

Gamified discrimination tests for speech therapy applications

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The integrity of phonetic perception abilities in young age is necessary for a normal functioning future speech development. Since the ability to discriminate linguistic sounds is associated to the correct acquisition and production of the same sounds, an alteration of the same ability could contribute to the onset of speech and language disorders [Brancalion et al., 2012]. For preschool children, the paradigms of identification and discrimination are the same as used by adults [Polka et al., 1995]. In this work, we propose an acoustic discrimination test as the first step for the creation of a renovated Italian Literacy Tutor. Among several types of discrimination tests, we choose the standard AX or “same-different” procedure. Traditionally, AX tests to evaluate the phonemes discrimination capability of young children are designed as scripts and software traditionally used to administer this kind of test also follows scripts (e.g. [André et al., 2007]). The scripted approach has the disadvantage of not being able to adjust the test depending on the subject’s performance. Also, as a limited amount of time is available to administer the test before the child gets tired, choosing the most informative stimulus at each step of the test would represent an advantage when information is clearer on some traits and more uncertain on others. The system architecture we designed has two main purposes:

- dynamically adapt the test to the child’s performance;
- support groups of virtual agents to establish engaging social setups

To pursue the first goal, we represent the discrimination test as a dialogue model where each stimulus, once paired with the child’s answer, generates a new stimulus as a system response. This stimulus is selected depending on a utility function taking into account the child’s performance. From an architectural point of view, this reflects in a dialogue manager acting as the system’s controller and in linguistic knowledge being distributed between the dialogue manager and a database of Italian words. The dialogue manager is provided with the capability to establish which kind of information can be obtained by presenting each available stimulus and with a non-words generator using phonotactic rules to avoid structures not belonging to the Italian language. The database contains morpho-syntactic, phonological and frequency data about words to improve the quality of the selected stimuli. To present the discrimination test in a social setup, the dialogue manager controls a set of virtual agents with different characteristics. In our case, a virtual avatar is presented on a computer screen and acts as the game’s guide while a social robot is used to implement a learning-by-teaching approach. The full architecture is shown in Figure 1.

We will present the outcome of the preliminary test sessions we used to evaluate the potential of the prototype system developed in the AVATAR project. Although the considered group of test subjects is limited and it is not possible to obtain conclusive data, promising indications are present from the point of view of the user experience and from the basic capabilities of the system.

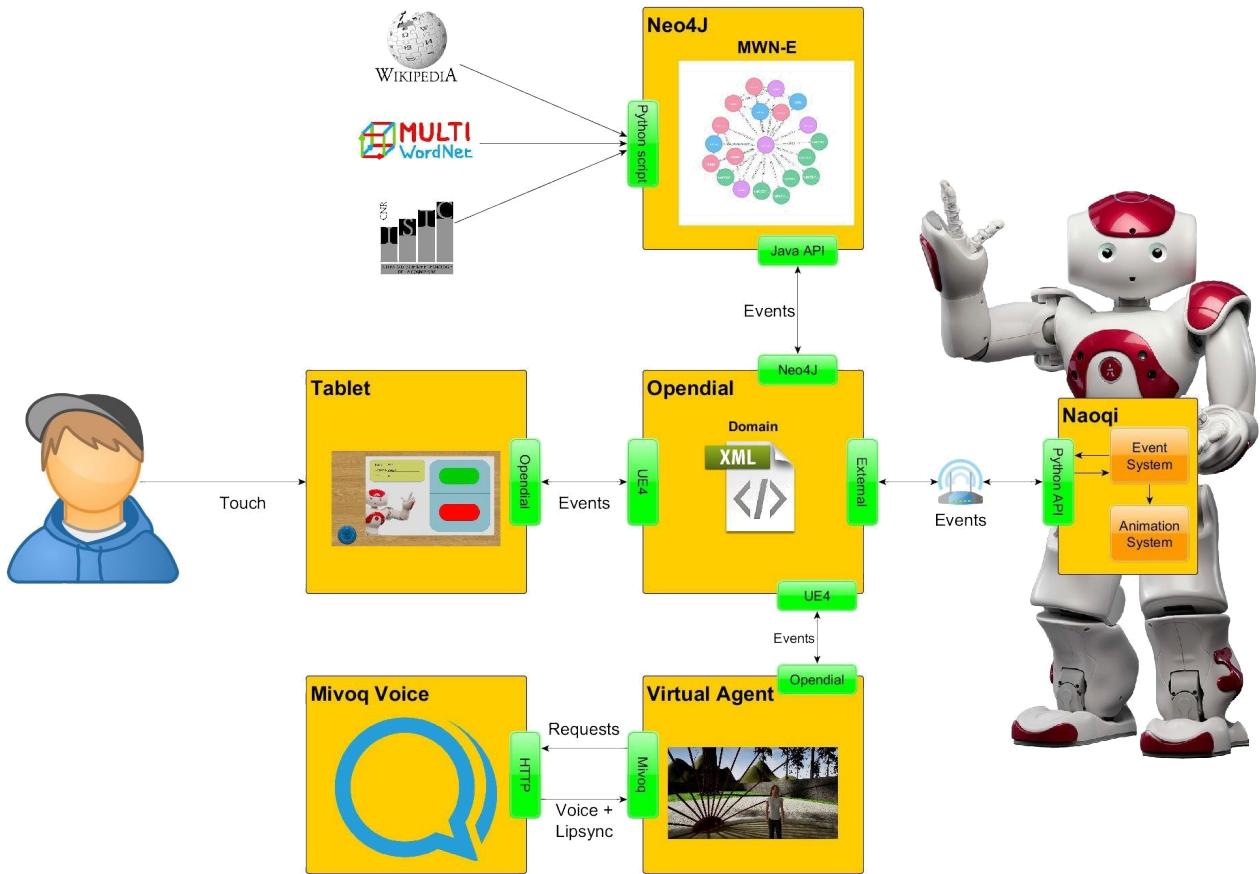


Figure 1: System architecture

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