Supplemental Material S1. Language Exposure Assessment Tool (LEAT) manual.

This manual outlines the Language Exposure Assessment Tool (LEAT) in two parts:

1) Part 1, Filling out the LEAT. This part outlines each section and provides dialogue to aid administering the form over the phone or in person.
2) Part 2, Summarizing data. This section goes over how to easily compile a spreadsheet for summary variables across LEAT's.

The LEAT workbook contains two sheets. The first sheet, titled "LEAT", is outlined in part 1. This is meant to be filled out by the researcher based on caregiver reports of exposure. The details on filling out this first sheet are found in Part 1. The second sheet, titled "exposure summary" contains a summarized set of data pulled from the "LEAT" sheet. A second workbook titled "Merge LEAT's" is available for those who wish to summarize exposure data across a series of LEAT's by generating a summary spreadsheet. This spreadsheet can be easily exported into data analysis software. A guide on using these features is found in Part 2.

PART 1. FILLING OUT THE LEAT

Important notes:

Fields in gray are areas that must be filled out. Fields in white hold formulas that will calculate language exposure and should not be changed. These formulas can be found in the relevant sections below. These calculations allow quantifying language exposure. To avoid alterations on these equations, these fields are protected.

In addition, the general dialogue (provided in red below) is also added to the electronic excel-based LEAT document for ease of administration.

General Information

Fill in Date of Experiment, Participant ID (corresponding to child), Today's Date, Date of Birth, and the name of the Reporter who is providing you with the information for this form (e.g. mom or other caregiver).

Age of Child in Months

This field will calculate the age of the child in months once the Date of Birth field and the Date (found at the beginning of the form, in the "General Information" section) have been completed. You should not have to input the child's age since it is automatically calculated, but you should still double-check this value in case of an error.

Primary Input by Person

This field should include anyone who sees the child on a regular basis (at least once per week), languages they speak and any dialect information.

Write down the primary language under "Language 1," the secondary language in "Language 2," and the tertiary language in "Language 3," as well as dialect information for each language if applicable.

Note that the language field will only allow the following inputs: the default languages (English and Spanish), Other1, Other 2, Other 3, and Other4. You can either type in these options, or use them from the drop down menu located in each cell. If you choose to type them, you must type them exactly as they are found in the drop down menu, or an error will be displayed. To access the drop down menu, hover over the cell. Two small arrows will appear to the right of the cell. Click on these to get a drop down menu of the language options. If you are using a language other than the default languages, use the Other1, Other2, Other3, and Other4 options. Enter the languages that each of these corresponds to in the field directly below the breakdown of language input in the section titled "If using Other1, Other2, Other3, and Other4 please specify." The corresponding cell will be highlighted to remind you to enter a language.

Below is an example of a mom and a dad who both speak Spanish and Chinese, but acquired them at different times. Note that "Other1" corresponds to "Chinese" (as specified in the section directly below the chart).

Primary Input by Person: "Who interacts with <child's name> on a regular basis?" (Regular basis = once per week)

Person	L1 (Primary Language) Dialect/Region		Native?	L2 (Secondary Language) Dialect/Region		Native?	L3 (Tertiary Language) Dialect/Region		Native?	Notes
Mom	Spanish	Mexico	Yes	Other1 - specify below	China	No				
Dad	Other1 - specify below	China	Yes	Spanish	Mexico	No				

If using a language that is not Spanish and English use Other1, Other2, Other3, Other4 please specify:

Other1: Chinese
Other2:
Other3:
Other4:

Sometimes we might not know the languages that specific people speak to the child, but we might know in which situations a child encounters the language. For example, a child might hear German in daycare, although we aren't certain from whom. In this case, we would simply write "Daycare" and complete the language and dialect fields that follow. Below are the questions we use to elicit all of this information.

Dialogue:
"Who interacts with <child's name> on a regular basis?" (approximately once per week)

For each person, we ask:
"What is the primary/secondary/etc. language of <person 1>?"

"What dialect of <language A> does <person 1> speak?" OR "Where did <person 1> learn to speak this language?"

"Is <person 1> a native speaker of <language>?"

Primary Input by Language and Person

Note: the information from the previous section will be automatically inserted into this section (person and languages).

This is area is used to get an estimate of exposure across the infant's life. Because language exposure may differ through the infant's life, we mark exposure per person, per day, and per time period (see below for an example). That is, if a child hears a language for only half of their life, we weight this accordingly to ensure an accurate calculation of exposure.

This section will expand on the "Primary Input by Person" section, by breaking down the input the child receives from each person. Below is an example, where the child's father interacts with the child differently between the weekdays and weekends, whereas the child's mom interacts equally with the child for every day of the week:

Table 1.

Primary Input by Language and Person

Who/Situation	What Ages? from	to	Sun	Mon	Tues	Wed	Thu	Fri	Sat	Language and Hours per day L1 & Hours/day		L2 & Hours/day		L3 & Hours/day	
Mom	0	18	☑	☑	☑	☑	☑	☑	☑	Spanish	4	Chinese	3		
			☐	☐	☐	☐	☐	☐	☐	Spanish		Chinese			
Dad	0	18	☐	☑	☑	☑	☑	☑	☐	Chinese	3	Spanish			
	0	18	☑	☐	☐	☐	☐	☐	☑	Chinese	4	Spanish	1		

If you find that you need more than two rows per person, use the extra blank fields at the bottom of the table.

Who/Situation:

These fields will automatically be populated based on the information provided in the pervious table.

What ages?

From what age did the child begin to receive input from this person? Make sure to enter these values in terms of months, even though parents will rarely answer in this way. For example, when asked how long the infant has heard Spanish coming from grandma, the parent might respond by saying "since birth." It is your responsibility to translate this into a range (i.e. 0-16) and enter it in the corresponding fields (i.e. enter "0" in the "from" field, and "16" in the "to" field).

If the person's interaction with the child has not been consistent through the child's life (e.g. grandma spent X amount of hours from 0-6-months, then moved in with the family and now spends Y

amount of hours from 6-16-months), split up the exposure data by making another row in the blank fields: Grandma row 1 = language input from 0-6-months, and Grandma row 2= 6-16-months (see Table 2).

Dialogue:
"At what age did the child start receiving language input from <person 1>?"

"Has <person 1>'s interaction with <child' name> been consistent or were there times when he/she spent more or less time with <child's name>?

Table 2.

Who/Situation	What Ages? from	to	Sun	Mon	Tues	Wed	Thu	Fri	Sat	L1 & Hours/day		Langu L
Grandma	0	6	☐	☑	☑	☐	☐	☐	☐	French	2	
	6	16	☐	☐	☐	☑	☑	☐	☐	French	4	

Sunday –Saturday:

Check the boxes corresponding to the days of the week that the child encounters this particular language input. For example, if grandma only visits on Saturday and Sunday, we would enter a check under both Saturday and Sunday, leaving all other days of the week blank.

Dialogue:
"During the week, what days is <person 1> around <child's name>?"

"How about the weekends? Is <person 1> around <child's name> on the weekends? If so, what days?"

Hours/Day

Enter the number of hours per day that the child hears the given language, given the specific days of the week. For example, in Table 1, we see dad speaking 3 hours of English between Monday and Friday, and speaking 7 hours of English and 1 hour of Spanish during the weekend.

Dialogue:
"On an average day during the week, how many hours is <child's name> exposed to <person 1> speaking in <language 1> and how many hours in <language 2> ?"

"On an average day during the weekend, how many hours is <child's name> exposed to <person 1> speaking in <language 1> and how many hours in <language 2> ?

Notes/Trips

Use this section to make note of anything you deem important, including any significant trips that the child has taken outside of the country where they may have encountered different languages. In our lab, any trip over one month should is included in the tabulation area titled "Primary Input by Language and Person." Anything below one month is noted in this "Notes/Trips" section.

> ***Dialogue:***
> *"Has <child's name> been on any vacations?"*
>
> **If Yes:**
> *"Where did he/she go?"*
> *"How old was <child's name> at that time?"*
> *"How long were he/she there?"*
> *"What languages were spoken to or around <child's name>?"*
> *"On an average day during the vacation how many hours was <child's name> hearing <language 1> and how many hours was he/she they hearing <other languages>."*

Parent Estimate

Now we ask the parent to give an overall intuitive estimate of their child's language exposure. We do this to ensure that we have accurately captured exposure to languages in the previous section.

> ***Dialogue:***
> *"If you think about all the people who have talked to <child's name> since birth and the languages they speak, what percentage would you give to <language 1> and <language 2>?"*

If the Parent Estimate differs markedly from the "Overall estimate" (see below), prompt the parent to reconsider any other exposure that might lead to a more accurate calculation. Return to the previous section ("Primary input by language and person") if needed. Remember that TV/Radio exposure should not be included.

Estimate 1, Hours per week

> This section will give you a breakdown of the percent of hours per week that a child hears each language. We noticed that the same language exposure calculated as a function of hours per week or as hours per day yielded slightly different estimates of total exposure. We address this by taking an average of these two estimates (see below).
>
> For Estimate 1, the formula sums the column titled "Weighted hours/week" and divides by the total for each language. These numbers are rounded to a second decimal place. These numbers will add to 1.

Weighted Hours/week

$$(Hours\ per\ day \times days\ per\ week) \times \frac{number\ of\ months}{age\ of\ child\ in\ months}$$

Estimate 2, Hours per day

This section gives a breakdown of the percent of hours per day that a child hears a given language. The formula adds up the weighted hours/day and divides by the total for each language. These numbers are also round to the second place. These numbers will add to 1.

Weighted Hours/day

$$Hours\ per\ day \times \frac{Number\ of\ months}{age\ of\ child\ in\ months}$$

Overall

This section takes an average of both Estimate 1 and Estimate 2 for each language. In our lab, this final calculation is used to classify bi/monolinguals.

PART 2. SUMMARIZING DATA

The "Exposure Summary"

The second sheet in the LEAT workbook is titled "exposure summary". Here you will find a list of variables that represent a summary of the data collected on the LEAT questionnaire in the same workbook.

Variable Names

Note that for all variables, the values are pulled directly from the LEAT sheet. Thus, any changes made to the LEAT sheet will automatically change the exposure summary.

ID	corresponds to the ID number entered on the LEAT sheet
DOB	Date of Birth
Date_completed	date that LEAT was completed
Caregiver	Name of interviewed caregiver (e.g. Mom)
Age_mos	Age of the infant when the LEAT was filled out, in months
L1	Language where overall estimate is greatest
L2	Language where overall estimate is second greatest
L3	Language where overall estimate is third greatest
L1_ParentEst	Parent estimate of exposure to the L1
L2_ParentEst	Parent estimate of exposure to the L2
L3_ParentEst	Parent estimate of exposure to the L3
L1_Hr_Wk	Proportion of L1 exposure per day, on average
L2_Hr_Wk	Proportion of L2 exposure per day, on average

L3_Hr_Wk	Proportion of L3 exposure per day, on average
L1_Hr_Day	Proportion of L1 exposure per day, on average
L2_Hr_Day	Proportion of L2 exposure per day, on average
L3_Hr_Day	Proportion of L3 exposure per day, on average
L1_overall	Relative language exposure to L1
L2_overall	Relative language exposure to L2
L3_overall	Relative language exposure to L3

Merging LEAT Variables across Participants

A second workbook titled "Merging LEAT's" contains a button that allows you to concatenate the exposure variables across a series of LEAT's. This data file can be easily exported to any data analysis software if saved as a CSV or TXT file.

For the merge to be successful, all of the LEAT's must have the default title for the summary sheet ("exposure summary"). If an LEAT does not have this sheet, or if the sheet's title is changed, the merging function will run into an error and will not continue to merge the remaining LEAT's.

The merge function is coded as a macro using VBA code in excel. If the file extension for the Merging LEAT's file is changed from .xlsm, the function will be deleted, and you will have to re-download the file. In addition, excel tends to prompt users when a .xlsm file to "enable macros" when the file is first opened. Be sure to select "enable macros" so that the merge function will load.

Upon clicking the merge function, you will be prompted with a reminder message about the title of the LEAT's. By clicking "YES", you will then be asked to select the folder that contains the LEAT's you would like to merge. Click "SAVE" when you have selected the folder. Following this, the macro will automatically open the LEAT's, one by one, that are saved in the selected folder. We recommend that you allow the macro to finish before attempting to run any other process on the computer.

Once the macro is completed, you will see a new, untitled, excel spreadsheet that includes the exposure summary variables across the selected LEAT's. This spreadsheet can now be saved in the location and format of your choice (e.g. .csv) and exported to data-analysis software.

Adding customized variables

Those who are familiar with excel and know how to use VBA code excel's built-in formulas will be happy to know that new variables can easily be created. For example, you might add a variable that tells you in which language Mom speaks the most to the child by adding an additional column to the "exposure summary" sheet. If you decide to add variables, it is important that you ensure that these columns match up across LEAT's when attempting to merge them. Recall that the merge function simply copies the second row of data (from cell A2 to BA2, to be specific) across a series of LEAT's. Therefore, if you attempt to compile LEAT's with different columns, they will not be aligned. Because of this, we suggest that researchers customize the exposure summary sheet as needed prior to creating a series of LEAT's to make the merging process easier.

Below is an image of the form. See DeAnda et al. online supplemental materials for an Excel version.

Language Exposure Assessment Tool (LEAT)

A parent-report scroring tool for measuring language exposure in young infants and children.

DeAnda, Bosch, Poulin-Dubois, Zesiger, & Friend (2016). The Language Exposure Assessment Tool: Quantifying language exposure in infants and children. Journal of Speech Language & Hearing Research.

Participant ID:
Today's Date:
Date of Birth:
Reporter:

age of child in months:	

Primary Input by Person: "Who interacts with <child's name> on a regular basis?" (Regular basis = once per week)

Person	L1 (Primary Language) Dialect/Region		Native?	L2 (Secondary Language) Dialect/Region		Native?	L3 (Tertiary Language) Dialect/Region		Native?	Notes

If using a language that is not Spanish and English use Other1, Other2, Other3, Other4 please specify:

Other1:
Other2:
Other3:
Other4:

Primary Input by Language and Person

Who/Situation	What Ages? from -	to	Sun	Mon	Tues	Wed	Thu	Fri	Sat	Language and Hours per day *L1 & Hours/day*		*L2 & Hours/day*		*L3 & Hours/day*	
			☐	☐	☐	☐	☐	☐	☐						
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			☐	☐	☐	☐	☐	☐	☐						
			☐	☐	☐	☐	☐	☐	☐						

Notes/Trips:

PARENT ESTIMATE	
language	**percent**
Spanish	
English	
0	
0	
0	
0	