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# Manual BILEX (Pylex)

Version 2.0

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# 1 About BILEX

The BILEX assesses monolingual and bilingual children's receptive vocabulary. It is suited for children between 1;6,0 and 4;5,30 years. The dependent variables are children's receptive vocabulary size in the monolingual's language, and in the second language of the bilinguals, the conceptual vocabulary as well as the number of translational equivalents. Currently, there are 36 languages in the BILEX (see Table 6). BILEX works by presenting six distinct images to the child, followed by an audio recording a proficient female native speaker of the respective language naming one of the images. The child's task is to accurately identify and select the corresponding image associated with the spoken word. This approach offers a significant advantage as it eliminates the requirement for the examiner to possess fluency in all languages being assessed by BILEX. For further detailed information on this assessment tool, please refer to Gampe et al., 2018.

## 1.1 Requirements

### 1.1.1 Hardware

To run the BILEX, you will need a laptop with a touchscreen or a tablet running windows or macOS. There is no app running on Android or IOS yet. Requirements for running PsychoPy from the PsychoPy homepage (retrieved on April 26, 2023):

*The minimum requirement for PsychoPy® is a computer with a graphics card that supports OpenGL. Many newer graphics cards will work well. Ideally the graphics card should support OpenGL version 2.0 or higher. Certain visual functions run much faster if OpenGL 2.0 is available, and some require it (e.g. ElementArrayStim).*

*If you already have a computer, you can install PsychoPy® and the Configuration Wizard will auto-detect the card and drivers, and provide more information. It is inexpensive to upgrade most desktop computers to an adequate graphics card. High-end graphics cards can be very expensive but are only needed for very intensive use.*

*Generally NVIDIA and ATI (AMD) graphics chips have higher performance than Intel graphics chips so try and get one of those instead.*

### 1.1.2 Software

The BILEX consists of a Python script made for PsychoPy Version 2022.2.5. You can download it directly from the PsychoPy Website (<https://www.psychopy.org/download.html>). To install the software follow the instructions provided by PsychoPy.

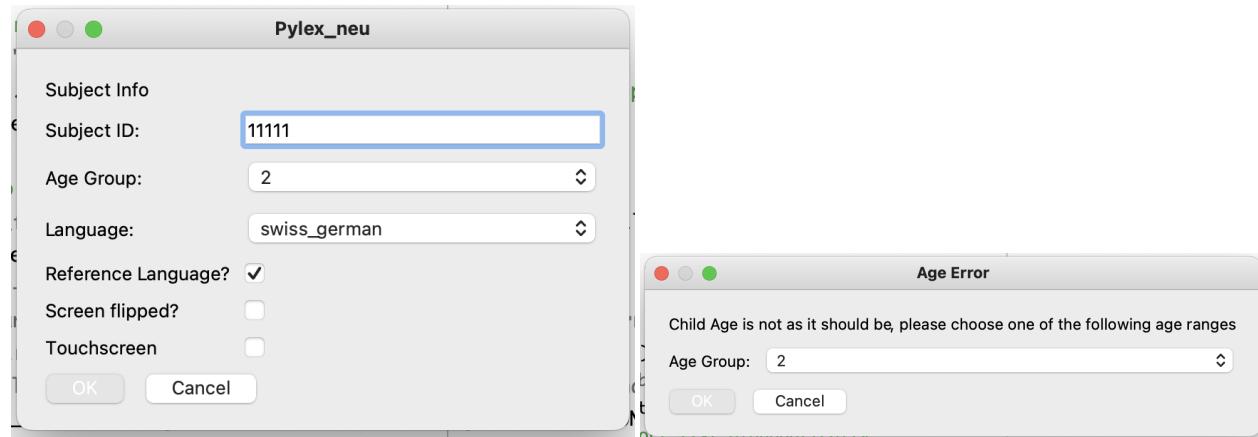
## 2 Run BILEX

To start the experiment, open the python script PyLex\_neu.py in the "PsychoPy Coder". For preparation, in lines 14 and 15 the Child ID (i.e., your subject identifier) and age group can be input. In doing so, you save some time during the experiment and the child does not have to wait. Though it is not necessary and can be done later on, after starting the experiment.

1. To run the experiment click on the "Run Experiment" Button.
2. Input Child ID and select the corresponding age group.
3. Select the language in which the test should be administered (for details see Startup Window).
4. Choose if testing the *reference language* or the *other language* (for details see Startup Window).
5. Choose if the screen should be flipped (turned around by 180 degrees). The default is the flipped screen.
6. Choose if working with a touchscreen or with a mouse. That is, whether the child needs to touch the correct image or click on it with a computer mouse.
7. Press "OK".
8. A white screen will pop up, press right arrow to start experiment.

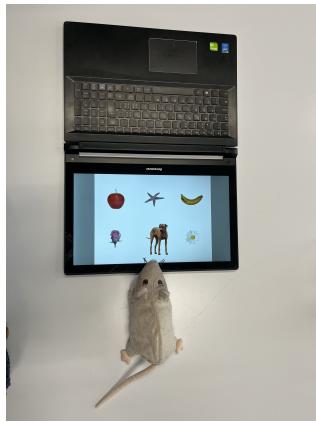
**Figure 1**

*Input Box and Age Error Box*



**Figure 2**

*Screen Flipped*



**Figure 3**

*Screen Not Flipped*



### 2.0.1 Startup Window

In the startup window, you can choose the age version of the BILEX. There are three age groups that can be tested with BILEX:

2 years: 1;6,0 – 2;5,30 (24 trials – reaction window: 12 seconds)

3 years: 2;6,0 – 3;5,30 (48 trials – reaction window: 7 seconds)

4 years: 3;6,0 – 4;5,30 (48 trials – reaction window: 7 seconds)

Choose the language you want to test. Currently, 36 languages are available, see section Adding New Languages for information on how to add further languages.

Furthermore, you can choose the order of trials. If "Reference Language" is ticked, this refers to the version of the monolingual's language. If you want to test the second language of bilinguals, uncheck "Reference Language". In both cases, the same items are tested, however the order of presentation changes. This is useful when testing both, the first and the second language of a child.

You can also select whether the screen should be flipped or not ("Screen flipped?"). In our lab, we work with the flipped screen on touch screen laptops for a simpler setup. See Figures 2 and 3 for reference. It is recommended to use the touchscreen option if working with a flipped screen and the mouse option otherwise (leaving the checkbox unchecked at "Touchscreen").

### 2.0.2 Test Trials

There are two test trials at the beginning (items "apple" and "dog"). A voice will ask the participant to select and touch these two targets using whole sentences ("apple, where is the apple, press on the apple"). Press the right arrow button on the computer keyboard to continue with the next trial (see Table 1). During the test trials, the touchscreen is not activated, meaning the next trial will not appear if the child taps on an image. Within the test trials, the examiner should make sure that the child understands the task and knows

how to select the images. If using a touch screen, children should rest their hands next to the display while listening to the audio cues. Test trials can be repeated by pressing the left arrow on the computer keyboard (see Table 1).

### 2.0.3 Target Trials

After the test trials, the target trials are administered. The target trials will only ask for the target item without a full sentence. The trials will automatically run to the next trial if participants touch the screen or the reaction window has elapsed.

**Table 1**

*List of Keys and Their Functionality*

p	pause
esc	close program/end trial
space	end trial and jump to results
left arrow	repeat trial

## 3 Log Files

Results are saved in two different log files in the log files folder. Both files are tab-delimited.

### 3.1 Quick and Dirty

This log file is named *ChildID\_quickAndDirty\_language*. As the name suggests, it provides a quick overview of the results by the participant. It includes the following information in columns:

<b>timestamp</b>	This is the timestamp of the start of the session.
<b>subject_id</b>	This is the unique subject identifier for each participant that was entered at the beginning of the experiment (i.e., Child ID).
<b>language</b>	This indicates the language, in which the trial was conducted.
<b>randomization</b>	Indicates whether the child was tested in reference language (= std) or other language (= other).
<b>age</b>	Indicates the age window chosen.
<b>correct items</b>	This column indicates the number of correct items.
<b>incorrect items</b>	This column indicates the number of incorrect items.
<b>missed items</b>	Indicates the number of items where no tap was registered (e.g., child did not click on an item before time was up).
<b>percentage correct</b>	This column indicates the percentage of correctly identified items.

<b>total time</b>	This column indicates the total time needed for trial.
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### 3.2 Longer Log File

This log-file is named *ChildID\_language*. It provides more detailed inside to each trial. It includes the following information for each trial:

<b>timestamp</b>	This is the timestamp of the start of the trial.
<b>subject_id</b>	This is the unique subject identifier for each participant that was entered at the beginning of the experiment (i.e., Child ID).
<b>language</b>	This indicates the language, in which the trial was conducted.
<b>randomization</b>	Indicates whether the child was tested in reference language (= std) or other language (= other).
<b>time</b>	This column indicates the time in seconds before the participants taped on an image.
<b>name_image</b>	This variable specifies the filename of the image used in the trial.
<b>ans_correct</b>	This variable indicates whether the participant selected the correct item in the trial. It can take on a value of 0 (= incorrect) or 1 (= correct).
<b>ans_wrong</b>	This variable indicates whether the participant selected an incorrect item in the trial. It can take on a value of 0 (= correct) or 1 (= incorrect).
<b>missed</b>	This variable indicates whether the participant did not select any item in the trial. It can take on a value of 0 (= not missed) or 1 (= missed).
<b>clicked item</b>	This variable indicates the location on the screen where the participant tapped (e.g. ['bottom_left']).
<b>correct item</b>	This variable specifies, which item would have been the correct one to select in the trial (e.g. bottom_left).

## 4 Adding New Languages

If you want to add new languages, please record them and put them into a new folder in the *sound\_files folder*. Please use the .wav format to save them. Please ensure that all files are recorded at a sample rate of 48 kHz, and that prior to adding them to the folder, any extraneous background noise is removed so that only the desired sound is included. You also need to ensure that the file name only has a two-letter code for the language, e.g. Swiss German files are named with "ch\_", such as "ch\_a11". New languages will appear automatically in the drop-down menu on the start window under the name of the respective sound file folder.

## 4.1 Naming the Files

Name your audio files using the following system: 1) two characters indicating the language, 2) underscore, 3) the name of the item you want to add: e.g., *al\_f12.wav*. Please make sure you name each file correctly and that all files are present. If some files are not present, BILEX will not run. For the test trial, there have to be four files present, see Table 4.

## 4.2 Renaming Files Automatically

If you need to rename the files and you recorded them in order, there is a python script doing this automatically for you. The file *rename\_sounds.py* will rename all files in one folder. To use it, create a new folder and place the script within this folder. Create a sub folder with the name of the language you want to add (e.g., German). Inside the language folder, add a folder called *rename* where you place all the sound files you want to rename. Please note that the script only renames the target trial sounds and not the test sounds. The target trial sounds have to be in the order of Table 5. The test trial sounds must not be added to this folder. Before running the python script, in lines 7 and 8, change the name of the subfolder (e.g., German) and the prefix you want to add in front of the sound files (e.g. ge\_). You can now run the python script.

## 4.3 Editing Sound Files

To ensure optimal sound quality, we edit all files using Audacity. When editing the sound files, please remove all background noise, truncate the silence, and improve speech quality if necessary. There are multiple explanation videos on YouTube explaining how this can be achieved. For instance, we use the *Compressor* and *Normalize* functions in Audacity.

# 5 FAQ

### Why were my files not renamed correctly by the *rename\_sounds* script?

Please make sure that the correct number of sounds is present in the *rename* folder. There should be exactly 68 files in the folder. The sounds will only get renamed correctly if the sound files are in alphabetical order (so the first item is a11, the second b11, etc.). Lastly, ensure, that the folder structure is correct. If all else fails, please make sure you are running the Python file correctly and have all Python dependencies installed on your computer, the script uses the Python 3 environment.

### Can I run BILEX on an iPad or Android device?

No. Unfortunately, no PsychoPy Version is supporting this yet. You will need a device running Windows or macOS with a touchscreen.

### **Why does BILEX abort a trial before it was finished?**

Please make sure that all sound or picture files are present. To check, there is a Python script called *check\_files.py*. Running this script will go through all sound and picture files needed for BILEX and check for missing files. It will export a table into two Excel sheets (one for pictures, one for sounds) and files that are missing are indicated in those sheets.

### **Why does BILEX skip over target trials?**

The BILEX is sensitive to touch, though there is a 0.5 ms delay added. It may be that BILEX recognizes a second touch before the intended touch (e.g., the participant remains on screen too long with a finger, the second hand or an elbow touches the touchscreen, etc.). If this is the case, please instruct participants to lift both hands and place them next to the computer.

### **What is the *Run\_BILEX\_blankscreen\_variant* script?**

This script is related to the previous question in the FAQ. If a participant presses the touchscreen for too long, the BILEX skips the following trials. The blank screen variant of the BILEX includes an additional 1.5 second delay after the answer on each trial during which the script is not responding to touch, in case the participants are unable to tap on the items quickly, e.g., due to their young age, it is hard to instruct them.

## 6 Appendix

**Table 4**

*Filename and Content of Test Trials*

<b>apfel</b>	apple	<b>hund</b>	dog
<b>w_i_apfel</b>	where is the apple, tap on the apple	<b>w_i_hund</b>	where is the dog, tap on the dog

**Table 5**

*Filename and Content of Target Trials*

<b>a11</b>	cat	<b>g12</b>	mouth	<b>a22</b>	castle	<b>g31</b>	pelvis
<b>b11</b>	tomato	<b>h12</b>	turtle	<b>b22</b>	lamp	<b>h31</b>	lynx
<b>c11</b>	bus	<b>i12</b>	mug	<b>c22</b>	butterfly	<b>i31</b>	-
<b>d11</b>	lemon	<b>k12</b>	pants	<b>d22</b>	leg	<b>k31</b>	-
<b>e11</b>	table	<b>l12</b>	wasp	<b>e22</b>	tiger	<b>l31</b>	moth
<b>f11</b>	ant	<b>m12</b>	tambourine	<b>f22</b>	arrow	<b>m31</b>	saxophone
<b>g11</b>	arm	<b>a21</b>	church	<b>g22</b>	airplane	<b>a32</b>	pagoda
<b>h11</b>	elephant	<b>b21</b>	chair	<b>h22</b>	undershirt	<b>b32</b>	filig cabinet
<b>i11</b>	fork	<b>c21</b>	spider	<b>i22</b>	duck	<b>c32</b>	termite
<b>k11</b>	shoe	<b>d21</b>	eye	<b>k22</b>	pear	<b>d32</b>	vertebra
<b>l11</b>	fly	<b>e21</b>	horse	<b>l22</b>	hammer	<b>e32</b>	tapir
<b>m11</b>	guitar	<b>f21</b>	sword	<b>m22</b>	giraffe	<b>f32</b>	boomerang
<b>a12</b>	snake	<b>g21</b>	car	<b>a31</b>	platypus	<b>g32</b>	skateboard
<b>b12</b>	onion	<b>h21</b>	socks	<b>b31</b>	leek	<b>h32</b>	clog
<b>c12</b>	boat	<b>i21</b>	rooster	<b>c31</b>	paraglider	<b>i32</b>	kiwi
<b>d12</b>	strawberry	<b>k21</b>	grapes	<b>d31</b>	red currants	<b>k32</b>	-
<b>e12</b>	couch	<b>l21</b>	shovel	<b>e31</b>	lectern	<b>l32</b>	chisel
<b>f12</b>	ladybug	<b>m21</b>	cow	<b>f31</b>	-	<b>m32</b>	armadillo

**Table 6***Languages Included in the BILEX*

Albanian	American English	Aramaic	Bosnian
Brazilian Portuguese	British English	Bulgarian	Cantonese
Colombian Spanish	Croatian	Czech	Danish
Dutch	Finnish	French	Greek
High German	Hungarian	Italian	Japanese
Kurdish	Luxembourg German	Mandarin	Mexican Spanish
Polish	Portuguese	Rhaeto-Romanic Grischun	Rhaeto-Romanic Sursilvan
Romanian	Russian	Serbian	Slovak
Slovene	Sorbsch	Spanish	Swedish
Swiss German	Tamil	Turkish	Ukrainian
Vietnamese			

## References

- Gampe, A., Kurthen, I., & Daum, M. M. (2018). BILEX: A new tool measuring bilingual children's lexicons and translational equivalents [Publisher: SAGE Publications Ltd]. *First Language*, 38(3), 263–283.  
<https://doi.org/10.1177/0142723717736450>