Mobile Gaming with Children in Rural India: Contextual Factors in the Use of Game Design Patterns

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ABSTRACT

Poor literacy remains a barrier to economic empowerment in the developing world. We make the case that "serious games" can make an impact for these learners and highlight that much remains to be learned about designing engaging gameplay experiences for children living in rural areas. Our approach revolves around game design patterns, which are building blocks that can inform game designs. We argue that patterns are beneficial because they facilitate the reuse of existing knowledge about successful games, and can capture contextual information such as domain applicability that has evolve through iterative testing. We describe the design of three mobile games based on patterns and report on a field experiment with rural children in India that evaluated these games against games that were not designed with patterns. We found that patterns are decontextualized design tools that can both help and hinder good designs. We distill lessons on the contextual factors that designers must consider when using patterns to design for this user group. These factors include designing for fun by focusing on the gameplay process and not only the winning conditions, and taking the power structure in local communities into consideration in the game designs.

Author Keywords

Design pattern, Developing world, India, Mobile game.

INTRODUCTION

Poor literacy remains a barrier to economic empowerment in the developing world. While there is still resentment of English in post-colonial India, it is widely seen as a key to socioeconomic success [25]. English is taught in almost all schools in India: as a second language in public schools, and as a first language and the medium of instruction in most private schools. Fluency in English can almost be equated with membership in the middle and upper classes [9]. A recent article states that mastery of English is the "single most influential factor that determines access to elite educational institutions, and hence to important avenues of economic and social advancement" [15].

More broadly, the literature [e.g. 7], our conversations with international development professionals in Africa, Asia and Latin America, and further experiences in the field indicate that a large proportion of low-income populations in these places desire to improve their command of an appropriate "world language." English is certainly one of these, as is Mandarin and Spanish. But even in countries where such a language is an official "national language," many speakers (inevitably the least empowered) have a different native language, and many *regional* languages (let alone dialects) are often spoken. In India, Hindi and English are official "national languages," but Hindi is native to only 20% of the population; there are 18 major regional languages. Fluency in a "world language" opens the door to further education, a larger regional (or world) marketplace, to "new economy" outsourced jobs, and often improves access to government, health and legal services.

Unfortunately, government schools in developing regions face difficulties, especially with ESL (English as a Second Language). From the literature [e.g. 2] and our fieldwork in the poorest state of India, two significant factors stand out: non-regular attendance in schools owing to the need for students to work for the family in the agricultural fields or homes, and disinterest in schoolwork. Another factor is the qualifications of local ESL teachers, who often could not communicate with us in English without interpreters.

We believe that ESL learning games on cellphones can address the above challenges, especially when the cellphone is the fastest growing technology platform in the developing world. In particular, we believe that learners can improve their ESL skills by using mobile devices in out-of-school settings. We also believe that game-like design can improve enjoyment of the learning experience by children and foster

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spontaneous adoption. "Serious games" for education in developing regions are not far-fetched. At least two non-government organizations, Pratham and the Azim Premji Foundation, have used computer games in their initiatives for children in the urban slums and rural areas of India respectively. Most importantly, a large-scale evaluation by Pratham[1] showed significant gains on math test scores from playing computer games that target math learning [3]. It is plausible that similar learning outcomes can be replicated using mobile games for ESL. We also believe that many of our lessons will transfer to other languages.

One critical challenge is: how can we design mobile games that are engaging and fun for rural children in India to play? In particular, we have not encountered any studies on how children in rural settings interact with mobile games, which we could use to inform our work.

In this paper, we describe our approach that takes advantage of game design patterns, that are usually found in earlier successful games, as basic building blocks for informing new game designs [16]. A design pattern is a "template" description of a solution to a recurring problem that has been solved. In this way, there is no need to reinvent the wheel, and new game designs can leverage on earlier games that were successful. A pattern also captures contextual information such as domain applicability and its rationale. A pattern may also capture tacit knowledge on the domain after having evolved through iterative design cycles.

Our hypothesis is that games that are *consciously* designed using game design patterns as design tools are more fun and engaging to play, in comparison with games whose design process did not involve the patterns. This qualification is critical because patterns are arguably pervasive to the extent that novice designers with extensive gaming experience can *unthinkingly* apply patterns encountered in prior gameplay to their work. Our hypothesis assumes, however, that there are still benefits to taking patterns explicitly into account during the design process, e.g. in doing so, the designer can deliberate on the rationale and tradeoffs for each pattern.

This paper's contribution is threefold. First, we describe our fifth round of fieldwork in India, where we conducted an experiment with 24 children at a rural school to evaluate the efficacy of game design patterns as design tools. Among the 8 mobile games that we deployed, we had designed and implemented 3 of them with the aid of patterns, while the remaining 5 games were obtained off-the-shelf and did not consciously factor the patterns into their designs. Second, we present the data collection procedures for eliciting rural children's opinions on how they had found each game to be fun and engaging. These procedures evolved out of pre-tests with the same users and are potentially invaluable for other game studies researchers wishing to work with similar rural demographics. Third, we report our qualitative observations on how participants played these 8 games, in order to draw lessons on designing future games for this under-studied user group.

[1] A longitudinal randomized experiment over more than two years with over 10,000 urban slums students.

MOTIVATION AND RELATED WORK

Design patterns have been used in building architecture and urban planning [1], software engineering [10], interaction design [5], website design [26], computer science education [22], science education [19], language acquisition [14] and other social applications of computing [18].

Where the field of game studies is concerned, Björk and Holopainen [6] is the most comprehensive compendium of game design patterns. These design patterns can be used in the creative design of new games according to a structured brainstorming process, as well as to analyze existing games. Our work builds on [6] in two ways. First, [6, 16] make the case for patterns but do not provide case studies in which patterns have been applied in real-world settings, whereas we report on a comparative study that examines the extent to which patterns are useful in practice. Second, we distill lessons from this study on the contextual factors that must be considered when applying the patterns, particularly when designing games for rural children in India. After all, design patterns are abstract – and hence mostly *decontextualized* – representations of common solutions to frequent problems.

Lazzaro [17] identifies four "keys," namely, Hard Fun, Easy Fun, Altered States and The People Factor, which the game designer can use in tandem for unlocking an engaging play experience. Gee [11] argues games are fun because they give the player opportunities to grow by learning and solving problems. The player can learn and solve problems in the game when he can assume an identity to act in it. At the most basic level, the player can attribute meaning to his play experience when story elements such as actions, states, events and characters are merged with the game's abstract rule system. Malone [18] proposes that games are fun when they are designed to challenge the player, are situated in a fantasy setting and arouse the player's curiosity. Norman [20] discusses how one can design for pleasure by combining design at the visceral, behavioral and reflective levels. In our view, all of the above work complement design patterns in that they are less concrete than individual design patterns and thus provide the game designer with high level principles that guide him in applying the patterns.

On the other hand, Salen and Zimmerman [24] believe that game design is a second-order design problem in that it is not possible to design the play experience directly. Instead, all that the designer can design is the game's core mechanic, and that the play experience emerges from this structure. Notwithstanding their position, we argue that game design patterns comprise building blocks which the designer can use to compose the core mechanic for a engaging game, particularly when these building blocks are found in several previously successful games.

Figure 1: Screenshots of the 8 mobile games that were deployed in the study, in the order that they were introduced to the participants: (A) Toy Factory, (B) Crocodile Rescue, (C) Floored, (D) Beginner Land, (E) Jump Bot, (F) Dancer, (G) Train Tracks and (H) Critter Crossing.

We have not encountered previous studies that report on how rural children in India – or another developing country, for that matter – engage with mobile games in terms of interaction design and gameplay. We believe that this user group deserves attention. A recent news article reports on the phenomenal sales of mobile games in India, and adds that although mobile games in India are currently targeted at urban consumers in India, "the real market … lies in rural areas" [4].

HYPOTHESIS

Although our broad hypothesis is that games which were consciously designed using game design patterns are more fun and engaging to play, in comparison with games whose design process did not involve game design patterns, this statement needs to be framed in a more nuanced manner, as we soon learned in the process of selecting games for our comparison group. More specifically, the mobile games that we piloted came under three categories, i.e. those which we:

- consciously designed using the game design patterns,
- obtained off-the-shelf that were designed by amateur game developers, and
- obtained off-the-shelf that were designed by professional game developers,

such that we hypothesize that games which we (who are not specialists in game experience design) designed with the aid of game design patterns would be more engaging than those which were designed by amateurs, e.g. hobbyists who develop games without a profit motive. On the other hand, we expect that games designed using patterns would not be as enjoyable as those designed by professional designers. In other words, while patterns can scaffold non-specialists in designing enjoyable games, patterns do not substitute for specialized knowledge and experience in game design. The implication is that patterns are likely to be more useful to novice game developers. This does not mean, however, that patterns have limited usefulness in general since they can help novice designers transition to expert status.

GAMES

We believe that casual games are especially appropriate for developing regions since their low time overhead is a good fit with children's work commitment. The sample of casual games that we evaluated at a village school included three games (Crocodile Rescue, Dancer and Train Tracks) that

we had designed with the help of game design patterns, after which we implemented in Flash Lite. The sample also comprised three amateur games (Floored, Beginner Land and Turtle Boat[2]) and professional games (Toy Factory, Jump Bot and Critter Crossing). The off-the-shelf games developed by amateur and professional game developers were selected such that they were comparable to the games that we had designed, in terms of play complexity, age appropriateness, cognitive demand and the rural children's ability to relate to the games culturally. We also ensured that the games have comparable animation effects such that participants could not distinguish commercial games from non-commercial ones simply from their user-interfaces. The off-the-shelf games were developed for the phone platform in Flash Lite or native code. Figure 1 shows screenshots of the games that we deployed.

Games Implemented Based on Design Patterns

Since our focus is on casual games, we reviewed a series of casual games that appeared on bestseller charts in order to identify those patterns found in them. In total, we identified slightly more than 30 patterns, which we classified into 4 categories: core mechanics, story elements, goal states and reward mechanisms. Next, we randomly picked 1-3 patterns from each category and used them as "germs" to brainstorm our designs. We repeated this process to culminate in three game designs (Crocodile Rescue, Dancer and Train Tracks), with Table 1 indicating the actual patterns that we applied:

- *Crocodile Rescue*, where the player rescues the drowning boy by moving his boat around a 2D map to the boy. The level is completed once the player moves onto the same location as the boy within the time limit. As a reward for completing the level, the player is challenged with more obstacles that take the form of crocodiles, which he must bait out of his path using chunks of meat, in order to clear a path to the boy.
- *Dancer*, in which the player moves among the audience on a 2D map in order to throw tomatoes at dancers on the stage. The player seeks to maximize his scores within the time limit by hitting as many dancers as possible at least once, and completes the level once every dancer is hit. As such, the player assumes the coveted identity of a trouble-maker that is not necessarily possible in real life.
- *Train Tracks*, in which the player meets his need for self-expression by laying railway tracks to extend the existing track in any direction he desires, so long as there is no obstacle. The goal is to get the moving train from the top left-hand corner of the map to the bottom right-hand corner before the train derails at the end of an unfinished railway track.

The game settings for Crocodile Rescue, Dancer and Train Tracks were chosen such that rural children could relate to them readily. As a consistency check with the literature, we also verified that the patterns we had used could also be found in Björk and Holopainen [6] in some form.

Table 1: The patterns that we applied to our designs for the Crocodile Rescue, Dancer and Train Tracks games, in terms of their core mechanics, story elements, goal states and reward mechanisms.

	Crocodile Rescue	**Dancer**	**Train Tracks**
Core Mechanics	2D moveable object	2D moveable object, Projectile	Polyline construction
Story Elements	Rescue	Dodging, Dancing	Racing, Building
Goal States	Trigger condition	Trigger condition, Maximize	Trigger condition
Reward Mechanisms	Deliberate obstacle	Coveted player identity, Create time pressure	Self expression, Create time pressure

Comparison Games

Among the games that we piloted, those that were designed by amateur game designers were:

- *Floored*, in which the goal is to flip the colors of each tile on the board until all the tiles share the same color. Each time the player moves from one tile to another, the color of the previous tile changes. The rules may become more difficult at higher levels, e.g. the player is not allowed to backtrack to the tile that he was last on.
- *Beginner Land*, where the player moves around the game world (which spans multiple screens) to collect enough coins before he is allowed to fight the boss. It is in the player's best interests to shoot the white ghosts who fly around since they will hurt him when they draw nearer.

The 3 games in our sample designed by professional game developers were:

- *Toy Factory*. In this Tetris-like game, the player needs to drop toys on an existing heap of toys with the same color before the heap overflows. This game differs from Tetris in that there is a toy dropper at the top of the screen that oscillates from left to right, and that it is not possible to rotate the toys released by the toy dropper.
- *Jump Bot*, where the goal is to scale the highest possible height by jumping onto the next highest platform when it hovers to float above the player. The player will plummet to his death if he misses the platform when he jumps.
- *Critter Crossing*, in which the goal is to help the various creatures at the bottom of the screen cross the road, river, etc. without getting hit by a vehicle within the time limit.

On a final note, we deliberately omitted games with ESL learning content from our study so that our findings could potentially apply to other "serious games" domains.

[2] Due to lack of time in the field, we could not deploy Turtle Boat.

EXPERIMENT

The experiment took place over 10 days in January 2007 at a rural school near Mysore, India. When we conducted this study to evaluate the effectiveness of game design patterns as design tools, we had already concluded four earlier field studies between July 2004 and August 2006 with children living in the rural areas and urban slums of India. The goal of these studies was to learn first-hand about their everyday learning contexts as part of a broader needs assessment, and to assess the feasibility of ESL learning on cellphones. The experiment was assisted by 4 bilingual local adults whom we hired as interpreters.

Participants

We obtained consent from parents, the village head, school teachers and government officials for all grade 1-2 students (i.e. ages 6-7, on average) to be excused from classes in the mornings, so that the students could participate in our study and resume classes after lunch. In total, there were 9 1st-graders (5 male and 4 female) and 15 2nd-graders (6 male and 9 female) enrolled at this school. About 6 participants did not appear to be regular school-goers and showed up only after hearing about our study involving mobile games. Although none reported having used cellphones previously, all of them understood what cellphones are. None had prior experience with electronic games either. They could write simple words in their native language Kannada. English was not taught in school until grade 5, but a few students have learned the English alphabet from their parents or siblings. None spoke English beyond simple greetings.

Instruments

We adapted our data collection instruments from Read's Fun Toolkit [23], which are techniques for standardized questionnaire interviews with children aged 5-10 to elicit their views on the extent to which their play experiences with particular games were fun and engaging. Although there is other work in the game studies literature to develop methodologies for "measuring fun," the Fun Toolkit is the only methodology that we know of which is specifically for and has evolved through iterative testing with children.

Figure 2: The Smileyometer, reproduced from [23].

Two instruments in the Toolkit that are especially relevant are the Smileyometer (see Figure 2) and the Again-Again table (see Figure 3). The rationale behind the Smileyometer is that asking a child to rate the level of fun that he had with a game on a 5-point scale may be more appropriate for adult respondents. The Smileyometer was designed with some children, such that child respondents are shown five faces corresponding to a 5-point Likert scale and asked to pick a face that best matches their experience with a game, with the help of this visual tool. The Again-Again table is used to determine the extent to which a child finds a game engaging such that he would like to play it again.

However, since Read's instruments evolved from iterative testing with children in urban developed country settings, we are concerned about the ecological validity of our results if we do not adapt these instruments for a rural setting. In particular, we know from earlier cross-cultural psychology studies [8] that children in other cultures may fail to provide valid responses to interview questions that are not culturally meaningful or which they had never been exposed to.

Pre-Test

The above concerns prompted us to pretest our instruments with our participants prior to introducing them to the 8 mobile games given in Figure 2. The pre-test occupied the initial 3 days of the 10-day field study. Since participants had no prior experience with video games, we introduced 4 mobile games (Tangram, Litterbug, Captain Gravity and Over the Fire; see Figure 4 for screenshots) during the pre-test before conducting the questionnaire interviews based on the same prefatory games, which were chosen so that we could introduce the children progressively to basic controls found in most games, e.g. the joystick button, the shooting action, etc.

Although we could have pre-tested with a different group of rural children, we chose to refine our instruments with our participants so as to familiarize them with the questions and train them to give meaningful responses. We worked with our interpreters to "tease out" what the children actually meant, as opposed to taking their answers literally. In the process, the interpreters rephrased our questions repeatedly until they conveyed our intentions without cultural biases or translation errors.

Would you like to do it Again?

	Yes	Maybe	No
Visit U Boat	✓		
Puppet show		✓	

Figure 3: Part of an Again-Again table, reproduced from [23].

We found that it was necessary to scrap the Smileyometer because the participants kept selecting smileys for "really good" and "brilliant". We learned that they never chose "awful" or "not very good" because they found smileys to

Figure 4: Screenshots of the 4 games that were used to pre-test the data collection procedures: (A) Tangram, (B) Litterbug, (C) Captain Gravity and (D) Over the Fire.

be aesthetically more appealing than frowns. We eventually asked them to give a score from 1 (lowest) to 5 (highest) to rate their enjoyment with each game. We learned that they initially rated the games on a reversed scale because it was a customary school practice to rank students in class, such that "1" denotes the top student, etc. However, we retained our original scale when participants understood it after our explanations. We also streamlined our interview process by asking the "Would you like to play this game again?" question from the Again-Again table immediately after the above rating question, and removed the "Maybe" option after finding that participants struggled with this ambiguity.

To reduce recall failure and interference from exposure to newer games, our preference was to ask the above questions for each game immediately after participants had finished it. This would also make it easier to seek clarifications on the reasons that participants had for assigning the ratings that they gave. However, due to their limited experience with electronic games, we found that they understood each game better – and how to play it with greater successes – after they had learned more games. For instance, participants did not appear to understand Over the Fire and disliked it until they had gained exposure to more games, whereupon they developed more positive impressions about the game. As such, the compromise that we adopted was to ask the above questions for each game after participants had been exposed to 1-2 subsequent games.

Procedure

On each day, we introduced an average of two new games and conducted a revision of 1-2 earlier games. The 8 games were introduced according to a sequence that interleaved those designed by us with those games from amateurs and professionals. In the ideal within-subjects experiment, we would have introduced games in a different sequence for each participant to minimize ordering effects. But we lacked manpower for this level of classroom management.

Three researchers conducted the interviews using questions refined during the above pre-test phase, as well as observed how participants played the 8 selected games. To minimize observer bias, we rotated ourselves among the respondents. On the last day, after most participants had become familiar with the games, we selected 3 of them and asked to video-tape them as they played every game. They were selected based on the understanding of the games that they exhibited in the above interviews. They were also selected to ensure a variation in age (one 1st-grader and two 2nd-graders) and sex (2 boys and 1 girl) among the participants whom we videotaped. But their prior performance in the games was not a criterion for selection because we wanted to observe any usability problems that they may encounter.

Figure 5: A boy looks on as he waits for his turn.

Given our concerns that the above self-reported data may not be reliable, we performed one more round of interviews on the last day of the study. More specifically, we showed printouts of screenshots from each game and asked every

child to pick the top two games that he or she would like to play again. This data provided us with an additional source of data to triangulate our analysis with the above numerical ratings and video observations.

The cellphones used in the experiment were the i-mate SP5 Windows Mobile 5.0 smartphones.[3] Since we only had 9 phones, students took turns to play (see Figure 5).

RESULTS AND ANALYSIS

How useful are game design patterns as a design tool? Table 2 shows the average rating assigned by participants to every game on a 5-point scale. We can make three striking observations. First, none of the "top three" games (Floored, followed by Critter Crossing and Jump Bot) were designed using patterns. Second, and more interesting, one of the games in the "top three" (Floored) was in fact designed by amateurs. Third, among the three least popular games, one was designed using patterns (Crocodile Rescue), one was designed by amateurs (Beginner Land) and another was designed by professionals (Toy Factory). Clearly, designing engaging mobile games for rural Indian children is more complex than labels such as "amateur" and "professional," or even the direct application of tools such as patterns.

Table 2: The games that we had deployed and their average ratings as assigned by participants, ranked in order from the most popular game to the least popular.

Game Title	Mean Rating (Out of 5)
Floored	4.5
Critter Crossing	4.5
Jump Bot	4.1
Dancer	3.9
Train Tracks	3.9
Beginner Land	3.7
Crocodile Rescue	3.4
Toy Factory	3.3

Three Most Popular Games

Among the three most popular games in the case of Floored, during the interviews, 5 participants specifically volunteered that they liked it because it was an easy game. We observed that participants succeeded at initial levels through a divide-and-conquer strategy, where they made "local" moves in specific regions of the game board until the tiles in the region had switched to a uniform color before proceeding to do likewise with other regions. That is, it was possible to work on different parts of the board as independent regions without incurring significant cognitive overhead for strategic reasoning or thinking ahead. 13 participants added that they enjoyed the game because they liked the colors of the tiles.

However, while aesthetics play a role, we also noted that many other games in our sample were equally – if not more – colorful, yet few participants liked them because of their colors alone. Based on feedback from respondents that they enjoyed changing the tile colors, we believe that it was this ability to change the aesthetics of the game elements in addition to the colors themselves that contributed to the excellent ratings. We also note that colors and household drawings have a dominant role in Indian cultural festivals.

For Critter Crossing, 4 participants enjoyed it because they found it easy to help the critters cross the road, although 2 participants disliked the game because they found the road crossing goal to be difficult to achieve, presumably due to heavy road traffic. 4 more children cited liking the critters and their appearances as their reason for liking the game.

Jump Bot received positive ratings because 9 participants enjoyed performing the jump action. On the other hand, Jump Bot received negatively ratings from 4 participants who found it difficult. In particular, the game was not well designed for player error in that missing the platform during a jump results in the player plummeting to destruction and having to restart. It seemed that Jump Bot would have been more popular if the consequences of a failed leap had been less dire.

Three Least Popular Games

Turning our attention to the three games with the lowest average ratings, 5 participants indicated that they did not like Beginner Land for its difficulty because it was hard to shoot the ghosts before they draw closer to the player. A possible reason was that participants had limited familiarity with arcade games that required hand-eye coordination. It was also possible that the joystick button on the cellphone was difficult to use, due to hardware usability problems. We also believed the software user-interface could be improved in terms of usability and aesthetics. In terms of its positive aspects, 5 participants enjoyed the shooting action.

As to Toy Factory's unpopularity, 3 participants indicated that it was difficult to play, plausibly because it is an arcade game like Beginner Land. It was also possible that Toy Factory received the lowest average rating among all the 8 games because it was the first to be introduced, when the participants were still learning how to play mobile games.

In the case of Crocodile Rescue, the biggest problem was that 4 children did not like the crocodile sprites in the game. In particular, two girls found the crocodiles frightening, especially when they open their jaws in our animations. We

[3] We are sometimes asked if these expensive cellphones are appropriate for low-income children in underdeveloped regions. A primary reason for developing on the smartphone is the availability of rapid prototyping tools for this platform, which reduces the burden of iterative design. We can port our game applications to lower-end phones after we have gained a better understanding of the requirement specifications from pilot deployments. There are also proposed business models to make cellphone-based learning affordable for this learner group, which is outside the scope of this paper.

understand that crocodiles are often villains in Indian mythology, and soon learned that crocodiles are perceived as dangerous by villager dwellers. In contrast, 3 participants enjoyed the Crocodile Rescue game because they fared well in it while another 3 identified with the hero whose goal was to rescue the drowning boy from the crocodiles.

Other Results

Among the remaining two games designed using patterns, which received moderate mean ratings, Dancer was popular because 4 children enjoying the sight of the dancers moving about on stage while 3 players loved to throw tomatoes at the dancers. Players appeared to identify with the coveted identity of the mischief maker whose goal in the game was to ruin the dancers' stage performance. The game was not as well-liked on the whole, however, because 4 respondents found it difficult to hit the dancers accurately.

Similarly, for the Train Tracks game, 8 participants enjoyed watching the train move on the railway track. But 4 children found the game difficult for reasons such as the obstacles on the game map.

Lastly, we observed children handing over the cellphones to the adult interpreters to restart the game or advance them to the next level. In some cases, usability was the issue since some games such as Floored required the player to advance to the next level by passing through 3 "next level" screens. But in other games that required pressing a button at only one screen to advance to the next level, we also observed similar behavior with children seeking adult assistance. More interestingly, in some of these situations, we observed an asymmetry in that some children restarted the game in the event of a "Game Over" but solicited help when they did well in the games and needed to advance to the next level. We hypothesize that these solicitations for help were in fact attempts to gain the approval of adults by showing them one's accomplishment in a game.

DISCUSSION AND LESSONS LEARNED

We found that it is too simplistic to make generalizations about patterns, which are akin to decontextualized formulas. We realized that there are contextual factors that we should have taken into account when we employed patterns to design mobile games for our target users in rural India. On one hand, patterns can be building blocks for successful games. As an example, the **coveted player identity** of the hero and trouble-maker in Crocodile Rescue and Dancer respectively appealed to the children. Similarly, a reason for Critter Crossing's popularity was the fact that its design incorporated **characters** such as rabbits that appealed to children.

On the other hand, failure to apply patterns in a manner that is contextually and culturally appropriately is likely to bring about poor gameplay experiences. For instance, introducing **deliberate obstacles** in Crocodile Rescue as crocodiles conflicts with the typical village sentiment (and sensibility) about these dangerous creatures. Equally important is the observation that **creating time pressure** may be a common approach to making games more challenging and engaging, as Malone recommends [20], but negative comments about the time limits from our participants suggest that electronic games for rural children, who have less exposure to video games as their counterparts in developed countries, should not be designed to be overly difficult.

In fact, this point about difficulty relates to Lazzaro's [17] distinction between Hard Fun and Easy Fun. By the former, she means an engaging play experience that challenges and rewards the player for each tangible progress, similar to Malone's challenge heuristic [20], whereas Easy Fun refers to the player's enjoyment of a game when his attention is focused on enjoyment of the experience as opposed to the winning conditions or final goals. An analogy might be the enjoyment of life as a journey instead of the destination(s).

From our study with rural children in India, it seemed that Easy Fun plays a significantly more dominant role in this cultural context than Hard Fun in unlocking an engaging play experience. We saw that participants reacted favorably to Floored, Crocodile Rescue and Critter Crossing because they could immerse themselves in the flow of the gameplay experience, while they found Beginner Land, Toy Factory, Jump Bot, Train Tracks and Dancer to be less than pleasant because various factors, including challenges coming from time limits, impeded the optimal flow that is required for an engaged play experience. We therefore recommend that the designer adopt Easy Fun as a primary principle in designing electronic games for this user group.

But we also caution that Easy Fun alone is inadequate. As we have seen in Crocodile Rescue, participants liked it, but our mis-application of the **deliberate obstacles** pattern resulted in this game receiving the second lowest average rating among the games in our sample. The broader lesson is that there will be interaction effects between patterns, which highlights the importance of combining patterns holistically such that the whole is greater than the sum of its parts. A pattern which is a poor fit with the other patterns is sufficient to impair the play experience drastically.

To complement design patterns, the above results indicate that aesthetics continue to matter to a significant extent. Our experience with Floored suggests that games be designed with rules that allow the player to change the aesthetics of game elements, especially in the case of a culture where vibrant colors have a major place in festivities and other cultural events. The aesthetics of game elements that move on their own in the game world will also be welcome by players who enjoy being spectators.

Finally, when designing mobile games for rural children in India, and possibly other rural contexts, it is vital to take the existing power structures into account. Teachers and other adults are undoubted authority figures, especially in a community where utmost respect is accorded to seniority. Games can be designed such that they facilitate the player in gaining adult approval and strengthen community ties.

For instance, screens between levels can feature the player's performance and/or improvement over previous sessions prominently. A pause feature can also be added to allow players to show off their proudest moments to others. However, unlike the pause feature in the typical game, which occludes the active game screen, a pause feature that is more visually transparent is more suitable in this context.

CONCLUSION

Alexandrian patterns have been gaining popularity in design communities because they facilitate the reuse of existing knowledge about successful solutions to common problems. When we began the reported comparative study to examine the extent to which patterns can leverage prior lessons and promote the design of successful games, we observed that patterns can both help and hinder good designs. In the process, we gained a better appreciation of how patterns are analogous to "knowledge constructs" such as formulas in that they are decontextualized artifacts that are to be guided and framed by broader cultural and contextual knowledge in their use. We hope that the contextual factors which we have identified for the effective applications of patterns in a rural Indian context will encourage other designers and researchers to pursue work on the "situational" dimension of design patterns, which have hitherto been viewed mostly as abstract representations of solutions that are applicable to other contexts to a large extent.

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