<table>
<thead>
<tr>
<th>Type</th>
<th>Morpheme</th>
<th>N° of Obligatory Contexts</th>
<th>% accurate productions</th>
</tr>
</thead>
<tbody>
<tr>
<td>TNS</td>
<td>Past auxiliary avoir (passé composé)</td>
<td>8</td>
<td>25%</td>
</tr>
<tr>
<td>TNS</td>
<td>Copula être</td>
<td>3</td>
<td>66.7%*</td>
</tr>
<tr>
<td>TNS</td>
<td>V-stem – present</td>
<td>3</td>
<td>100%*</td>
</tr>
<tr>
<td>TNS</td>
<td>Irregular verbs in present tense</td>
<td>12</td>
<td>66.7%</td>
</tr>
<tr>
<td>N- TNS</td>
<td>Determiners</td>
<td>33</td>
<td>80.9%*</td>
</tr>
<tr>
<td>N- TNS</td>
<td>Dans/leur</td>
<td>3</td>
<td>100%*</td>
</tr>
</tbody>
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### Comparison to similar tasks on monolingual DS

<table>
<thead>
<tr>
<th>Group</th>
<th>Task</th>
<th>Age Range</th>
<th>Task</th>
<th>Age Range</th>
<th>Test Group</th>
<th>Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>GH</td>
<td>TEGI</td>
<td>13.5-19</td>
<td>Similar task</td>
<td>9-11-10.9</td>
<td>Mono DS</td>
<td>English</td>
</tr>
<tr>
<td>Laws &amp; Bishop (2003)</td>
<td>TEGI</td>
<td>12.0-14.3</td>
<td>Similar task</td>
<td></td>
<td>Mono DS</td>
<td>English</td>
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<tr>
<td>O’Neill &amp; Henry (2001)</td>
<td>Similar task</td>
<td></td>
<td>Mono DS</td>
<td></td>
<td>Mono DS</td>
<td>English</td>
</tr>
<tr>
<td>Ring &amp; Clahsen (2005)</td>
<td>Similar task</td>
<td></td>
<td>Mono DS</td>
<td></td>
<td>Mono DS</td>
<td>English</td>
</tr>
</tbody>
</table>

### Feltmate & Kay-Raining Bird: bilingual DS and TD and monolingual DS

#### Grammatical morphemes use in obligatory contexts

| morpheme | present | auxiliary | 3SG | regular past | 3pl | plural
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>3SG</td>
<td>none</td>
<td>none</td>
<td>100%</td>
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</tr>
<tr>
<td>2SG</td>
<td>100%</td>
<td>none</td>
<td>none</td>
<td>100%</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>1SG</td>
<td>none</td>
<td>none</td>
<td>100%</td>
<td>none</td>
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<td>none</td>
</tr>
<tr>
<td>3pl</td>
<td>none</td>
<td>none</td>
<td>none</td>
<td>none</td>
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<td>1pl</td>
<td>none</td>
<td>none</td>
<td>100%</td>
<td>none</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>2pl</td>
<td>none</td>
<td>none</td>
<td>none</td>
<td>100%</td>
<td>none</td>
<td>none</td>
</tr>
</tbody>
</table>

Note: Percentages are of correct usage in obligatory contexts. * marked as defined by 80% or more correct use in four more optional contexts.
Overall mastery of grammar

- GH's utterances showed the correct SVO structure used in both French and English 100% of the time.
- In French, omission of subjects (with verbs not marked for tense) (a classic pattern from TD and SLI)
- In English, occasional omission of articles, preposition commission errors, wrong gender on pronouns (‘she’ for ‘he’)
- In both languages, use of all purpose verbs, e.g. 'do' or 'aller' (to go) instead of more specific verbs: "Le garçon aller dans le bain" [the boy to go in the bath] for the target "Le garçon prend un bain" [the boy takes a bath]. 'She's doing the football'

Difficulties with complex sentence structures

In English, GH avoided modals, passives, wh-questions, relative and embedded clauses.
- Target: The children were taken to the office as GH: He went outside the office'
- Target: "The boy must sweep the floor in the kitchen" as GH: They were sweeping the floor in the kitchen'
- Target: "He wouldn't have brought his friend if she was nasty" GH: "She was a little bit nasty"

Difficulties with complex sentence structures

- In French, GH often avoided complex constructions by producing fragments:
  - Target: "J'ai vu le chien qui a mordu la vache" [I saw the dog that has bitten the cow] GH: As "mordu la vache" [bitten the horse]
  - Target: "Il voit l'avion qui passe" [He sees the plane that passes by] GH: "L'avion qui passe" [the plain that flies by].

Overall summary

- GH is a successful bilingual, demonstrates dominance in English, and his pattern of acquisition and errors have been observed in bilingual literature on typical development and in DS. His level of language impairment differentiates him from a TD bilingual.
- In line with literature on monolingual DS, we see difficulties with aspects of morphosyntax, though his performance on some tense morphemes surpasses many monolinguals with DS.
- GH's relative mastery of both tense and non-tense morphemes could be influenced by his bilingualism – exposure to two tense system supporting grammatical development – but also be a result of individual differences known in DS.

Potential advantages of bilingualism for grammatical development in DS – to be tested

- Possible advantages in metalinguistic awareness and better responsiveness to therapy and intervention? There are currently no intervention studies in bilingual DS (Kay-Raining Bird et al 2016)
- Possible transfer of grammatical knowledge: awareness of grammatical morphology in highly inflected languages, e.g. Serbian, could benefit grammar development in a language such as English with less transparent morphological paradigms – implications for therapy and intervention.
- Improved executive function skills – could have far-reaching consequences for cognitive development.

Challenges!

Theoretical and empirical:
- Validity of case studies, the role of individual differences
- Methodological:
  - Difficulty obtaining spontaneous speech sample/narratives – rely on combination of different methods to assess tense in English and French
  - The use of standardised assessments normed for monolinguals – GH scored at floor on most standardised measures of language and cognition – qualitative data a lot more useful
  - Difficulties with social interaction (confirmed by scores on CCC-2 and SCQ) and inattention or just impeded performance on both standardised tests and experimental tasks – not looking at the screen/booklet, randomly pointing at pictures!
  - Assessing both child’s languages is a lengthy process – difficult to do in school setting; constraints on data collection: native speakers needed for assessing both child's languages
Thank you!

Acknowledgements

• Participants and their parents
• Collaborators: Jess Gudenus-Oribe, Froso Argyri, Merle Mahon
• DownRight Excellent
• Belinda Winn

**Check out our new information website, UCL BiLingo, for information and advice on bilingualism for parents and professionals, founded by UCL researchers: Dr Froso Argyri, Dr Merle Mahon, Dr Alex Petrovic, Professor Lee Walt**