Appendix I

Computer-Based instrument for Low motor Language Testing (C-BiLLT)

The C-BiLLT consists of a pre-test, a learning module and a computer test:

**The pre-test** is used to explore whether a child is able to communicate a choice between two concrete objects (or digital photos of the objects) when provided with the spoken name of the objects. Eight pre-selected familiar objects (as identified by parents) from the child’s home environment (i.e., the child's milk-bottle or cup, ball, spoon, coat, trousers, toy car or doll, favourite book, and favourite digital video disc cover) are presented in pairs to the child. While holding a target and foil object in separate hands, the examiner verbally asks the child to select the target object (e.g., 'Where is the ball?') by reaching, pointing, eye-gazing to his/her object of choice. This is repeated in fixed order until all eight pairs of objects have been presented. Next, the child is presented with the same eight objects but now presented as generic photographs of the item (photographic print size A5). Again in fixed order of eight pairs, the child is asked verbally to select the target item. Although the investigator was allowed to encourage the child to provide a response in any way possible, the actual question could only be repeated once. The response of the children was considered correct if the child (based on Heim, 2001) fixated his/her eyes on the targeted object for at least two seconds; or reached for the targeted object with his/her arm, foot, elbow, or hand; or pointed to the targeted object with his/her hand, arm, foot, or head; or turned his/her head to the targeted object with an accompanying vocal sound. If the child correctly identified at least 5 objects and/or 5 photographs, he/she was considered to be able to communicate a selection in response to a spoken response opportunity and advanced to the learning module.

**The learning module** is incorporated in the assessment package for two reasons. First, to make the child aware of the association between the access methods and the visual representations (response selection) on the 19-inch touch screen. Second, to empirically find the best response mode for the individual child (e.g. eye gazing, touch-screen, input switches, or the child’s own wheelchair head support) when there are concerns regarding the access method for the child.

**The computer test** consists of 75 items presented in two parts. Part I consists of three primary sections, with each section containing 10 items referring to nouns, verbs, animals, objects and persons. For each item, the child is shown two digital photographs (a target and a foil) arranged horizontally on the computer screen. To control for effects of chance for each of these three sections, a parallel section exists, presenting the same test items in a different order and with a different foil for each target item (see Figure 1). The examiner always completes the primary form. Only when a child delivers one or more incorrect responses on the primary form, the examiner assesses the entire parallel form.
Part II consists of 45 test items pertaining to spoken sentences with increasing complexity of grammatical structures and is organized into 8 sections. The response options per test item are now represented by four digital photographs in a 2 x 2 matrix on the computer screen (see Figure 2), providing one target and three foils. For both the first and second part of the computer test, visual feedback of the child’s response is shown by the appearance of a red square around the chosen photograph.

**Score calculation.**

Pre-test (max. 2 points) The child can attain a pretest score of either 1 point (for identification of at least 5 real objects or 5 photographs) or 2 points (for identification of at least 5 of both real objects and photographs). The learning module activities do not contribute to the final score.

Part I. (max. 30 points) For the computer test Part I (Sections 1, 2 and 3) one point is given for each correctly identified item in both original and parallel version with a total of 30 points. For instance if a child answered the question “Where is the telephone” incorrect in the primary form and correct in the parallel form, no point is scored for the item “telephone”. If the child answered this question correctly both in the primary as well as in the parallel form, one point is scored for the item “telephone”.

Part II (max. 45 points) For the computer test Part II (Sections 4 to 11), one point is scored for each correct response with a total of 45 points.

The maximum achievable C-BiLLT score is 77, i.e. the sum of the pre-test and the scores of the two parts in the computer test.

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**Figure 1**

Example of an item of the C-BiLLT (test Part I and parallel section): the child is asked: “where is the shoe?”

**Figure 2**

Example of an item of the C-BiLLT (test Part II): the child is asked to identify: “The book is standing on the plate”
Section’s and examples of items of the computer test of the C-BiLLT

Part 1

- Section 1 and parallel Section 1: 10 items; identification of nouns (e.g. Where is the car?)
- Section 2 and parallel Section 2: 10 items; identification of verbs (e.g. Who is sleeping?)
- Section 3 and parallel Section 3: 10 items; identification of animals, objects and persons (e.g. Where is the baby?, where is the vacuum cleaner?)

Part 2

- Section 4: 4 items; identification of more difficult nouns in “where” phrases (e.g. Where is the umbrella?)
- Section 5: 5 items; identification of spatial relations embedded in simple sentences with objects in combination with function and prepositions (e.g. The dog lies in the basket)
- Section 6: 5 items; identification of “who” questions of persons performing activities (e.g. Who walks the dog?)
- Section 7: 4 items; identification of passive sentences with objects and prepositions combined with events. (e.g. The boy is pushed by the girl).
- Section 8: 8 items; identification of simple sentences with more complexity in grammar and semantic (e.g. One of the uncluttered toothbrushes is long).
- Section 9: 6 items; identification of simple active sentences referring to non-observable situations of four persons (mother, baby, son Joshua and daughter Kim) (e.g. Joshua and Kim are going to play outside, who stays with Mammy?)
- Section 10: 9 items; identification of more complex sentences with comprehension of two and more concepts referring to food products. (e.g., A little jar of jam is standing beside a large red jar of jam.)
- Section 11: 4 items; identification of compound sentences referring to the lunch table. (e.g. First an apple was lying on the table, but now there is a banana in its place)

Examples of visual presentation of the different sentence types

Example of a noun phrase (NP). The child is asked: "Waar is de schoen" [Where is the shoe ?]

Example of a verb phrase (VP). The child is asked: "Wie is aan het slapen" [Who is sleeping ?]
Example of a Who-question? (WhQ). The child is asked: “Wie maakt er muziek?” [Who is making music?]

Example of spatial relation embedded in simple sentences (SR). The child is asked to identify the image the test leader is saying: “de hond ligt in de mand” [The dog lies in the basket]

Example of simple sentences referring to non-observable situations (SOOC) of four persons. The child is asked to identify the image the test leader is saying: “Joost en Kim gaan buiten spelen, wie blijft er bij mama?” [Joshua and Kim are going to play outside, who stays with Mammy?]

Example of simple sentence with function words (SSF). The child is asked to identify the image the test leader is saying: “Een kleine pot jam staat naast de rode pot jam” [A little jar of jam is standing beside the red jar of jam]

Example of compound sentence (CS) referring to the lunch table. The child is asked to identify the image the test leader is saying: “Eerst lag er een appel op tafel maar nu is er een banaan voor in de plaats gekomen” [First an apple was lying on the table, but now there is a banana in its place]