Notes Towards a Framework for Designing Mobile Games for Children in the Developing World to Learn English as a Second Language in Out-of-School Settings

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ABSTRACT

For a number of underdeveloped regions, English as a Second Language (ESL) is a critical enabler for improving access to education, knowledge, economic opportunities, social status and computer literacy. Existing educational institutions such as schools, however, have not always effectively addressed this demand for ESL. Based on three field studies among children from the urban slums and rural areas in India, we argue that mobile games on cellphones have the potential to make ESL learning resources more accessible to children in out-of-school settings. We first frame our problem of ESL learning in terms of Gee's distinction between primary and secondary discourses. We next review the literature, including Krashen's highly influential theory of second language acquisition, Bruner's work on how play is a mechanism whereby children are socialized into the language and culture of their society, and Malone's heuristics on what make electronic games enjoyable. We then show how these theories can inform the design of an example game that target the train traveler secondary discourse.

INTRODUCTION

A fair proportion of low-income populations in underdeveloped regions desire to improve their command of conversational and written English. This is because competency in English as a Second Language (ESL) is critical for securing higher-paying economic prospects, attaining academic achievement in classrooms where English is the medium of instruction, and using the Internet whose content is predominantly in English [e.g. 5, 6, 7, 17].

Unfortunately, conventional educational systems have not always effectively addressed the demand for ESL. For example, the state government in Uttar Pradesh, India has made ESL classes mandatory in Hindi-medium public schools owing to pressure from rural parents who wanted their children to receive an education that is comparable to English-medium private schools. But from our fieldwork in Uttar Pradesh, we found that students who had received 2 to 5 years of ESL lessons at a well-managed rural school could barely read every letter in the English alphabet. Two significant factors account for the limited impact of formal schooling in developing countries, namely, irregular school attendance due to the need for students to engage in agricultural work or housework, and the lack of interest in schoolwork.

We argue that appropriate and low-cost technologies can be valuable learning resources in these impoverished settings. In particular, electronic games on cellphones which target ESL learning in out-of-school settings appear to be a promising approach for complementing the existing formal schooling system for two reasons. Firstly, mobile devices can potentially enable children to access educational resources anytime and anywhere, including out-of-school settings such as after-school programs, the home and agricultural fields. Secondly, educational games can potentially motivate learners by creating a more engaging learning experience.

As designers of instructional technologies, our concern is: how can literacy and learning theories inform the design of mobile ESL learning games for out-of-school contexts? James Gee's well-known book on the educational potential of electronic games [10] is a first step to addressing this question. But more importantly, Gee's book echoes his earlier work on discourse [9] which we revisit in this paper since they resonate with Stephen Krashen's highly influential theory of second language acquisition [e.g. 17-24]. By framing our problem of ESL learning in terms of Gee's distinction between the primary and secondary discourse, our central question becomes: how can we design ESL learning games so as to introduce elements of valued secondary discourses into the primary discourse?

The remainder of this paper proceeds in the following manner: First, we motivate the use of mobile games for ESL learning in out-of-school settings in developing regions. Second, we review Gee's distinction between the primary and secondary discourse, as well as argue that these theoretical constructs provide for a more compelling perspective on ESL literacy than conventional views of literacy that are couched in terms of functional literacy or the ability to determine the meanings of decontextualized statements of text. Third, we review Krashen's theory of second language acquisition. Fourth, we discuss how Bruner's work on play as a mechanism whereby children are socialized into the culture and language of their society [4] constitutes a critical link between language acquisition and play. Fifth, we review Malone's heuristics [28] on what makes electronic games fun. Next, we raise the striking design considerations and possibilities that Krashen's theory implies for learners in developing regions. We conclude by weaving the above ideas together to illustrate how they can be applied to the design of an example game.

MOTIVATION

Although our approach is potentially generalizable to any language, including literacy in native languages, we target ESL as our first step because of its prominence as a global language. According to Crystal [6], there are 1.2 to 1.5 billion people around the world who make use of the English language. Crystal adds that English holds a special status in more than 70 countries as the official language in law, government, education and the media. For other countries where English does not have a special status, English is nevertheless the language that is most widely taught as a foreign language in over 100 of these countries.

In this context of English as a global language, a fair proportion of low-income populations in underdeveloped regions want to enhance their ESL competency because it is a critical foundation for improving their access to education, economic opportunities, computer literacy and the Internet, as well as social status. The relevance of ESL is supported by the literature [e.g. 5, 7], our discussions with international development professionals, and fieldwork conducted by ourselves and our colleagues [e.g. 17]. Let us give a few concrete examples: ESL literacy enables one to find relatively well-paid jobs in the formal economy, such as the civil service, multinational corporations and even rural business processing outsourcing centers. Furthermore, as much as 80% of the content on the Internet is in English.

We target out-of-school settings for children to acquire ESL because the impact of schools in developing countries can be severely limited. In India, for example, the percentage of children between the ages of 6 to 10 who actually attend school, as opposed to being merely enrolled, ranges between 39% to 57%, depending on geographic region and gender [1]. The reasons for the current situation are complex and cannot be reduced to a single factor. However, two reasons stand out consistently in a number of India-wide surveys [e.g. 31, 40]. First, depending on geographic region and gender, 13% to 31% of the children surveyed cited the need to work in the fields, home or elsewhere. Second, and more striking in terms of the magnitude, 15% to 43% of the respondents mentioned their lack of interest in schoolwork.

The shortage of well-qualified teachers is another factor. For example, when we interviewed rural school teachers in Uttar Pradesh, India, our respondents cited ESL as one of the three most difficult subjects to teach. In fact, the same teachers who were responsible for teaching ESL could not communicate with us in English, and we relied on Hindi-speaking translators to proceed with our interviews.

While conventional wisdom holds that parents do not always appreciate the value of schooling, the literature suggests that the other side of the coin is equally plausible. That is, parents are supportive of their children attending schools but withdraw their support when they do not see tangible learning outcomes from school. Based on this line of reasoning, one way to enlist parental support is to improve formal schooling. However, previous collaborations between non-government organizations (NGOs) and education ministries in this direction have met with mixed success. More specifically, attempts at curricular innovations and teacher training do not always receive adequate support from government officials [e.g. 18, 25]. At the ground level, teachers are sometimes under implicit pressure from the education system, or from their own biases, to conform to old and ineffective teaching methods.

The above reasons suggest that technology – in the form of educational games for cellphones – which enables children to learn ESL at convenient times and locations is a promising solution for two reasons. Firstly, mobile devices can potentially enable children to access educational resources anytime and anywhere, especially out-of-school settings such as after-school programs, the home and agricultural fields.

Secondly, educational games can possibly motivate learners by creating a more engaging learning experience. This view is supported by theoretical frameworks on the potential for games to motivate learners [13]. Similarly, in his bestselling book, the literacy scholar James Paul Gee stresses how games can incorporate good educational principles [10]. Most importantly, educational games have demonstrated positive learning outcomes in a developing country context. A team of development economists from the MIT Poverty Action Lab collaborated with the NGO Pratham (Mumbai, India) to conduct a

longitudinal, randomized experiment that lasted over 2 years and involved more than 10,000 students from the urban slums. They found that significant gains in mathematics test scores accrued as a result of playing, for two hours per week, computer games that target mathematics literacy [2].

We propose the cellphone as the delivery platform for interactive educational content because of its mobility and increasingly penetration in the developing world. For instance, a Vodafone report indicates that Africa is the fastest-growing market for mobile communications in the world between 2000-05 [42]. This sentiment is shared by several other members in the Information and Communication Technology for Development (ICTD) community. But we do not rule out other mobile platforms that are designed specifically for developing country conditions, such as the cellular phone personal computer proposed by Bill Gates [27] and the US$100 laptop initiated by Nicholas Negroponte from the MIT Media Lab (http://laptop.media.mit.edu). As such, one of our design principles is to ensure that our educational software can be easily ported to other platforms.

PROBLEM FORMULATION

Although ESL is an important socioeconomic enabler, the problem cannot be conceived narrowly in terms of developing competency in a "universal English." More recent perspectives on literacy, such as the United Nations' view that literacy should be "functional" in that it should be "meaningful or useful" [41], or Scribner and Cole's account of literacy as a social practice [35], supports the plurality of English literacies in which each literacy entails employing oral and written English skills to different extents to achieve varying goals in particular situations. For example:

- a university student in Bangladesh aspires to a well-paying job in the capital city with a multinational company after he graduates, but these jobs require employees to communicate with English speakers around the world.

- in Sri Lanka, a local entrepreneur plans to set up a business process outsourcing center in a rural region where costs are lower. But he has difficulties finding employees with the requisite skills in written English to perform basic tasks such as medical transcription, digitization and data entry, although the average rural person can acquire this proficiency in less than a year with the appropriate training.

- in parts of sub-Saharan Africa, a 4th-grade student struggles with his studies because his school adopts a native language as the medium of instruction for grades 1-3 but switches to English beginning from grade 4. He is frustrated that he is not able to comprehend the forms of English spoken in the classroom or found in textbooks, which are significantly more complex than everyday conversational English.

The aim of this section, however, is to show that it is necessary but insufficient to see literacy through a functional lens – it can be argued that a functional account contains deterministic overtones about how the acquisition of ESL unequivocally results in better social conditions. As the literacy historian Harvey Graff observes, literacy does not necessarily bring about social mobility and may in fact perpetuate existing stratifications, especially if construed narrowly as occupation-specific technical skills while leaving out the covert norms and values essential for navigating the associated social contexts successfully [11]. We quote an anonymous engineer from India, where English fluency can be equated with private-school education and membership in the upper middle classes [1]:

> When I first joined my engineering school at 17, I was a misfit… I didn't eat out in expensive places... so... everyone [in my hostel thought] I was stingy and boring… I had to learn to enjoy eating out and spending money… In the technology institute, people read computer journals and stuff about automation and production. I did not even understand that stuff but I felt pressured to look at them. I started reading English books and English fiction there… I have continued to move in the direction of my new interests because five years ago, I wasn't accepted by my upper class classmates. I was afraid of them. But now I am accepted and admired by the same people [7].

We thus find it most helpful to frame our problem of ESL acquisition using the literacy researcher James Gee's notion of discourse [9]. Gee defines literacy as the mastery of a secondary discourse, where the primary discourse is one to which a person is acculturated initially in life through his family whereas a secondary discourse is one to which he is socialized later in life as a result of with social groups and institutions beyond the home. In fact, parents can provide their children with a head-start in life by introducing aspects of highly desirable secondary discourses into the primary discourse. Furthermore, a discourse encapsulates the three dimensions of language as linguistic unit, language as action and language as social identity that the above examples allude to.

Let us provide an example to help the reader better appreciate Gee's theoretical constructs. After all, we are often asked: "How is English applicable to the everyday lives of rural kids in India?" English has very little relevance in their immediate lives precisely because Hindi is the language of their primary discourse, whereas there are English-speaking secondary discourses distant from their primary discourse that they aspire to become members of. A boy growing up in an Indian rural

village who seeks to join the middle-class by running a small-and-medium enterprise that transacts with customers and suppliers from other regions such that English is the only feasible common business language, for example, may have to acquire literacy in English-speaking secondary discourses including: a seasoned train traveler, a restaurant diner, an astute interviewer of job applicants, a bank client with financial planning skills, and a citizen who knows how to navigate bureaucratic channels.

To further illustrate, we touch on the three dimensions of language that make up the train traveler secondary discourse. In terms of language as linguistics, an accomplished member of this discourse community has a context-specific vocabulary of English words that include "arrival time" and "ticket", the grammar rules for using these words, a familiarity with their pronunciation, etc. Where language as action is concerned, the seasoned traveler knows how to do things with these words [e.g. 36], such as communicating his interest in buying a ticket to the ticket counter staff, or buying water at the train station. Finally, since language is a marker of social identity that includes values, beliefs and attitudes, values such as vigilance (e.g. checking the ticket and informing the ticket counter staff if there is an error) increase the traveler's probability of achieving his travel goals successfully.

SECOND LANGUAGE ACQUISITION
It is beyond the scope of this paper to review the literature on the science of second language acquisition. For a highly readable introduction, we encourage the reader to refer to Bialystok and Hakuta [3]. Similarly, we refer the reader to Larsen-Freeman [25] for an excellent overview of common methods and principles for teaching a second language.

In this section, we review the work of the linguist Stephen Krashen [e.g. 17-24], whose highly influential theory of language acquisition is consistent with the Vygotskyan perspective [e.g. 43, 44] on how cultural and historical practices lead to the development of the individual's consciousness. Briefly, Krashen's comprehensible input hypothesis (more below) resonates with Vygotsky's zone of proximal development in that the development of higher mental functions take place as a result of the internalization of social practices, including those based on interactions through language, that the individual is capable of understanding at his or her current stage of development. Furthermore, Krashen's affective filter hypothesis (more below) supports our approach of using games to promote language learning.

More specifically, Krashen's theory consists of the following five hypotheses:

- *Acquisition-learning hypothesis*. Krashen distinguishes acquisition (a subconscious process) from learning (a conscious process) and argues that a learner develops language ability (including grammar) more effectively through acquisition than learning. Whereas conscious learning entails formal instruction, acquisition requires communicating naturally in the target language, such that learners are more concerned about understanding and conveying meaning as opposed to grammatical correctness. Krashen adds that it is acquisition and not learning that is chiefly responsible for the development of fluency and accuracy in the use of language, and that error correction plays a limited role.

- *Natural order hypothesis*. Krashen claims that learners acquire both their first and second languages along a similar and predictable order that is both non-obvious (because some grammar rules may be linguistically simple but are nonetheless acquired late in the process) and cannot be modified through external interventions. More importantly, this order is independent of factors including background, age and conditions of exposure to the target language. Krashen emphasizes, however, that the optimal teaching order should be based on comprehensible input (see below) and not grammatical sequencing.

- *Monitor hypothesis*. According to Krashen, the sole function of conscious language learning is to monitor and correct one's output production for grammatical correctness before and/or after making an utterance. "Over-Monitors" may lack the confidence to communicate in the target language when they monitor their utterances too often, whereas "under-Monitors" either do not use or have not learned how to use their conscious knowledge about grammar rules. "Optimal Monitors" achieve the correct balance, though.

- *Comprehensible input hypothesis*. Krashen argues that the learner acquires a language by reading or listening to utterances that he understands, versus acquisition through output production. In the above process, the learner advances from one stage along the natural order to the next. Krashen adds that language acquisition is more effective than grammar instruction in promoting grammatical accuracy, is effortless relative to learning, and takes place involuntarily when no affective barriers (see below) exist.

- *Affective filter hypothesis*. Krashen notes that language acquisition may not occur even when comprehensible input is present if the learner erects an affective filter. This filter is raised in situations when the learner is anxious (e.g. when

asked to speak using the target language when he does not feel ready), has low self-esteem or does not identify with speakers of the target language. On the other hand, the filter is lowered when the learning process is enjoyable.

It is worth noting that Krashen and Gee make a similar distinction between acquisition and conscious learning. Both of them agree that acquisition is superior to conscious learning for developing fluency in performance in a second language (Krashen) or secondary discourse (Gee). Gee adds that learning is more effective when preceded by acquisition. But while Gee believes that conscious learning is superior to acquisition for developing meta-knowledge about how multiple discourses relate to one another, Krashen insists that the only purposes of conscious learning are the Monitor function and to develop the final few "stages" of language competency that are not amenable to acquisition. Gee is clear, however, in concluding that good teachers facilitate both acquisition and learning, and that in some societies, acquisition is employed in place of learning (to some degree) and vice versa.

For ease of exposition, we will use the terms learning and acquisition interchangeably in this paper unless we want to highlight the distinction, in which case we will explicitly contrast acquisition with *conscious* learning.

SECOND LANGUAGE ACQUISITION AND PLAY

Since the sociocultural theory of learning is a cornerstone in our framework, it is important that our formulation includes a social practice of play that is subsequently internalized as the individual's higher mental functions, including those associated with language. And more importantly, this practice needs to be consistent with a genre of electronic games that can be implemented.

For our social practice of play, we choose the Language Acquisition Support System [4] proposed by the psychologist Jerome Bruner. At its core is the "format," which is a script-like interaction between a parent and child, such as peekaboo and hide-and-seek games. We reproduce a portion of one such interaction:

> *Mom: Shall Mummy hide him?...*
>
> *Mom: He's going. He's going to go-o-o. Gone! He's gone!*
>
> *Mom: Where's he gone?*
>
> *Mom: Here he comes…*
>
> *Mom: There he is.*

The above illustration omits nonverbal details of the parent-child communication, but the reader should be able to infer that the parent is playing a game around the appearance and disappearance of a toy. In the beginning, the child responds in nonverbal ways, such as by gazing at the toy or reaching out for it. As his mastery of the game increases, he starts to make utterances such as "ooo!", "ah" and other babbles to communicate his intentions to his parent. His linguistic and performative skill with language continues to grow as his parent plays this game with him into subsequent months, until he is capable of reversing roles with his parent.

There are a few salient features of the format that we wish to highlight. First, the various actions, just like games, are goal-directed. Second, actions that are linguistic utterances take on the form of routines and patterns, such that a routine is an entire phrase or utterance (e.g. "is this the train station?") whereas a pattern is an utterance with a moveable part (e.g. "is this the __?" where the blank can be filled in with a noun contingent on the actual context of interaction) [17]. Third, the format, like most games, contains demarcated roles. Fourth, a format is extremely constrained and regular at first, so that it can be easily learned. Fifth, a format becomes increasingly complex or abstract over time such that it can be generalized and applied to settings that the learner has not encountered previously. The parent in this way undertakes the role of the caretaker who introduces a new format, so as to help the child learn to use language to make references, requests and other actions reminiscent of speech acts [36].

It should be evident that the format is easy to implement in electronic games for ESL acquisition. In fact, commercial language learning packages such as the *Pimsleur* series (Simon and Schuster), *Tell Me More* (Auralog) and *Who is Oscar Lake?* (Language Publications Interactive) game engage the learner in some sort of script-like conversations with other (non-player) characters, although none of these packages explicitly frames the nature of literacy in terms of Gee's discourse.

More importantly, even though Bruner's format is restricted to first language acquisition, researchers in the field of second language acquisition have followed this line of inquiry for both adult and child learners. But there appears to be some contention. For instance, Krashen cites studies to show that routines and patterns are intrinsically different from the language that a learner acquires or learns consciously [17]. He suggests that a knowledge of formats may not necessarily evolve into linguistic or communicative competence. For instance, Krashen cites Lily Wong Fillmore's doctoral dissertation [8] as the

most exhaustive study that shows how Spanish-speaking children progress from formats to more natural forms of ESL. But he argues that Fillmore's findings do not exclude other learning styles in which the format is less conducive.

For a plausible theoretical explanation, Krashen cites Peters [33], who distinguishes between the "gestalt" and "analytic" styles of language development. Learners who favor the former perform better in picking up routines and patterns (i.e. utterance-level) in conversational situations. On the other hand, learners who favor the latter, which resembles natural human language, acquire language "one word at a time." As such, when provided with formats, analytic learners transition to acquired or learned language with greater ease than gestalt learners. Peters adds that a learner may prefer different styles in different situations. In any case, Krashen agrees that formats are useful for second language learners to express themselves meaningfully in an early stage of the language acquisition process, and in the process, make further language development possible by prompting comprehensible input from other parties.

We should also point out that our reference to Bruner's format does not imply a support for the Audio-Lingual Method (e.g. Larsen-Freeman [25]). While this method focuses on developing communicative competence using both verbal and nonverbal stimuli, it achieves this goal through drills on grammatical sentence structures. On the other hand, Bruner advances the format as a way for the child to acquire word meanings and the cultural conventions surrounding their use. In other words, we advocate routines and patterns that prioritize pragmatics and semantics over syntax.

This section on language acquisition and play is not complete without a brief discussion on the motivational aspect of games. Krashen's affective filter hypothesis [17] is consistent with frameworks on the potential of games to engage the learner. Jenkins has written a recent survey paper [13] on this topic, which we refer the reader to. But how exactly do we incorporate these motivational elements into a game design?

We turn to the work of Thomas Malone. In the early 1980's, Malone identified 3 heuristics that make games fun [28]. This work took place at Xerox PARC when he was finishing his doctoral dissertation on this subject at Stanford University, and remains influential even today. Malone's heuristics are:

- *Challenge*. For a game to be challenging, it must have goals whose attainment is uncertain. Ways of making the outcome of a game uncertain include adaptive/appropriate difficulty levels, maintaining multiple levels for each goal (e.g. keeping track of scores and the time the player takes to complete each goal), hiding information that the player needs to find out and having random game events.

- *Fantasy*. Malone distinguishes between an extrinsic fantasy in which the fantasy is determined by the skill that the player is required to perform in the game, and an intrinsic fantasy, in which the fantasy is not only determined by the skill but that the skill is also based on the fantasy setting. From an educational standpoint, an intrinsic fantasy is more motivating because it shows how the skill can be used to achieve a practical goal.

- *Curiosity*. Malone distinguishes between sensory and cognitive curiosity. In the former, a game can appeal to the player through sound and graphics. Whereas by the latter, he means that a game can draw the player to gaps or inconsistencies in his knowledge so that he would be motivated to find out more in order to resolve these gaps or inconsistencies.

CONSIDERATIONS FOR UNDERDEVELOPED REGIONS

Krashen refutes his critics to argue that it is comprehensible input, and not comprehensible *output*, that brings about language acquisition [24]. For the same reason, Krashen maintains that novice learners should be allowed to remain silent when they are trying to acquire a new language that they are being exposed to, especially if they do not feel confident to speak yet. In our view, Krashen's comprehensible input hypothesis thus suggests two tremendous possibilities for underdeveloped regions.

First, while we observe a trend in the computer-assisted language learning community to advance the technology envelope (e.g. by working on sophisticated technologies such as speech recognition that can monitor the learner's output production), we believe that it is possible to achieve substantial learning benefits simply by providing learners with comprehensible input, which entails less sophisticated technologies. We are reminded of the linguist Paul Pimsleur, whose principles for language learning have been implemented since the 1960's on audio cassette technology and continue to be popular in the market for commercial language learning products despite the lack of technical sophistication.

Two of the principles that the Pimsleur series of foreign language learning packages revolve around are those of anticipation and graduated interval recall. The anticipation principle helps the learner to situate his learning in specific contexts by presenting him with a situation (e.g. "You have just bumped into someone") and then prompting him on what he should say (e.g. "What do you say?") before providing the correct response. In conjunction, the graduated interval recall principle reinforces the learner's retention of new words by presenting them to him repeatedly and in increasing time intervals until they are transferred into long-term memory, and there is some empirical support for this principle where vocabulary building

is the goal [30]. To conclude, principles such as Pimsleur's can be implemented in comprehension-based approaches for novice second language learners without complex technology requirements.

Secondly, learners can acquire ESL by listening to comprehensible input in the background while performing repetitive and non-cognitively-demanding manual work in the fields or home, so that they can juggle their time efficiently between work and education. From a design standpoint, mobile games that aim to enable learners to use their time efficiently by combining learning with work will have to be dramatically different from most existing commercial language learning packages, which use visuals heavily. A possible starting point is audio-based solutions such as Pimsleur's. At the minimum, these games can support a "background listening mode" such that the player is exposed to plenty of comprehensible input, as a means of equipping him with the basic language competence that he subsequently needs and uses during the regular gameplay mode.

We plan to investigate the feasibility of the above two possibilities in future fieldwork.

PUTTING IT ALL TOGETHER: AN EXAMPLE
In this section, we describe scenes from an example game based on the train traveler secondary discourse since we expect the reader to relate easily to it. That is, this discourse is discussed for illustrative purpose and is by no means the most crucial for impacting the lives of our target learners.

General Gameplay
The player's avatar in the game is the local entrepreneur whom we mentioned in the Problem Formulation section above. He is required to travel to Kanpur by train to meet a business associate. The latter will be at the destination train station at 4 PM on September 24, 2006 to wait for his arrival. The avatar must not be late, so as not to create a poor impression. The game starts with a scene of the train station at the originating city, where the avatar is required to purchase a train ticket to Kanpur. Suppose that he is at the ticket counter engaging in a dialogue with the clerk non-player character (NPC) in English, such that multiple-choice options are provided for possible responses that he can select via the keypad.

The language novice relies heavily on extralinguistic context to make sense of verbal communication, and decreases his reliance on such context as he attains mastery of the target language. In this way, the learner is expected to understand how to use routines and patterns in formats such as the following after some experimentation, similar to how the parent scaffolds the child in Bruner's account to acquire the peekaboo format:

> Clerk NPC: Hello, may I help you?
>
> Player: Any trains to Kanpur on September 24?
>
> Clerk NPC: Kanpur Mail.
>
> Player: What is the arrival time?
>
> Clerk NPC: The arrival time is 4 pm.
>
> Player: How much is AC Chair Class? (Points at picture of an AC Chair class car)
>
> Clerk NPC: 500 rupees.
>
> Player: I would like to buy this ticket. (Hands money to clerk)
>
> Clerk NPC: Here is the ticket.

The rich multimodality of the game medium can be exploited to reproduce some of this extralinguistic context, so as to communicate the same meanings through non-linguistic ways at the same time. For example, in the above interaction, as the clerk speaks phrases such as "September 24" and "4pm" through the cellphone's speaker, the corresponding picture is displayed on the screen to convey these concepts non-linguistically. Extralinguistic context can also be communicated aurally. For instance, after the transaction is completed, the sound of the clerk tearing the ticket from the ticket register is played, after which an animated clip of the clerk handing it to the passenger is shown, so as to complement the "here is the ticket" utterance which the novice is not able to understand initially. As Krashen advises, pictures and animated movements can be used to help the novice comprehend input [24].

The Gestalt Style of Language Development: Demo-and-Watch
According to Gee's concentrated sample principle [10], games have an edge over "natural" environments in terms of learning because games can provide significantly more exposure to basic concepts (e.g. the above format) compared to less artificial settings in the real-world, so as to reinforce the learner's understanding. This principle is also one way to provide more of the comprehensible input that Krashen recommends. We can implement Gee's concentrated sample principle through a feature that allows the avatar to "watch" NPCs "demonstrate" formats before it is his avatar's turn to try it out. For the above

sequence at the ticket counter, for example, this can be achieved by showing the avatar waiting in a line at the ticket counter, where he observes NPCs ahead of him in the line perform variations of the format for the ticket purchase transaction. Each NPC's enactment of the format constitutes one demo-and-watch episode. Through this technique, the learner is exposed to significantly more comprehensible input than he otherwise would have in normal gameplay.

The demo-and-watch technique is informed by the Desuggestopedia Method [e.g. 25], in which dialogue sequences are explained to the learner before he is required to act them out. We can draw one more inspiration from this method for the demo-and-watch technique: when the learner is shown a format for the first couple of times, music is played softly in the background to make him feel more relaxed and understand that learning a new language does not need to be an anxiety-driven experience. In this manner, his affective filter is lowered. Another enhancement to the demo-and-watch technique comes from applying Pimsleur's anticipation principle, so as to prepare the learner with words to say for various situations. For example, for the "I would like to buy this __" pattern in the above format, the game does not provide the player with options in some demo-and-watch episodes and may instead prompt the learner's recall: "What do you say if you want to buy this item?" After a short pause for him to reflect on a possible response, the game provides feedback on the correct response: "I would like to buy this ticket."

The real power of the demo-and-watch technique lies, however, in its applicability to situations where the learner is working in the fields or home, as opposed to situations where he is focusing his eyes and hands on gameplay. Demo-and-watch episodes can incorporate a feature for the player to switch into background listening mode, such that the cellphone continues to provide him with comprehensible input in the form of continuous demo-and-watch episodes that he listens to while he proceeds with his work. In terms of gameplay, when this mode is activated, his avatar never reaches the head of the ticket counter, for instance. Pimsleur's anticipation principle can still be applied to promote active learning by focusing his attention on the routines and patterns in the given format.

The Analytical Style of Language Development: Learning Activities at the Lexical and Sublexical Levels
The game that we have described so far is more conducive, however, for learners who prefer the "gestalt" over the "analytic" style of language development. And we believe that the potential for electronic games and educational software to cater to different learning styles has been under-explored. One way to support "analytic" learners is to introduce learning activities that help them understand the same routines and patterns, but at the word- and sublexical-level (vs. utterance-level).

For example, a learning activity that targets vocabulary building may read a few English words (e.g. "I", "buy", "ticket", etc.) even as it conveys their meaning at the same time through pictures, in the same way that the Direct Method [e.g. 25] is used in ESL instruction to teach word-meaning associations. After it has explained a few words, it quizzes the learner on one of them so as to provide him with an incentive to pay attention. The activity also awards scores for correct answers. Other learning activities can target aspects of language such as phonics, letter-sound correspondences and syllable segmentation.

The sequence in which learning activities are presented in the game to the player is based on two factors. First, learning activities which facilitate the "analytic" style of development are arguably more drill-like activities and hence less engaging compared to those activities (including demo-and-watch episodes) which promote the "gestalt" style. As such, both types of learning activities need to be interleaved to promote the optimal gameplay and learning experience.

Second, learning activities that present vocabulary items to the learner can do so in a sequence determined by an algorithm that implements Pimsleur's graduated interval recall principle. For instance, if some time has elapsed since the learner first encountered the phrase "arrival time", this phrase will be presented again before the next graduated interval is over, so as to facilitate his long-term retention of this phrase.

Augmenting Electronic Activities With Paper-Based Activities
Not all learning takes place in front of the cellphone, however. We believe that it is critical to complement computer-assisted learning with paper-based activities because paper has superior affordances for certain purposes (e.g. it is generally more comfortable for the eyes when reading), as well as is an equally portable but less expensive medium, which is an important consideration for underdeveloped regions. For example, the following printouts can be distributed with the game software:

- *Picture phrasebook*: English words that are accompanied by pictures and Hindi text that indicate the former's meanings. These printouts make it more convenient for the player to check the meaning of an unknown word when he encounters it. While this idea is similar to the dictionary, and the typical classroom learner may be reluctant to consult a dictionary, the player is more likely to be motivated in looking up unknown words when they are situated within a game's context. For example, by providing the player with goals in the game such that he needs to know what some words mean in order to achieve these goals, we expect the game to arouse his cognitive curiosity where vocabulary is concerned.

- *Sheltered popular literature*: Questions that prompt the learner to reflect on how his primary discourse relates to the secondary discourse targeted in the game. For example, with reference to the "vigilance" value, questions that could be posed in Hindi might include: Were there occasions when you were not vigilant? How can the avatar be more vigilant? Do you see similarities between his need to be vigilant and yours? This approach builds on prior curricular innovations for low-income learner communities in India [25] that attempt to make the curriculum more relevant to the learners by situating the content in their everyday environments, such that an adult facilitator guides a discussion on related meta-issues, similar to how the above questions can be raised over literary texts written for the purpose of social commentary. A game used in this way resembles a literary artifact where a social context is created around for a community of gamers to share and debate, so as to motivate the learner further [e.g. 13].

The Fun Factor

Now that we have described how the example game promotes language development, we will now explain how Malone's heuristics [28] can be applied to make it fun:

- *Challenge*: Goals in the game are communicated directly to the player (e.g. a virtual commentator tells him in Hindi that his avatar needs to arrive at Kanpur at 4 PM on September 24, 2006) and indirectly (e.g. while his avatar is waiting in line at the ticket counter during a demo-and-watch episode, he sees NPCs buying water to quench their thirst and decides to achieve this sub-goal too). The trick, though, is to make the attainment of these goals uncertain and contingent on his mastery of the secondary discourse. For example, the player is not likely to succeed in purchasing a ticket or water unless he has the requisite vocabulary and knows how to use it in communicating with NPCs. Similarly, the game can implement probabilities for game events, such as the event that the clerk issues a ticket for the wrong train. In this case, the player will not arrive at Kanpur on time unless he checks his ticket for errors, which requires that he appreciates the importance of the vigilance value system and can recognize simple written phrases such as "arrival time" when his avatar reads the ticket.

- *Fantasy*: We achieve an intrinsic fantasy by creating a game world where the learning objectives are based on this world, and the player's mastery of these objectives changes the state of the world and brings him closer to completing the game successfully. Hence, he sees the practical relevance of learning vocabulary such as "water" and "arrival time" since these words enable him to do things, such as interacting with NPCs and objects in the game world that his avatar can read.

- *Curiosity*: The most compelling strength of the game lies in its potential to arouse the player's cognitive curiosity by exposing him to gaps in his knowledge of the secondary discourse. For example, his avatar's "hit points" attribute decreases steadily as he becomes thirsty while waiting in line at the ticket counter. He also knows, however, that it is possible to buy water in the game world to quench his thirst, after having witnessed other NPCs performing the "buy water" action in previous demo-and-watch episodes. He decides to pay closer attention in watching future episodes to learn how to perform this action with his avatar. In this way, he becomes motivated to learn vocabulary words such as "water" and how to do things with them.

Finally, this example can also illustrate how a language learning game can be designed so as to teach for transfer [e.g. 10]. For example, the player may know how to purchase water at the train station, but his understanding of how to perform this action in English may be initially fixed in the train station context. By incorporating other scenes (e.g. while on board the train) where his avatar can purchase water but through slightly different dialogue formats into the game, the player can begin to appreciate how the same routines and patterns (e.g. those that involve the words "buy" and "water") can be used in slightly different ways and in other contexts to achieve the same goal.

CONCLUSION

The above example game for the English-speaking secondary discourse of the train traveler covers the three dimensions of language as linguistic units, language as action and language as social identity. The last aspect is usually omitted from a typical literacy program, and we believe that it is equally crucial to equipping learners with the values, beliefs and attitudes to become successful members of secondary discourses. For instance, a learner who grows up in a primary discourse that lacks an appreciation for why values such as vigilance are critical is not likely to have his avatar read his train ticket to check for errors. But after a few dismal "game overs" due to this lapse, he is expected to develop an appreciation for this value system.

Most importantly, we believe that this genre of educational games will be popular with our target learners who belong to both genders. If the findings of a recent survey of gamers in the United Kingdom [34] are any indication of future trends in underdeveloped regions, the genre of simulation games that encompass our conception of ESL learning games is expected to be highly popular among players in the 11-15 age group, for both males and females. Given the unique challenges facing

low-income learners in underdeveloped regions, we hope that more learning science researchers will take on the challenge of investigating how mobile games can be designed to foster out-of-school learning and literacy for this learner population.

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