E-learning Design Principles

Project

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INTRODUCTION

Overview

The project will be designing an e-learning system for language learning. The focus of the learning resource will be to teach people the basics of how to communicate orally in Spanish.

The user

The system is designed for English-speaking students and professionals ages 15-40 that have some experience with technology and are already motivated to master a foreign language, but don't know where to start or cannot afford a private teacher. The system will be especially tailored to people with little to no prior experience in Spanish. The idea is to prioritize pronunciation skills and build vocabulary from the ground up.

Learning challenges

Some people think that learning a language is a hard and frustrating experience because they think they have to learn all the rules and study a lot of words before they are able to have a very basic conversation.

Long-term retention is also a challenge: many people have studied languages in high school and are not able to speak it now because the instruction's emphasis was not placed on fostering conversation and communication, which is what language is for, but on memorization of words and grammar rules, which has faded away with inactivity. We hypothesize that by focusing initial instruction on pronunciation skills, learners will be more engaged during the language learning process, and as a result will be able to achieve longer-term retention of the material.

This system will take a motivated individual and boost his/her confidence little by little, pushing him to speak from day one so that he can integrate what he has learned in common, real-world situations. Making mistakes (but getting progressively better) will be encouraged, because in my experience people learn faster by struggling a little and getting out of their comfort zone than by waiting until they finally have "enough" competence in the language to engage native speakers.

Concepts, skills and dispositions

Skills

- Learning the different sounds of Spanish by demonstrating the correct pronunciation both in English words and Spanish words (e.g. the 'a' in "father" is the same as the 'a' used in "casa"). The system will have the students self-assess their pronunciation by comparing their own recordings of words with an expert's. The idea is to minimize the "embarrassment factor" from the very first day.

Concepts

- Building a base vocabulary list of the most frequently used words. John Bauman's General Service List (http://jbauman.com/gsl.html) is an example for learners of English. The most frequently used Spanish words should not be very different from the English list, but more research could be done to confirm that this is the case.
- Incorporating some bits of cultural knowledge in the course. For example, teaching Latin American colloquial expressions, talking about the Catholic Church and the social phenomena surrounding it, etc. The student may find it more motivating to communicate with the native speakers if they know more about them.

Dispositions

- Fostering and maintaining a positive attitude towards language learning, especially towards communication.

Importance of learning in this domain

Learning a language greatly contributes on understanding other people's cultures and behaviors. It can enable people to engage in meaningful experiences with other people from all over the world. It can broaden people's personalities and perspectives. It can provide people with a career boost if they're looking for an experience abroad and/or with a foreign company.

Where will learning occur?

This e-learning system is meant to be used from home, through the Web, ideally on a touch device that has better overall usability than a computer. In the information age, location isn't critical to learning the basics of a language: practice by videoconferencing with native speakers from all over the world will be encouraged by the system.

When will learning occur?

Students will use the system on their own schedule. However, the plan is to keep people engaged and enable them to form the habit of taking the lessons and practicing daily. This would entail reminding the user to practice through notifications and emails.

The course will take advantage of spaced repetition techniques to help the learner retain and memorize sounds and vocabulary effectively. It's possible to take advantage of the FaCT system (http://optimallearning.org/frequently-asked-questions.html), developed by a postdoctoral researcher at LearnLab, with which *in vivo* experiments have been conducted for foreign language vocabulary practice.

The course will last 2 months if used daily for half an hour, which would be around 30 hours of instruction. Spanish has the same alphabet and is similar enough to English for its basics to be taught in this time span. The goal of the system is not to take the learner to fluency, but to provide familiarity with the language and motivate the learners to keep going on their own.

After this period, learners will be encouraged to do some guided discovery learning, in which the system will prompt them to watch TV shows, read books and talking to people using language practicing networks like Verbling, Italki and Busuu.

Experience in the project domain

As a student, I've learned two languages, English and Swedish, by applying some of these techniques, emphasizing speaking and not being ashamed of making mistakes. I'm currently learning Portuguese this way.

As a teacher, I've done language exchanges with Swedish-speaking people trying to learn Spanish. I have found it's generally easy to detect and provide immediate feedback for pronunciation mistakes, but Spanish grammar is very challenging and requires more time to study.

As an expert, I am a native Spanish speaker and will be able to design most of the exercises as well as engage in prescriptive forms of cognitive task analysis.

Readings

- Dlaska, Andrea, and Christian Krekeler. "**Self-assessment of Pronunciation**." <http://www.sciencedirect.com/science/article/pii/S0346251X08000602>.
  This study supports the possibility of self-assessing pronunciation performance. Even though it was performed on advanced level learners, Spanish is less phonetically challenging for English speakers, since they can already produce most of the sounds. For this reason, I believe self-assessment might work for this project, even for beginners.
- Yongqui Gu, Peter. **"Vocabulary Learning in a Second Language: Person, Task, Context and Strategies."** <http://tesl-ej.org/ej26/a4.html>.

This paper gives an overview of practical strategies based on four different elements (person, task, context and strategies) that are important to consider on how people learn vocabulary.

- Saniei, Andisheh. **"Developing Cultural Awareness in Language Instructional Materials."** <http://www.ipedr.com/vol33/003-ICLMC2012-L00008.pdf>.
  This article reviews some ways to include cultural content in a language-learning curriculum.

Educational standards

The most widely known standard for language learning is the Common European Network of Reference for Languages. The *Instituto Cervantes*, a non-profit created by the government of Spain that is the largest organization for teaching Spanish, has built a full curriculum based on the European standard (and divided in expertise levels) that is available at http://cvc.cervantes.es/ensenanza/biblioteca_ele/plan_curricular/indice.htm.

I have found Washington State's K-12 World Languages Learning Standards to be focused on communication and culture, which are ideas central to this project. The document is not very detailed and only states general principles, but it may be helpful to define the scope of the cultural content of this e-learning system.

Project consultants

I got in touch with Severin Hacker, co-founder of Duolingo, and he's happy to give me some feedback on the project, which I think will be valuable because of his industry experience. I also talked with Brian MacWhinney, an expert in language acquisition that has recently done research on second-language learning, and he gave me a brief overview of how challenging phonology can be, even for a language like Spanish.

Educational materials that have been designed to teach this domain

- **Duolingo**
  It's a very popular e-learning system in which the student can build knowledge of words and grammar rules very quickly. It is not very speaking-oriented, so it might be more difficult to transfer the skills learned here to real-world conversation.
- **The Language Hacking Guide by Benny Lewis**
  A set of very informal tips that are very useful to develop the right mindset to learning a language: making mistakes is okay, practice speaking from the very first day.

- **Learning with Texts (http://lwt.sourceforge.net)**
  It's a very useful tool to practice vocabulary within a context. The basic idea is that users read articles with some challenging words and form relationships between the learned words and the new words to learn faster. Combining this with spaced repetition could yield very good results.
- **Traditional learning textbooks**, such as Rivstart for learning Swedish.
  They're useful for language learning, but sometimes they feel a little bit too formal. Motivated learners usually go beyond what's in the textbook to learn faster.

Other references

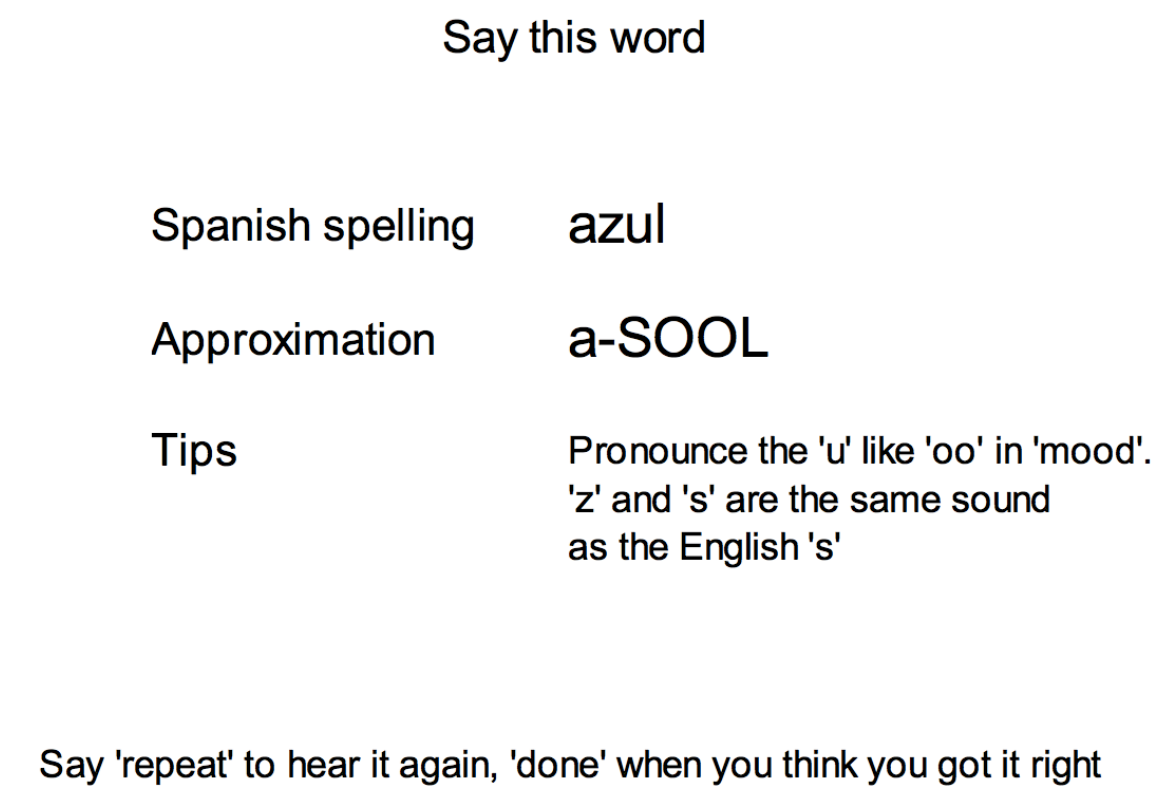
Benny Lewis's website:
http://fluentin3months.com
Gabriel Wyner's language learning tips:
http://lifehacker.com/5903288/i-learned-to-speak-four-languages-in-a-few-years-heres-how
Base vocabulary list for any language:
http://www.towerofbabelfish.com/the-method/vocabulary/base-vocabulary-list/

BENCHMARK TASKS

For this iteration, we explored three different variations of a task that taught the basic sounds of Spanish, and two assessment tasks: sound transcription and reading aloud. From all the possible pairings of input and output, they seemed most likely to support the learning of pronunciation and the understanding of sounds in the foreign language.

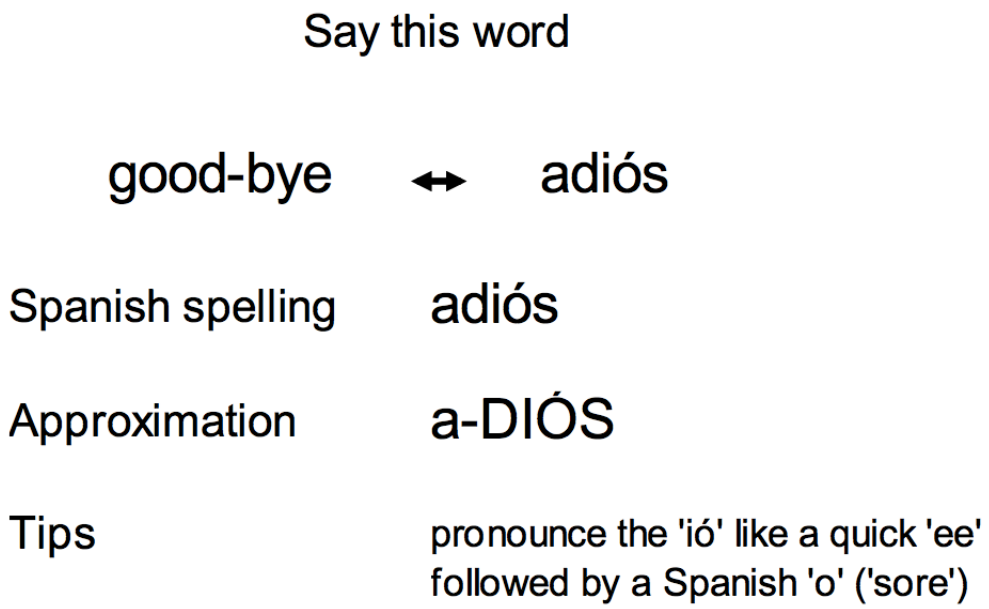
Task 1: Just pronunciation

The first teaching task presents the correct Spanish spelling, an approximation of the word in English sounds, and pronunciation tips for getting every sound right. As this information is presented, the correct pronunciation of the word is spoken aloud so that the user can emulate the native speaker. The student is then asked to repeat the word and self-assess his performance.



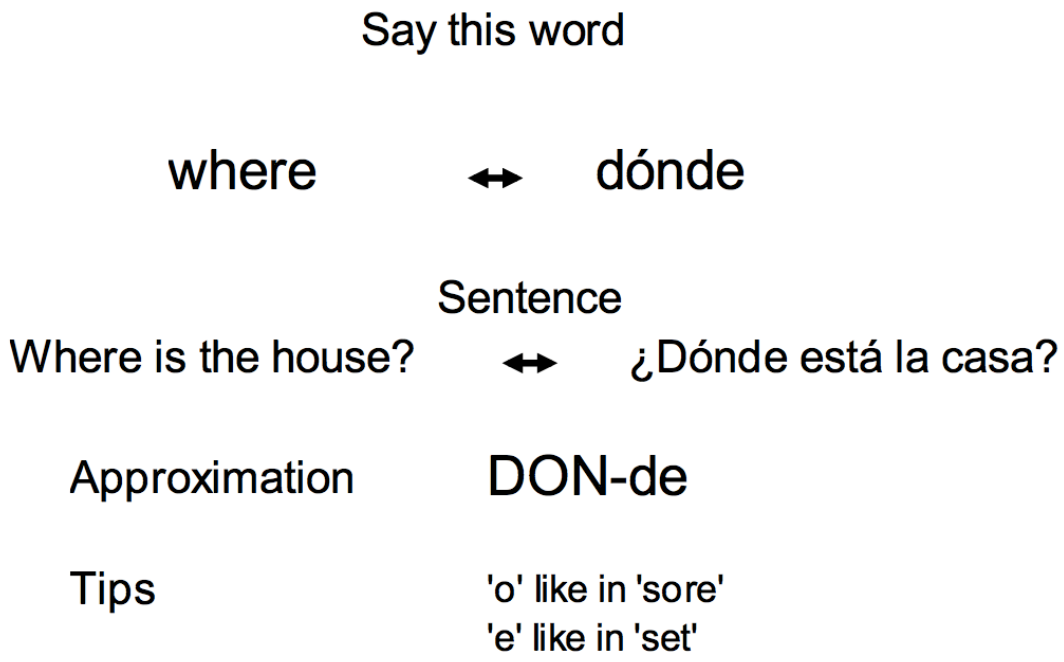
Task 2: Pronunciation with translations (sensemaking)

A slight variation of Task 1 was made to include an English translation of the current word. This might lead students to a better performance, since they can connect the word with something they already know in their language and thus presumably become more motivated in completing the lesson (hypothesis #1). A low-fidelity mockup is shown below.

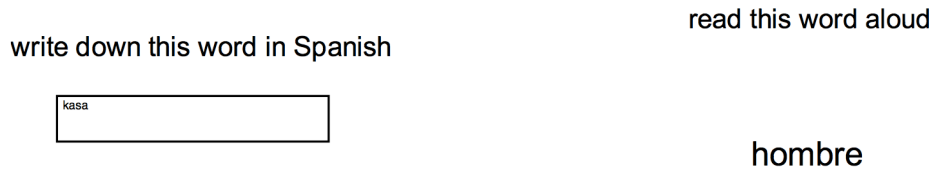


Task 3: Pronunciation with translations and reference sentences

Yet another slight change was made to include the usage of the word within a larger context, i.e., a sentence. Hypothesis #2 is that including a sentence will motivate students even further to continue learning the language, because they can presumably relate to this basic unit of action more than they relate to isolated words. This change is illustrated below.



The two assessment tasks are basic: **Task 4 - Transcribing words and Task 5 - Reading words aloud**. A low-fidelity mockup is shown below.



The three variations of the learning task can be paired up with a sequence of both assessment tasks during think-alouds so that performance data is collected and the student may give its opinion about the different variations.

RATIONAL COGNITIVE TASK ANALYSIS

Task 1: Just pronunciation

Hear the sound uttered by the native speaker

IF the word is encountered for the first time, read the approximation carefully

IF the approximation is unclear, read the pronunciation tips carefully

Try to emulate the speaker, syllable by syllable

IF you think your pronunciation wasn't good enough, try again

Task 2: Pronunciation with translations (sense-making)

Hear the sound uttered by the native speaker

Notice the written English word that is shown, try to associate it with the new Spanish word

IF the word is encountered for the first time, read the approximation carefully

IF the approximation is unclear, read the pronunciation tips carefully

Try to emulate the speaker, syllable by syllable

IF you think your pronunciation wasn't good enough, try again

Task 3: Pronunciation with translations and reference sentences

Hear the sound uttered by the native speaker

Notice the written English word that is shown, try to associate it with the new Spanish word

Read the English sentence and try to associate it with the Spanish translation

IF the word is encountered for the first time, read the approximation carefully

IF the approximation is unclear, read the pronunciation tips carefully

Try to emulate the speaker, syllable by syllable

IF you think your pronunciation wasn't good enough, try again

Task 4: Transcribing words

Hear the word uttered by the native speaker and try to recall its spelling

IF the sounds you heard don't make sense, ask for a repetition

IF you think you remember the spelling, write it down

Task 5: Reading words aloud

Read the word, remember the different pronunciation rules that apply

Pronounce the word

IF you think your pronunciation wasn't as close to what you remember the correct pronunciation to be, try again

Kinds of learning goals

	Cognitive	Metacognitive (thinking about the thinking/ knowledge)
Concepts (Declarative)	- Basic vocabulary: phrases like “hola”, nouns like “hombre”, adjectives like “grande”. - Relationship between written and spoken language - Recognizing pronunciation rules, like “the h is silent”	- Conjuring images as mnemonics when trying to recall adjectives, particularly when comparing two opposite adjectives
Skills (Procedural)	- Pronouncing the basic phonemes (‘a’, ‘ca’, etc.) - Listening comprehension - Pronunciation of stressed syllables - Mimicking the correct pace of words in sentences in spoken language	- How to deal with pronunciation when there’s no close English approximation
Dispositions/Attitudes	Acquiring confidence in basic pronunciation skills to continue instruction and become more motivated in vocabulary learning, grammar and other components of a full Spanish curriculum	

EMPIRICAL COGNITIVE TASK ANALYSIS

Think-alouds

Three think-alouds were conducted. Every participant experienced three different variations of a learning task (tasks 1, 2 and 3), and had his performance assessed through tasks 4 and 5. Different words were used to avoid interference. Thus, the full list of steps for every think-aloud was:

1. Learn “hola”, “casa”, “hombre”, “grande”, and “azul” (via Task 1, pure pronunciation)
2. Transcribe the words from step 1
3. Read the words from step 4 aloud

4. Learn “adiós”, “calle”, “mujer”, “flaco”, and “verde” (via Task 2, pronunciation and translation)
5. Transcribe the words from step 4
6. Read the words from step 4 aloud
7. Learn “dónde”, “gato”, “ancho”, “auto”, and “morado” (via Task 3, pronunciation, translation and sentences)
8. Transcribe the words in the line above
9. Read these words aloud

These think-alouds were audio-recorded, and a short informal interview with each participant was carried out after their experience. The most important observations are presented below.

Participant 1: female, 20-25 years old, native English speaker, American, almost no previous Spanish exposure (only elementary school courses)

- She was not always following or reading the tips. For example, she said “hom-bray” instead of the suggested “e as in set” pronunciation, and “fla-ckow” instead of the suggested “o as in sore” pronunciation. This result may suggest that the course to go slower in the beginning, maybe down to the phoneme level instead of the word level.
- Her spelling on Task 4 was flawless. Maybe because of her distant Spanish background?
- Very English-like pronunciation of the “soft r” and “ll/y” sounds that are very common in Spanish: “grande”, “calle”. Making it sound more Spanish-like may be a challenge, because the sound doesn’t exist in English. I will look in more detail into this in future steps, reviewing research by McClellan et al. and discussing the findings of a recent interview I had with Carmen Martínez, a Spanish professor at Carnegie Mellon with eight years of experience who is also doing a PhD at the University of Pittsburgh.
- When she saw the sentences on the third part, she immediately said “I don’t know how useful that is”. She didn’t read most of the sentences, but focused on the words. This may be due to the way the information is presented in our rough interface, all at once and not interactively.
- She really “enjoyed” having the pronunciation exercises with the translations (Task 2). She thought it was helpful.

Participant 2: male, 20-25 years old, native English speaker, Indian, no previous Spanish exposure

- He had no trouble pronouncing most of the words. He said that in Hindi there are similar sounds, and it’s very easy for him to replicate them. He effectively ignored all the pronunciation tips and dedicated just to emulate the sounds the native speaker was making.

- Spelling was really difficult for him. Since one of the most prominent areas of the “interface” was the approximate pronunciation, it seems to be what stuck with him the most and frequently wrote the words with a phonetic spelling (“ola”, “asool”, “kaja”, “muher”, “flacko”). Does this cause extraneous interference? This is something I will test further with slightly longer user studies in the more refined prototypes. Perhaps changing the visual design to help the learner focus on the correct spelling, or gradually fading out the pronunciation tips, would help.
- He really liked the sentences (Task 3). He could read them quickly, and even laughed out loud when he read, “the man is purple”. He suggested it could be a good idea to make memorable sentences like that a part of the e-learning system: according to his self-reflection the funny, uncommon sentence made him remember the sounds more.
- When reading aloud he forgot some of pronunciation rules, even though he could physically utter the sounds (e.g. he pronounced “calle” as “kale”).

Participant 3: male, 25-30 years old, native English speaker, Indian, no previous Spanish exposure
- Like the previous participant, he wrote down the phonetic spelling instead of the correct Spanish spelling.
- He had no trouble in remembering the “h” was silent because he was emulating my pronunciation, however, he did not read the tips and thought there was too much information being presented at a single time. He wanted to move on quickly through the tasks, so he ignored the pronunciation advice. Just repeating the native speaker’s pronunciation can become a crutch for the user, and he feels that the system should “make people linger on a word for a longer time”, perhaps by not providing the audio right away but letting him give it a shot to pronouncing the word just with the tips first.
- He believes that in Spanish syllable emphasis is important, and it could be made clearer that the capitalization of a syllable in the approximation (like in a-SOOL) means that syllable is stressed. Color can also be used to highlight the dominant syllable.
- He couldn’t focus on my spoken words and the text at the same time, and he paid more attention to my voice because it was easier for him to emulate, being a Hindi speaker.
- He also found himself more engaged when he was presented with the translation of the words in comparison to when he had to replicate the bare sounds. He feels an alternative to the translations could be an image that represents the concept. He suggested including memorable images to serve as mnemonic cues for vocabulary acquisition.

Interviews

Participant 4: male, 25-30 years old, native English speaker, Thai heritage, 5 years of Spanish in High School

We gave this participant an overview of the hypotheses that we were trying to test, and asked for his opinion and remarks based on his Spanish learning experience. He said it's an interesting idea to focus on pronunciation at first, because the reason why he didn't speak it further after High School was mainly that he was not comfortable with his pronunciation and didn't want to practice speaking with natives, even though he had knowledge of Spanish vocabulary. He said the other main reason why he didn't speak it often was grammar: he was afraid of speaking it wrong.

One suggestion that this participant made was to also demonstrate how an English-only speaker would first utter the sounds, and progressively change the pronunciation to be closer and closer to the true Spanish sounds. This could cause interference and potentially get the student to make wrong first associations between the Spanish spelling and the English-like pronunciation instead of the correct one, but is an interesting direction to perform testing on.

He also suggested to start the course with the alphabet, so the learner can get a high-level overview of the range of possible pronunciations.

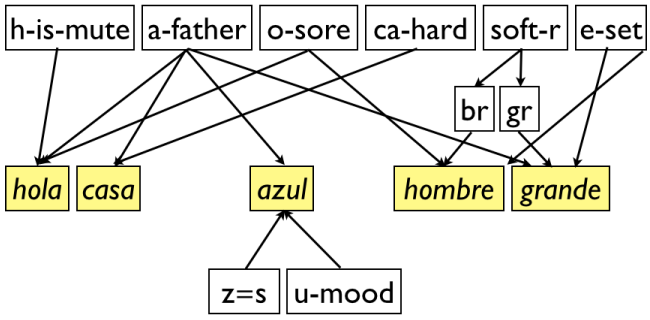
Participant 5: female, 20-25 years old, native English speaker, Chinese heritage, lifelong language learner and enthusiast, some Spanish in High School

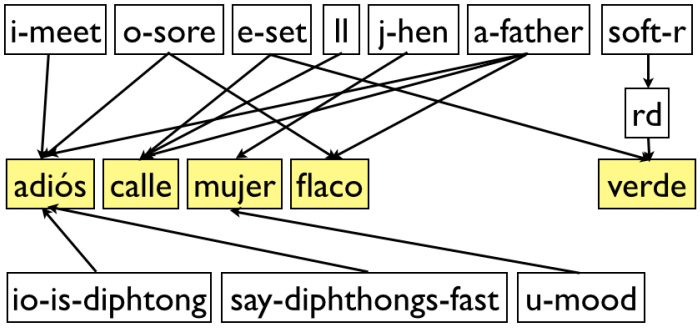
She had a good experience in her German class, where the teacher continuously gave the students pronunciation lessons in parallel with learning grammar. She pointed out that "if you don't have any grammar, you don't have much to say". If we followed a similar methodology in this e-learning system, we could begin with verbs and other grammatical components at a very basic level (with minimal conjugation), but still emphasize pronunciation so that the students can make sense of what they're saying and feel that it's more useful for real-life conversations.

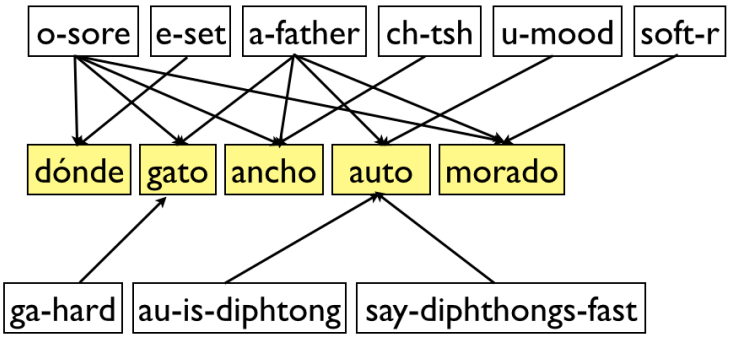
COGNITIVE MODEL SPECIFICATION

The cognitive model will be represented as a goal tree. There are some basic knowledge components that every student is known to already possess as a native English speaker, for example, how to pronounce the "l" letter or the hard "c" sound. These are not included in the cognitive model. For greater readability, three visual goal trees will be presented. Some of the knowledge components will be overlapping. They could be merged onto one, but it would be very difficult to visualize the relationship between the various knowledge components because of space constraints. The tasks are filled in yellow, while the KCs have a white background.

Vocabulary acquisition and sentence translations are two goals that are beyond the scope of this e-learning system; they are only explored because we are studying if they can help with student motivation in pronunciation tasks. Therefore, their KCs will not be included in the goal tree.







The conditions for applying these skills are that the student is familiar enough with English phonology to focus on the differences between English and Spanish rather than starting to study sounds from scratch, and that the student is motivated to continue performing the task.

The rational cognitive task analysis I performed earlier predicted that the learner would have to build on simpler phonemes to be able to utter the more complex sounds, e.g. the combination of the "soft r" and "rd" KCs to perform the task "verde". What it did not predict was that different learners have different starting knowledge depending on the languages they already speak and their previous exposure to Spanish, so they behave differently in regards to pronunciation tips: speakers of American English seem to follow the pronunciation advice because they're unable to mimic the native Spanish speaker on the first trial, while Hindi speakers can safely ignore the advice to get through the lessons more quickly. Something else that was not predicted by the rational CTA was, for example, the knowledge that "au" is a diphthong and both vowels should be pronounced: English speakers usually merge them together into a single sound. This was an expert blindness on my part, and the empirical CTA was very helpful in uncovering it.

ASSESSMENT DESIGN

In the interview I had with Carmen Martínez, she strongly suggested me to include an introduction to the pronunciation of each letter, starting with the vowels, as a first task. This idea was echoed by my classmates during peer review. Since the phonetic KCs in Spanish are mostly

constant-constant (e.g., the ‘a’ always has the same sound, and there are only a few exceptions to this), it may be desirable to treat these lessons like memorization exercises, making use of spaced repetition. These tasks would include both the pronunciation tip and the native Speaker recording to help students reconcile the two.

After this introduction, the students will be presented with the existing benchmark learning tasks. The words will be presented on the screen with their English translation (Task 2), because learners in the user study generally agreed that learning just sounds for an extended period of time is dull, and active engagement is key to instructional design, as we have seen that the receptive model of how people learn is not accurate. The refined version of Task 2 is presented below:

This task (from now on called 2a) gives the student the correct pronunciation of the word in a spoken form, and he can request pronunciation tips if needed. An alternative version of this task that gives the student pronunciation tips but no spoken words by default (task 2b) will also be prototyped and incorporated into the design to test its viability. After the learner is done, the screen will briefly show a picture that illustrates the current word, in a manner consistent to the Multimedia Principle.

hola (hello)

Thus, the overall strategy is to teach the basic sounds of Spanish first and then teach combinations of these sounds using basic vocabulary. A typical run through a learning unit would look like this:

1. Sounds learning task: “a”, “o”, “u”, “c”, “f”, “l”, “z”, “n”, “ch”
2. Pronunciation learning by repetition or tips
    a. Repeat the words: “hola”, “azul”, “flaco”
    b. Pronounce the words using tips: “casa”, “ancho”
3. Pronunciation assessment task: “hola”, “azul”, “casa”, “flaco”, “ancho”, “no”, “azul”, “luz”, “cana”, “choza”.
4. Transcription assessment task: “casa”, “azul”, “flaco”, “no”, “cana”, “choza”, “luz”.

The first learning task will not include any formal assessment, but the student will be encouraged to try to emulate the sounds to the best of his ability.

Task 2 will be self-assessed: he will try to repeat the word, or pronounce it using the tips, for as long as he wants, with multiple trials if necessary, and signal to the computer when he’s satisfied with his pronunciation. The time it has taken him to achieve “mastery” will be recorded. Tasks 2a and 2b will be interleaved, so in one session the student will have to repeat some of the words and recall how to pronounce other words using tips. On a previous step, these two tasks were combined into one, but the think-alouds showed that the student typically focuses her primary attention to either the voice or the tips.

Task 3 is similar to Task 2, but it will give the learner only two opportunities to record himself and compare his pronunciation to the native speaker, then decide if he got it right or not.

Task 4 will be the same "transcribing words" task described in the original benchmark tasks used for the empirical CTA: students will be asked to recognize and type the word they're hearing from a recording of a native speaker.

An end-of-unit test will incorporate tasks 3 and 4 with knowledge components drawn from the knowledge base of the student (i.e., including words from previous units and new words that combine KCs from different units). I think this is feasible because the variety of sounds is manageable: Spanish has only 24 phonemes.

INSTRUCTIONAL DESIGN

Multimedia Principle

The Multimedia Principle consists of including both images and text in the learning activities. It will be applied on Task 2 by providing a visual that complements the word to reinforce the real-world mapping required to learn new vocabulary words. This will only be done with nouns, in order to keep the visuals simple. A more extensive Spanish learning system that has to teach grammar concepts will find this principle harder to apply for more abstract nouns, adverbs, and verbs. In this simple system, it is expected that using the Multimedia Principles will enhance vocabulary learning (although this is not the focus of the course) and have noticeable effects on pronunciation, a hypothesis that should be tested.

As shown in the previous section with the "hola" task example, the visual will be presented after the learner is done pronouncing the word, not simultaneously, to not incur in a cognitive overload of presenting two pieces of text in different languages and an image at the same time.

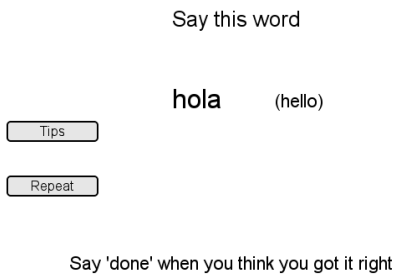
Modality Principle

The modality principle generally suggests presenting words as speech rather than on-screen text, especially when including visuals and animations. However, the Clark & Mayer book also suggests that this principle loses validity when:

(a) the learner has control over the pacing of the material, and

(b) when there is value in keeping words available to the learner: e.g. when they are not in the learner's native language.

Both of these reasons apply here. Let's look at Task 2 again as an example:



The words are spoken aloud, but still left as a reference to the learner. The student can also repeat the audio recording and decide when the task is over, so there are good reasons to consider this as an exception to the Modality Principle.

Segmenting and Pretraining Principle

The "pretraining" part of this principle states that instruction is more effective when students know a few key concepts that they'll be building on for the rest of the instruction. The case for making a pretraining exercise in pronunciation exercises is very strong, as a few basic sounds (phonemes) can be used as building blocks for pronouncing any Spanish word.

I revised the benchmark tasks to include pretraining exercises with the basic sounds of Spanish, based on feedback from others. An example task to teach the "a" sound would look like this:

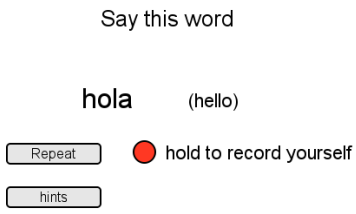
A recording of the sound would be displaying at the same time. One idea that I think would be interesting to test, if time allows, is to include a video of a native Spanish speaker producing the sound and perform some user testing. This concept came from an instructional material from the

University of Iowa that Carmen uses in her Spanish course, available on http://www.uiowa.edu/~acadtech/phonetics/.

Collaborative Learning

When I interviewed Severin Hacker, from Duolingo, I noticed that one of the recurring themes is user engagement. The team working at this company is focusing on making users come back to their site often so they can learn better: the most important thing in developing language skills, they believe, is through everyday practice. They use several techniques to keep the learner engaged, and one of them is the existence of discussion boards for every practice exercise. Severin says that users make the same mistakes very often. Using discussion boards, they can learn from each other's comments, while also relieving the instructional designers from the task of manually annotating every problem and performing costly techniques like difficulty factors assessments to figure out where the common problems are. It also overcomes the designers' expert bias, since users are the ones creating the helper content. I think this is an unusual approach that is not used very often in the context of language learning, and I would like to include it in my instructional design.

Let's reiterate over Task 3. This is what the task could look like:



If the principle is not applied, the "hints" button would present the common "say 'o' like in 'sore', 'a' like in 'father'" message. If the student wants to hear the sounds with a different voice, or in a different pace, he can't: all he can rely on are the original recording and the generic pronunciation tips. But if collaborative learning is integrated into the design, clicking on the "hints" button would look like this:

Now, besides the generic tips designed by the instructor, the user has access to recordings from other (more advanced) users whose score on this word is high and that have voluntarily decided to make a recording to help out learners. They could share the story of how they struggled with the word until they were finally able to pronounce it, what is a tolerable approximation of the word, or other pronunciation tips that are helpful for that particular word and the instructor may have overlooked. This time, the student has access to more sources, and besides being able to listen to different ways of saying the same word, they are able to better assess their performance because they are now aware of their more advanced peers' levels.

The challenge that comes with this approach is to keep the user's pronunciation improving progressively: being stuck in a loop where the peer's standards for assessment is low (e.g., when saying "flack-ow" is acceptable) is a risk that needs to be taken into account, and designed against.

RAPID PROTOTYPING AND STUDENT TESTING

Three low-fidelity prototypes in PDF were created with a quick prototyping tool called moqups. The full prototypes are available on the web linked to this document. This section will discuss the types of activities developed for the three iterations of the prototype, and how the design was revised after each round of user testing.

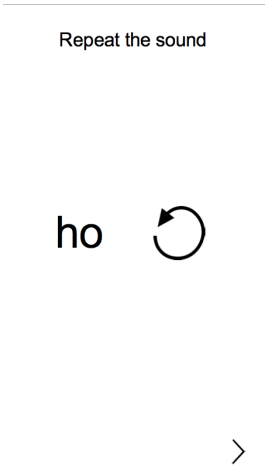
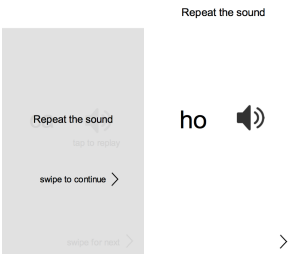
For testing, the PDFs were loaded on a smartphone so the user could simulate tapping or tapping-and-holding in a natural way. The user was instructed to swipe for switching to the next page in the mockup. Since the second and third activities involved recording the user so he could compare his actual pronunciation with the native speaker's, my first low-fidelity approximation

was to use my own voice to imitate the way that the user spoke and then give the correct pronunciation. For the second iteration, an actual recorder was used to make the interaction closer to what it would be in a real setting: the first user said it was “very easy” to make adjustments based on my imitation of his pronunciation because I exaggerated the wrong parts of his rendition of the word.

After speaking with Brian MacWhinney and getting a feel for the complexities of human phonology, I have been doing further research and brainstorming for tasks other than repetition that may help with pronunciation. By recommendation of Prof. MacWhinney I will meet with Natalie Baker, a professor at Carnegie Mellon’s School of Drama whose life is devoted to teach people to produce sounds they are not used to. I will find out more about how she performs her work and if/how it could be accomplished in an e-learning setting.

Screenshots of the iterations

The appendix contains links to the full prototypes that were tested with users, and give a much better idea of how the tasks were laid out. The table below table shows some of the most important design revisions between iterations: the third task (a test) was not a part of the first iteration.

1st iteration	2nd iteration	3rd iteration
		

Tasks

The first task just asks the learner to listen and repeat sounds, as a way of pretraining. Sounds are syllables instead of phonemes, as this is a standard practice in pronunciation teaching according to Prof. MacWhinney.

The second task presents the student with a word, its meaning, and its pronunciation. The student is asked to record his pronunciation of the word, compare it to the native speaker's, and self-assess his performance.

The third task is exactly like the second one, but no native speaker pronunciation is provided. Some of the syllables on this task have not been presented in the pretraining, but all the phonemes have been studied, so this task attempts to measure transfer for reading new words in Spanish without having heard them before.

Design revisions

The first participant struggled with the meaning of some of the icons at first. He suggested having a guided walkthrough for the more complex task 2, so a sequence of screens gradually exposing the interface and containing instructions was deployed in the second iteration of the prototype. Another aspect brought to attention was that the meaning of the word could be presented first (hypothetically, for increased engagement, so that the student could know what word he is trying to pronounce while he is working on it). This change was implemented in the second iteration. The student expressed concern over the way his pronunciation and the native speaker's pronunciation were always spoken in the same order, and said he would like the flexibility to review his own pronunciation separately from the native speaker's. Thus, the "repeat" button was replaced with controls for playing back both the native speaker's and the student's renditions of the words.

The second participant had less trouble using the application. However, he wanted to know when a type of task started and when the next one began: especially for the differences between the pronunciation exercise (2nd task) and the test (3rd task). Thus, for the third iteration an introduction screen was placed before every task to alert the learner. Other minor adjustments were changing the "swipe for next" text in every screen with a meaning of a word to "swipe for pronunciation", because the participant was worried that swiping would take him to another word, skipping the pronunciation practice.