Using the Livescribe Echo® Smartpen for Language Documentation

Reviewed by Michal Temkin Martinez, *Boise State University*

OVERVIEW. This review presents different uses and applications of the Livescribe Echo smartpen for the purposes of language documentation and linguistic fieldwork. Its ability to simultaneously record audio and written notes can assist those working on language documentation and language revitalization. In §1, I provide a brief background of the pen and its basic functions. §2 provides an account of the physical properties of the pen. In §3, I detail the pen's functions, and in §4 and §5, I provide possible applications of the pen for language documentation and language revitalization, respectively. Finally, §6 provides a summary of the review alongside a comparison of the Echo with other Livescribe smart-pens.

1. BACKGROUND. The Echo is one of three smartpens currently available from Livescribe, and is likely the most appropriate for use in language documentation and revitalization. It allows users to simultaneously take notes and record audio, digitize all notes (with synchronized audio), as well as store and back up all notes, play back audio on both the pen and a computer, and search the digital document. To take advantage of all of its features, the pen must be used with specialized paper, as well as proprietary Livescribe software applications, available for free download from the Livescribe website with purchase of the pen.

2. PHYSICAL SPECIFICATIONS. The Livescribe Echo is larger than a regular pen, at 6.22" (15cm) long, and 0.45" (1.14 cm) wide at its tip. The pen weighs 1.3 oz. (37g), which is also slightly heavier than an average pen. Overall, its size and weight may take some getting used to, but they do not make it prohibitive to use the device. The size of the Echo relative to regular pens is illustrated in Figure 1.

Figure 1. Livescribe Echo as compared to other pens

As Figure 2 illustrates, the Echo has a power button, a small OLED display, a microphone and built-in speaker, as well as a micro USB connector and audio jack at its top. Its tip houses a high-speed infrared camera, which enables the tracking of its user's strokes, as well as the synchronization of written text with recorded audio. Notes and recordings are first saved onto the pen's available 2GB of internal memory.
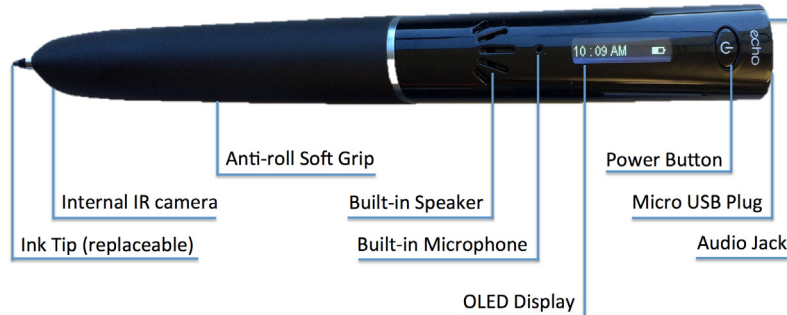

Figure 2. Livescribe Echo and its components

3. GENERAL USES. The Livescribe Echo is marketed as a note-taking tool that allows users to keep an electronic record of all hand-written notes, audio record meetings and events, and play back the audio. It requires the use of specialized Dot Paper, which can be purchased in two spiral notebook sizes (A5 and Letter), a journal, small flip pad, and small (3x5" (7.6x12.7cm) and 3x3" (7.6x7.6cm)) sticky notes. To take notes, users power on the pen and write on the Dot Paper. To record audio while taking notes, users simply tap the pen on the control icons at the bottom of the Dot Paper pages to begin, pause, and stop the recording function. Other icons on the bottom of the page include options for playing back the audio recordings, marking bookmarks on the page, and controlling the general settings of the pen. The control icons from the large spiral notebooks are illustrated in Figure 3. A picture of the full control panel included on the inside cover of spiral notebooks appears in the Appendix.
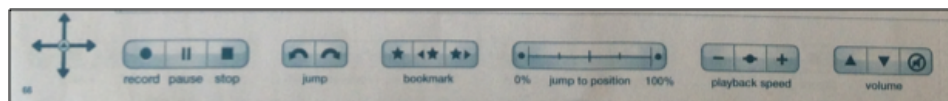

Figure 3. Control icons from the notebook page

Some functions of the pen (e.g., electronic versions of notes, archiving, and the search function) also require the proprietary software application Livescribe Desktop, which can be downloaded for free from the Livescribe website. Text and audio are uploaded to the software application when the pen is connected to the computer through its micro USB connector, and can be converted to a variety of file formats and shared with others using the Livescribe Connect software application by converting the file to a variety of formats which can be viewed and played by anyone.

The micro USB connection also serves as the charger for the pen's non-removable rechargeable lithium battery.

Audio from recordings made with the pen can be played back in multiple ways. In addition to using the Livescribe Desktop application on the computer, and the ability to share files on mobile devices and apps such as Evernote and Google Drive, users can take advantage of the pen's internal speaker and audio jack to access audio directly on the pen. If the user has access to the paper on which the notes were written, a simple tap of the pen tip on the text will begin playing the audio in synchrony with the handwritten notes. Recording sessions can also be accessed without the specific page by using the Paper Replay function on the pen, though users will need to know the date and time that the recording, or 'pencast,' was made in order to access it.

4. POSSIBLE LANGUAGE DOCUMENTATION APPLICATIONS. There are several functions that make the Livescribe Echo ideal for language documentation. The ability to record audio while taking notes is perhaps the most obviously linked to documentation. While the quality of the recording may not be sufficient for archival purposes (due to noise from pen strokes and the recording environment), the recordings are of high enough quality to be extremely useful when reviewing one's field notes using the Paper Replay function.

Paper Replay can also be applied for filling in gaps after a recording session. Instead of having to take copious notes during the elicitation, users can leave intentional blanks or symbols in their notes. Then, when reviewing the notes, they can tap on the text immediately preceding the blank to hear the audio and fill in the rest of the text. Since the Echo will be powered on while they do this, the new text will also appear in the Livescribe Desktop application the next time the pen's contents are uploaded. Unlike text that is synchronized with the audio, which appears as bright green, this new text will appear in black. Paper Replay can also be useful during elicitations when disambiguation is needed. Users can tap on the text from an earlier recording session, or even text from the current session, and the audio will play using the pen's internal speaker.

The Livescribe Echo allows users to write down prompts and ideas ahead of an elicitation session, as one might when using a regular field notebook. Then, while recording during an elicitation, users can make a mark next to the original prompt when saying it so that the recording is synchronized to the prompt. This is illustrated in the Livescribe Desktop screenshot in Figure 4, with the bright green text (both the dot to the left of the English gloss and the text to the right of the gloss) being synchronized with the audio recorded at the time, and the text in black illustrating the text written down ahead of time with no linked audio. The image on the right is a picture of the same page of the physical notebook.
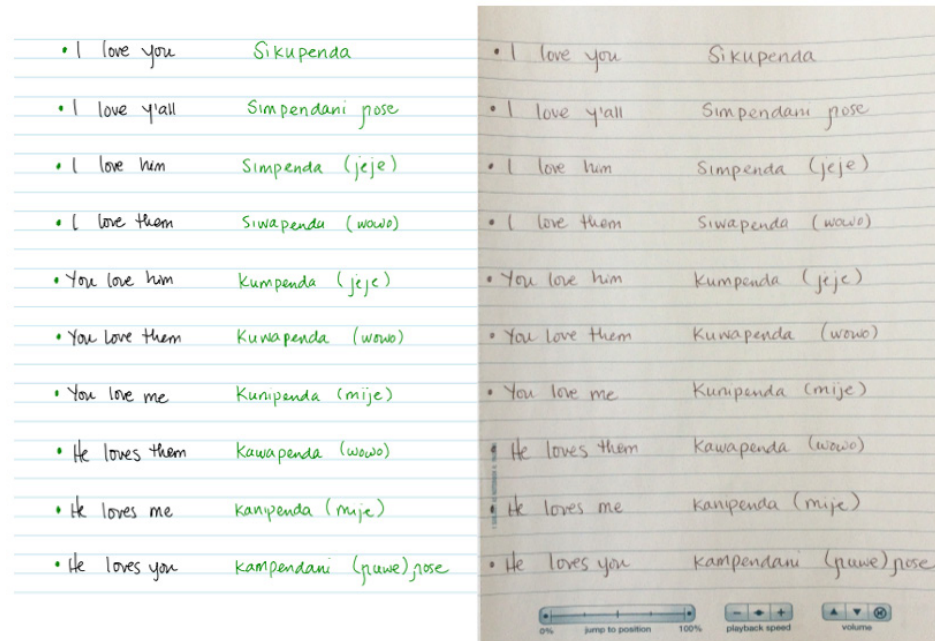
FIGURE 4. Screenshot and picture of notebook page

Unlike traditional field notebooks, the Livescribe Desktop application allows users to store and organize their notebooks electronically, and to search content for specific terms using its handwriting recognition capabilities. All Livescribe notebook paper and Dot Paper is numbered so as to allow users to find notes easily. The screenshot in Figure 5 shows the desktop view of the application. Notebooks are organized by name on the left side, and pages appear in order in the main window. Users may scroll through the pages, zoom in on the page icons to see the text more clearly, and double click on a single page to view it on the full screen and play the audio linked to the page (as shown in Figure 4). The linked audio and notes can be saved as a PDF 'pencast'. A sample PDF pencast can be found at http://scholarspace.manoa.hawaii.edu/bitstream/handle/10125/24604/martinez-2.pdf

Another function available through the desktop application is the ability to search documents for key words. Users can opt to search all pages of a given notebook or search through all of the notebooks and pages that have been uploaded to the application. The software application searches the handwritten notes for key words using a simple text recognition function. While this can be helpful for finding certain words and paradigms, the software is not always accurate in finding all occurrences of the search word(s). Illustrated in yellow highlights in Figure 6 are three iterations of the search function of the software application.
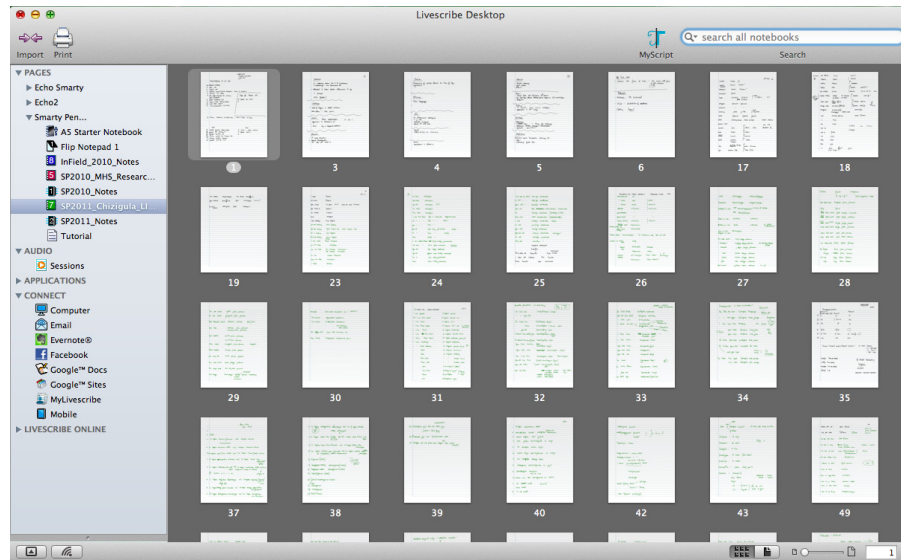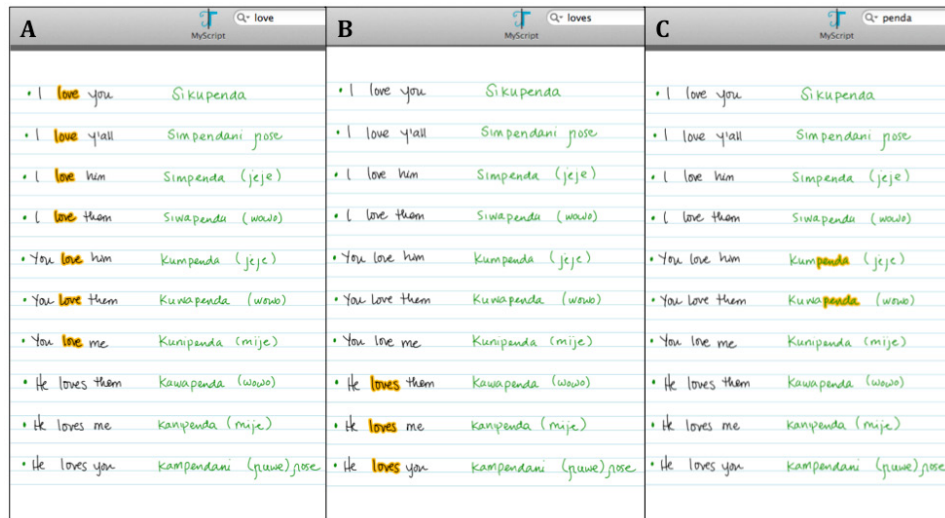
FIGURE 5. Screenshot of notebook view

FIGURE 6. Search function in Livescribe Desktop

In A, the string l-o-v-e (with no spaces following it) only selects instances in which the string appears as a whole word – the four-letter string is not recognized by the software when the letter <s> follows it immediately in the same word. It is not the case, however, that the software fails to recognize the sequence l-o-v-e in the latter instances. This is illustrated in B, where the software recognizes the string l-o-v-e-s when prompted. This seems

to be the case with English words that are recognized by the software application. In C, a search for the non-English string p-e-n-d-a brings up mixed results – with only some of the words containing the string being highlighted in the search. A search of the string m-p-e-n-d-a yields similarly mixed results, as illustrated in Figure 7. This makes the function less helpful when searching for non-English words, even when using the Roman alphabet for transcribing words in a language other than English.
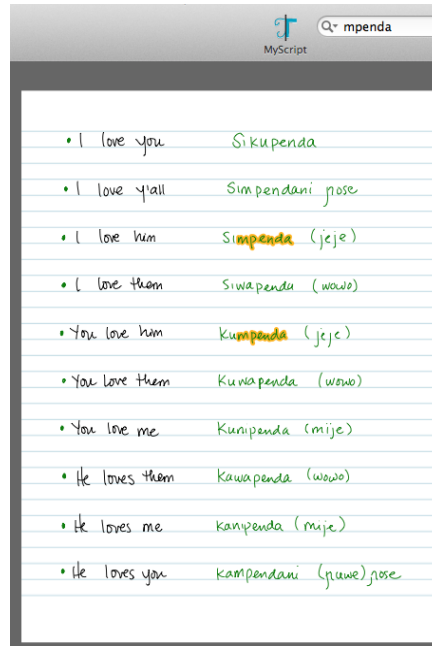

FIGURE **7**. Search results for 'mpenda'

Although most pen functions require writing on paper, the pen can also be used as a recording device without the paper if a recording device is needed in a pinch. The audio quality of these recordings is also higher than those collected while writing, since the pen strokes are audible in the latter. Sample recordings embedded in Figure 8 illustrate the quality of recordings made in noisy and quiet environments. Since the Livescribe Desktop application allows users to convert pencast sessions to other formats, these recordings can be converted to .m4a format through the Connect application included with Livescribe Desktop, and then reformatted to .wav using an audio editing application (such as Audacity).

Audio 1 - Loud environment, high quality recording

Audio 2 - Quiet environment, high quality recording

Audio 3 - Quiet environment, medium quality recording

Audio 4 - Quiet environment, low quality recording

FIGURE 8. Audio illustrations for recording quality

There are two adjustable settings that can affect the quality of the recording: recording quality and microphone sensitivity. The three recording quality levels – high, medium, and low – will determine the amount of memory taken up by the recordings, with the high quality recordings naturally requiring more memory. The two levels available for microphone sensitivity – 'conference room' and 'lecture hall' – can be selected manually, but can also be automatically set based on the noise detected by the pen at the start of recording. As illustrated in Figure 8, recordings made with the high quality setting selected are optimal, allowing the pen to serve as a secondary recording device.

5. POSSIBLE REVITALIZATION AND LANGUAGE TEACHING APPLICATIONS. Since the Echo smartpen allows for recording while writing, one of its uses can be for language teaching and language revitalization efforts. Using the small sticky notes, teachers can write the name of a household item in the language being studied, then record the pronunciation of the item in the target language as well as the students' dominant language. The student can then place the sticky note on the object they believe matches the word, and immediately check whether they are correct by pressing the pen's tip to the word on the sticky note, activating the audio associated with the written word. This can also be done with pre-recorded audio, as illustrated in the sticky note in Figure 9 with 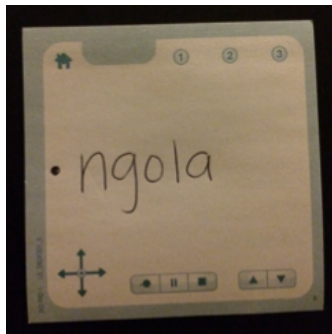the word for 'knife'. A pencast PDF can be found at http://scholarspace.manoa.hawaii.edu/bitstream/handle/10125/24604/martinez-3.pdf.

FIGURE 9. Sticky note

6. COMPARISON TO OTHER LIVESCRIBE SMARTPENS. There are currently three smartpens sold and supported by Livescribe: the Echo, Sky, and Livescribe 3. The Echo is likely the most well suited for fieldwork, as it allows for direct synchronization with a computer, allows for immediate playback of audio using the pen and notebook, and the software allows for exporting into several formats, including Evernote and Google Docs, in addition to the .m4a audio pencasts. Below are brief descriptions of the other two pens and the challenges they pose for fieldwork.

The Livescribe Sky is identical in shape, dimensions, and weight to the Echo. Unlike the Echo, the Sky synchronizes wirelessly through its internal Wi-Fi. Although there are provisional ways to synchronize the pen with a computer when Wi-Fi is not available, it is not as seamless as it is for the Echo. The Sky utilizes Evernote as its platform in lieu of the Livescribe Desktop application, which may be a drawback for its use for linguistic fieldwork. Although Evernote is able to synchronize across devices and operating systems, playback of the audio using the Evernote app requires an internet connection.

The Livescribe 3 is the newest in the lineup and represents a major shift in the interior and exterior design, as well as the platform. Unlike the Echo and Sky, the Livescribe 3 does not have internal memory dedicated for audio recordings, nor does it have built-in audio input or output. That is, the pen relies on a Bluetooth connection to an iOS device (and the installation of the Livescribe+ app) during recording sessions in order to record or play audio. This reliance on an additional device, as well as the inability to play audio without the device, makes it less appealing for fieldwork. A comparison chart of the three pens appears in Figure 10.

	Echo	**Sky**	**Livescribe 3**
Transferring notes	USB	USB/wifi	Bluetooth
Platforms	Mac/Windows	Evernote	iOS 7
Software	Livescribe Desktop	Evernote	Livescribe+ App
Search function	✓	✓	✓
Microphone	✓	✓	✗
Speaker/headphones	✓	✓	✗
Direct sharing to Evernote and email	✓	✓	✓
Exportable audio	✓	✓	✗
Record through iOS	✗	✗	✓

FIGURE 10. Comparison Chart for all Livescribe smartpens

7. REVIEW SUMMARY AND COMPARISON TO OTHER LIVESCRIBE SMARTPENS. Overall, this review of the Echo is favorable. I have personally found it relatively intuitive and extremely helpful to use the pen for language documentation. At just under $120, the 2GB pen comes with the micro USB, a starter notebook, two ink cartridges, as well as the

Livescribe Desktop application and 500MB of online storage. Notebook prices are: $25 for a set of two journals (100 sheets, 5.5x8.25"), $20 for a set of four A5 spiral notebooks (80 sheets, 5.8x8.3"), $25 for a set of four Letter-size spiral notebooks (100 sheets, 8.5x11"), $9 for a three-subject Letter-size spiral notebook, and $13 for a six-pack of sticky notes (450 total notes, 225 3x3" and 225 3x5"). A summary of the weaknesses and strengths of the Livescribe Echo is offered below.

Weaknesses:
- Larger and heavier than many standard pens, which may require getting used to.
- Proprietary software.
- Special paper and notebooks.
- Pen stroke noise in audio recordings.
- Search function is limited and not always accurate.

Strengths:
- Allows users to record audio and take notes simultaneously, synchronizing notes with audio.
- Variety of paper sizes and notebook formats.
- Keeps backup copy of notebook in case of loss/damage.
- Audio playback is available through the pen and on a computer.
- Audio quality (on 'high' setting) is sufficient as backup recording, especially when no notes are taken during recording.
- Backup and archive field notebooks.
- Search function allows user to search through all notebooks.

Michal Temkin Martinez
michaltmartinez@boisestate.edu

APPENDIX

PEN FUNCTION MENU:
1. PAPER REPLAY: allows user to play audio from different recording sessions without having the specific notebook or the computer present. Must know the date and time for the session.
2. CONNECT: allows user to send Livescribe sessions to a variety of electronic formats. Includes Google Docs and Sites, email, Evernote, Facebook, and MyLivescribe, PDF, iPhone, iPad.
3. SHORTCUT BUTTONS: allows user to assign any application or function to a printed buttons.
4. SETTINGS: (can also be accessed more quickly on front cover of notebooks)
    a. RECORDING QUALITY: low, medium, high
    b. MICROPHONE SENSITIVITY: conference room, lecture hall, automatic
    c. PLAYBACK LATENCY: on, off
    d. MENU VOICE: on, off
    e. DISPLAY BRIGHTNESS: % intervals (good for when you may not want speaker to be distracted by OLED display)
    f. SCROLL SPEED:
    g. DISPLAY ORIENTATION: allows left-handed users to see text displayed naturally
    h. DATE and TIME FORMAT:
    i. LAUNCH LINE: on/off
    j. AUTO-OFF TIME: 30 minutes, or 1, 2, 4 hours to save battery life.
    k. SMARTPEN NAME: Especially useful if multiple users or pens are used for the same project
    l. LOCALE: languages to be used: English, Spanish, French, German, Italian, Chinese, Korean, Malay, Turkish, Dutch, Arabic, Portuguese

CONTROL PANEL ON FRONT OF NOTEBOOK