Educational Software for the XO Computer for use in Nepal

An Interactive Qualifying Project Report

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By

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Abstract

This project aims to create an environment in which children's play is utilized to let children teach themselves. Through this goal, the project will also contribute to One Laptop Per Child's (OLPC) resources. Research and analysis of the situation at our target site, Nepal, was completed. After consulting with the OLPC organization, the team determined that developing an open source physics simulation game would be appropriate. The basis for this game, Squeak's Journey, was then designed and partially implemented.

Executive Summary

Nepal is a developing nation and carries much of the baggage that category entails. While approaching the levels of developed nations in some areas, it is still far behind in others, especially education. The One Laptop Per Child (OLPC) organization was created to help fill this gap in developing countries, like Nepal. It provides the children with low-cost, durable laptops designed specifically for them. These laptops come fitted out with a small array of software to enable children to communicate and interact with each other over distance. They also include useful tools, like a calculator, and some educational material. The collaboration and educational abilities of these laptops are what differentiates them from other laptops. These abilities are what allow them to be such powerful educational tools, empowering the children to teach and learn from each other.

However, there are few educational games found in the educational resources of OLPC that involve much more thought than recalling facts. Many of the educational games are simple flash card or matching games. However, some members of OLPC Nepal have expressed interest in more complex and engaging games. They showed specific interest for an open source physics simulation game along the lines of Bridge Builder or Armadillo Run to help children gain an intuitive understanding of basic physics and design. The goal of this project was to create the basis for such a game tailored for their laptop, the XO.

The initial game concept was based upon a fusion of ideas from Bridge Builder and Armadillo Run, given a more complex plot. In each level the player is faced with a two dimensional game environment. These game environments vary by level but all have at least two components: an avatar representing the character Squeak, and a destination portal to the next level. In some levels, there can also be platforms found at various locations like under Squeak, under the portal, or in any other location that might be useful for construction purposes. As the game progresses the difficultly level of the scenarios increases, sometimes incorporating building elements and themes, previously discovered in early levels, into larger structures. Paralleling the progression of difficulty is the progression of the storyline with Squeak traveling through various areas, illustrated by the background art and narrated through text in thought bubbles, on its way home.

The objectives of this project were focused on the design decisions involved in making such a game. To meet these objectives research was done into: the intended

deployment location, Nepal; the hardware and software of the XO; physics engines; and the preferences of OLPC Nepal. Information from this research was then incorporated in design decisions through action research; necessary higher level decisions limited the choices of consequential decisions. For example the choice of development language limited the options for physics engines the team could choose from. With these decisions made the game was implemented.

The resulting product was a working simple physics simulation with a bare bones graphical user interface. This met the goal of the project, providing a good basis for future development. However, there is still great room for the future development of the game. As a result the team developed a list of suggested enhancements for the next version of the game. These enhancements are: addition of multiplayer options; enhancement of game efficiency through study of optimal physics engine use; development of game play, including levels and plotline; development of realistic building materials; improvement of the GUI; improvement of the feel of the game as an XO application.

Acknowledgements

Authorship Page

Due to different project end dates for the members of this group, this is the first filing of the project and the version for submittal by Tesia Shizume. Nevertheless, the work done for this project was evenly distributed between Alex Camilo and Tesia Shizume. Alex Camilo took the responsibility of product leader and led the development of the game. Tesia Shizume took the responsibility of primary author and led the writing of the report.

In terms of the writing of the paper the abstract, executive summary, introduction, and the first major section of the background were written primarily by Tesia Shizume. For the methodology, results and analysis, conclusion, and annotated bibliography the work was split relatively evenly. Specifically for the annotated bibliography citations pertaining to the OLPC website were annotated primarily by Alex Camilo and those pertaining to recent events in Nepal and the Nepali government were annotated primarily by Tesia Shizume.

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1. Introduction

In this era of globalization, the ability to use a computer is becoming ever more important for those seeking a job or trying to hold on to one. Exposure to electronics in everyday life is ever increasing with the internet helping globalization speed along. At the same time the presence and impact of computers in business grows daily. Yet there are millions of children in the world today with limited or no access to educational facilities and many more without access to even basic computing facilities. As these children grow up and enter the workforce, they will be disadvantaged, compared to those with better educations and experience with computers. Many career and job opportunities will be closed to them, especially in the fields of mathematics, science and technology. For the world's poor, from which the majority of these children come, this may turn into a vicious cycle.

The One Laptop Per Child organization (OLPC) hopes to address this problem in many developing nations, including Nepal. They work with these governments to provide their rugged, portable XO laptops to children. These laptops are designed from the ground up, both hardware and software, to be child friendly and to provide a flexible learning environment where multiple students can collaborate with ease. There have been many pilots in developing nations and the results have shown that children are able to quickly utilize powerful tools like the internet.

The last dynasty of Nepal brought great improvements in education for that nation. They took education from the realm of the elite to a public service and in doing so increased the literacy rate by an order of magnitude to 53.7% overall in 2001 (Anonymous, Government of Nepal - Ministry of Education 2008). Yet they still left much room for improvement, with their highest dropout rate in secondary school and only 46.2% of students pass the School Leaving Certificate (SLC) Examination (Anonymous, Government of Nepal - Ministry of Education 2008). With the governmental change from a constitutional monarchy to a representative democracy, there is hope of a renewed emphasis on education. However, it will still take a great effort to continue to increase literacy rates and education, especially in a country where foreign aid still makes up a sizable part of its education budget.

The telecommunication infrastructure in Nepal is in a similar state of partial

development. In a country of almost 30 million people, there are about 1 million mobile cellular telephones but only 12 radio stations, 1 television station and less than 300,000 internet users (Anonymous, CIA - The World Factbook -- Nepal 2008). OLPC has chosen Nepal as one of their deployment sites to try to address this technological gap by supplying children with these education friendly laptops. However, there has not been significant activity at OLPC in developing educational software that address specific academic disciplines like mathematics, sciences, and technology. With the diversity found throughout the world and especially in Nepal these disciplines seem particularly appropriate for the development of educational software due to their universal nature.   A strong foundation in these subjects is a good basis for confidently going about everyday life or even for pursuing further/higher education. In a country like Nepal where the largest ethnic group only consists of 15.5% of the population and Nepali, the language spoken by the most Nepalese, is spoken by less than half the population, there are few other subject areas that would meet as universal a need.

The goal of this project was to create an environment where children's play is turned into an intuitive understanding of specific areas of mathematics, science and technology - specifically by creating the basis for an open source game the group calls Squeak's Journey.

Squeak's Journey was conceptualized as a physics simulation game where the player's goal is to get Squeak to the next portal so it can continue on its way home. The players are given a predesigned environment which they cannot drastically change and items with which they can build off the preexisting structures to transport Squeak to the portal using primarily gravity. The game uses a progression of levels to first introduce the controls of the game and then the basic idea of the game; thus the player learns the rules through observation and experimentation. It then moves on to develop basic topics like energy transfer and simple design elements like gears or pulleys through observation and play. The level difficulty increases as the player moves along developing more complex concepts from simpler concepts and more complex designs utilizing previously explored simpler designs.

To realize this goal research into educational software, the hardware and operating system of the XO laptop, learning, and games in general was performed. Action Research was chosen as a development strategy and the following objectives were then formulated and utilized to achieve this goal:

- Determine an appropriate development environment for this game
- Create simulations of the XO environment on other platforms to serve as a development and testing environment
- Determine the most appropriate physics engine for this game
- Design and implement the following game actions
    - Creation of a game environment in which the user can play with building elements
    - Creation of building elements for the user to utilize in game play
    - Creation of levels to supply the user with appropriate goals and resources

2. Background

There are millions of children in the world today without access to adequate educational facilities. Many of these children are found in developing nations like Nepal, which rely partially on foreign aid to support their education systems. Charitable organizations throughout the world seek to improve the lives of these children every day through providing necessary resources and volunteers. What makes the One Laptop Per Child organization different is that it seeks to directly empower the children to help themselves. For such an organization with a wide scope of volunteers and locations, development of effective software is necessary for its effectiveness. This chapter examines the current situation in Nepal and OLPC, including specifics on their current product, the XO.

2.1 Nepal

Nepal today is a changing climate, politically, socially and economically. With modern globalization, there is an influx of foreign culture, goods, and funds. The largest political party in Nepal was formerly the largest rebel group in Nepal, the Maoists. This group has drawn a lot of their beliefs from the teachings of the Chinese Communist leader Mao Zhe Dong and has gained inspiration from Peru's Shining Path rebels (Lawson, Alastair 2005). There is also a foreign presence in the education system. At a recent peak in 1995, foreign aid formed 26% of Nepal's education budget and in 2003 it was still 15.8% (Anonymous, Government of Nepal - Ministry of Education 2008). Some Nepalese fear that neighboring countries, especially India, are interfering in their government and domestic affairs (Rajkarnikar, Amar 2008; Sarkar, Sudeshna 2008). With such powerful foreign influences and the current political instability there is the danger that the children will be forgotten. These children need to learn how to deal with this ever growing influence to survive and thrive in their ever changing world.

2.1.1 Life in Nepal

Life in Nepal today is difficult. Nepal claims a 6.44% infant Mortality Rate and the Gross Domestic Product (GDP) Per Capita is only $269 according to their official website

(Anonymous, Central Bureau of Statistics). However, the CIA World Factbook sites a slightly lower number for infant mortality rate at 6.2% overall and a slightly higher number for GDP per Capita at $1200 with Purchasing Power Parity (PPP) taken into account. This discrepancy is most likely due to time difference in the data points. The most recent national report on the Nepal Statistics website was from 2001 while the CIA numbers are 2008 estimates. In 2007, the official GDP was 9.627 billion dollars and the GDP with PPP was 29.04 billion dollars (CIA World Factbook 2008). The majority of the work force works in agriculture and forestry. With such a low GDP and the majority of the workforce being involved in manual labor few people can purchase computers, which are often ironically considered luxury objects ignoring their long history in education and many occupational uses. However, the average life expectancy at birth was reported to be 59.7 years by their official census website (Central Bureau of Statistics) relatively long for a developing nation. This number is corroborated by the CIA World Factbook website's more recent estimate of 60.94 years on average. With such a long life expectancy, there is an even greater need for the nation's youth to develop lifelong learning skills so they can make the best out of any situation they are faced with and help propel their nation forward.

2.1.2 Recent Political Events

There has also been much recent political overturn and change. With a landslide vote in late May 2008 the final blow was struck to the monarchy and the 240 year rule of the Shah dynasty ended (Mainali, Ambar 2008; Anonymous, Nepal votes to abolish monarchy 2008). The world's only official Hindu state and constitutional monarchy decided by representative vote to reestablish itself as a representative democracy (Rajkarnikar, Amar 2008). Prior to this, the country was disgraced by the monarchy through an unfortunate series of events. In 2001 a large part of the royal family, including the popular King Birendra, was massacred by one of its members. Gyandendra, brother to the previous king, ascended to power inheriting many problems. Eventually he seized absolute power leading to escalated attacks by the Maoists and the eventual retraction of the action (Anonymous, Profile: Nepal's King Gyanendra 2008; Rajkarnikar, Amar 2008). What is missing from all this recent press coverage is what impact this is having on the children and will have on the children. Often in times of political unrest the children are forgotten. The lack of any information on the political stances of the new government on education suggests this may be the case.

2.1.3 The Maoists

Until 2006 Nepal was still in open conflict with the then Maoist guerilla group (Anonymous, Nepal Maoist make offer to end political deadlock 2008). The Maoists are an organization founded on resentment of the caste system, the plights of the rural poor and a general disillusionment with the previous Nepalese political system. They have grown from a group that the government did not even acknowledge as a threat to one of the most powerful rebel groups in South Asia and more recently the largest party of the new Nepalese government (Anonymous, Q&A: Nepal's future 2006). Their record includes previously having the formation of Nepal as a communist state as a goal. What effect this former rebel group will have on the newly forming democracy is unknown. However, their influence on the nation's youth is undeniable. "In the summer of 2004, the rebels abducted hundreds of school children for a week-long 're-education' course on Maoist ideology." (Lawson, Alastair).

2.1.4 Education in Nepal

Historically, education in Nepal has been for the elite. However, since the 1950s there has been drastic change. Once the domain of royalty and the choice elite, education has become a public institution, with noticeable results. The overall literacy rate has increased from 9.5% for males in the 1950s to 65.1% in 2001; for females it has gone from 0.7% to 42.5% over that same time period. The number of students enrolled in lower secondary schools more than tripled between 1990 and 2003. The percentage of girls enrolled also increased by more than 10% (Central Bureau of Statistics).

Table 1– Data from Nepal's Central Bureau of Statistics

Level of Education	Grades	Normal Age Range (years)
Primary	1-5	5-9
Low Secondary	6-8	10-12
Secondary	9-10	13-14
Higher Secondary	11-12	15-16
Higher Education (University)	13+	17+

The current state of education in Nepal needs improvement, but is generally moving in the right direction. They have a seventeen grade system, as seen in Table 1, with grade 1 starting at 5 years of age. The net enrollment rate for girls in Primary Education is 78.0% and for boys 90.1%. However, enrollment for Lower Secondary Education drops to 40.2% and 47.6% respectively and for Secondary Education they drop even further, to the point where only 28.8% of girls and 35.2% of boys are enrolled (Central Bureau of Statistics). With such an economically strained education system there is little money for computers let alone more experimental teaching methods.

2.2 One Laptop Per Child (OLPC)

The One Laptop per Child (OLPC) organization was founded to help children in situations similar to those in Nepal. By taking advantage of the great ability of children to learn, share, and create, the organization seeks to help children learn learning and think about thinking through their main product the XO computer. This greater understanding of themselves can help kids take full advantage of any educational opportunity. By providing children in the developing world with the opportunity to explore a technology, share ideas with each other, and participate in the sharing and creation educational resources, a world of educational opportunities is opened.

2.2.1 The XO - Hardware

The XO is a low cost, rugged laptop designed to serve as an educational tool for children aged 6 to 12, in places with minimal or nonexistent computer infrastructure. Serious thought has gone into all aspects of the XO's design to bring the benefits of modern computing to environments where it has never had a significant impact. However, due to the intended deployment scenario, there are many key differences between the XO and an average laptop, even though the XO is categorized as a laptop computer.

The XO has to function in areas where the combinations of ambient temperature, humidity, and vibrations would render a normal computer inoperable. Unlike most laptops the XO design eliminates vulnerable cooling methods, such as fans and vents. This allows it to be more thoroughly sealed, preventing excess dust or moisture from damaging the laptop. Potential damage from vibrations is mitigated through the XO's use of solid state

storage, which has no moving parts and allows for the elimination of the hard drive, a common point of computer failure when vibrations are involved. (OLPC, 2008) The above measures increase the potential lifespan of the XO in the intended deployment areas, enabling the laptops to benefit the children longer than would otherwise be possible. This ruggedness also reduces the risk of the child breaking the laptop accidentally.

Due to the lack of infrastructure in a large portion of the intended deployment locations of the XO, its internal power circuitry was designed to be extremely versatile and incorporate power saving features. The use of the Central Processing Unit (CPU) is not necessary when displaying a picture, allowing the CPU to be put into suspend mode. In addition, the display is also capable of functioning in a daylight readable monochrome mode that only consumes 1w of power, allowing the laptop to act as an e-book reader for 20 hours on a full charge. (OLPC, Hardware> Specifications.) This way the child does not have to depend on the availability of a wall socket to charge their laptop to continue learning but can use other power sources and does not constantly need to be near a power source to recharge the laptop when only using it to read e-book material.

In order to meet its low price tag the XO has a limited amount of computing resources compared to modern desktops and laptops. However, it has capabilities to mitigate this effect. To reduce the need for costly infrastructure, the XO is capable of sustaining a mesh network, even when powered down. A mesh network is essentially a local wireless network. The maintenance of this network allows information to be passed along to a recipient by intermediaries, even if the recipient is out of range of the sender. (OLPC, Hardware> Specifications.) This way children can share information and help each other learn over distance even when the infrastructure is not in place for access to the internet. They can also access a school server, possibly with internet, to get further information.

2.2.2 The XO - Software

The XO laptop runs a version of the Red Hat distribution of Linux with a custom interface, called Sugar, which has been designed from the ground up to facilitate collaboration and create an environment that better suits the way a child learns. Instead of adding network functionality to a preexisting interface as an afterthought, the OLPC team completely redesigned the user interface embracing networking by making it an integral

part of the user interface. (OLPC, Software>Specifications)

Neighborhood

Groups

Home

Activity
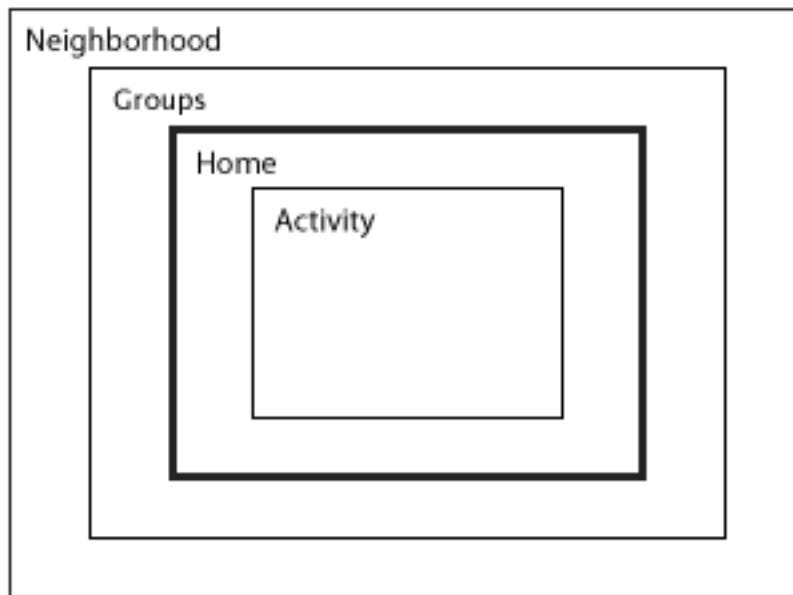
Figure 1- Zoom Analogy

The interface is broken up into several layers through which the user can navigate to complete tasks and interact with others, as illustrated in Figure 1, above. At one time, only one level is visible to the user; however there are icons and hotkeys on the keyboard to enable the switching between layers. This movement between layers is analogous to zooming in or out of an image. As the user moves toward more internal layers more specific functionality is opened up just as more detail is revealed in an image when a section of an image is magnified. However, as is true with zooming in, the variety of larger tasks and functionalities is reduced. An example of one such case is moving from the 'Home' layer to the 'Activity' layer. At the 'Home' layer the user can see multiple tasks and choose among them to move to the 'Activity' layer. At the activity layer the user can no longer see the other tasks but is given the ability to interact with that specific activity and its details.
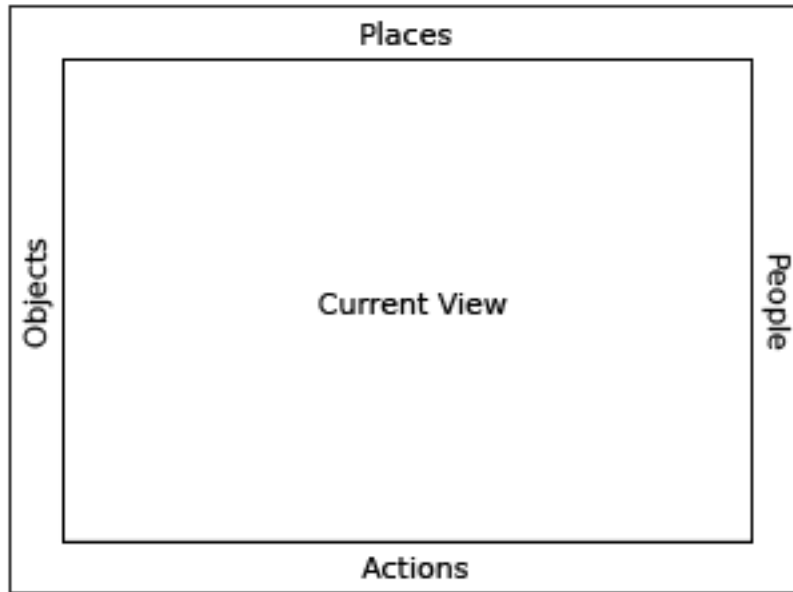
Figure 2 - The Organization of a Frame

Around each view is a frame that contains peripheral information that the child might need across all views. Its components, as seen in Figure 2, consist of Places, People, Actions, and Objects.   The 'Places' bar consists of two parts, as shown in Figure 3. To the left there are icons that refer to the different levels of zoom allowing the child to have easy navigation on the screen, between views. On the right side there is a 'Bulletin-Board' icon which toggles a complementary layer that allows contextual chat and a place to share objects. 'People' refers to all the people with whom the child is collaborating with in the current activity.   Each person is represented by their own colored XO icon and further information about them can be found by mousing over their icon.
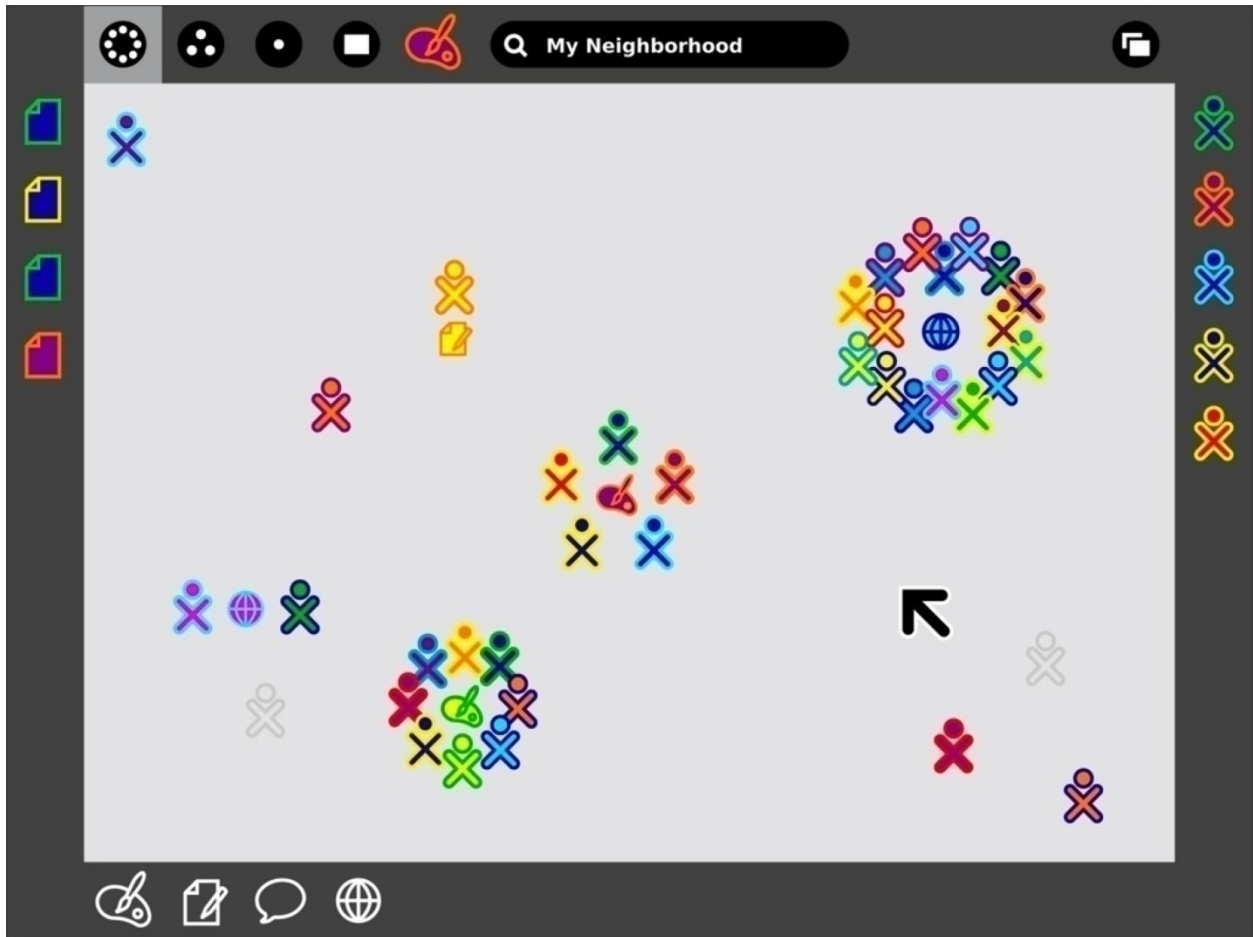
Figure 3 - An Example Frame around a Neighborhood View

The 'Objects' bar is similar to the clipboard found in various locations in both Microsoft and Mac software. It is a location for the temporary storage of objects like images, sections of text, URLs, and other items. This helps facilitate the transfer of data among activities and through various zoom levels.

Finally, the 'Actions' bar contains icons which allow the starting of activities and also displays notifications and invitations from other users. With the most recent in the left corner the child can easily handle them.

All of these bars help complement the central view, enhancing usability and helping to create a visual consistency that is carried on throughout the XO. Similarly the views also create a thematic consistency that increases the ease of use for the user.
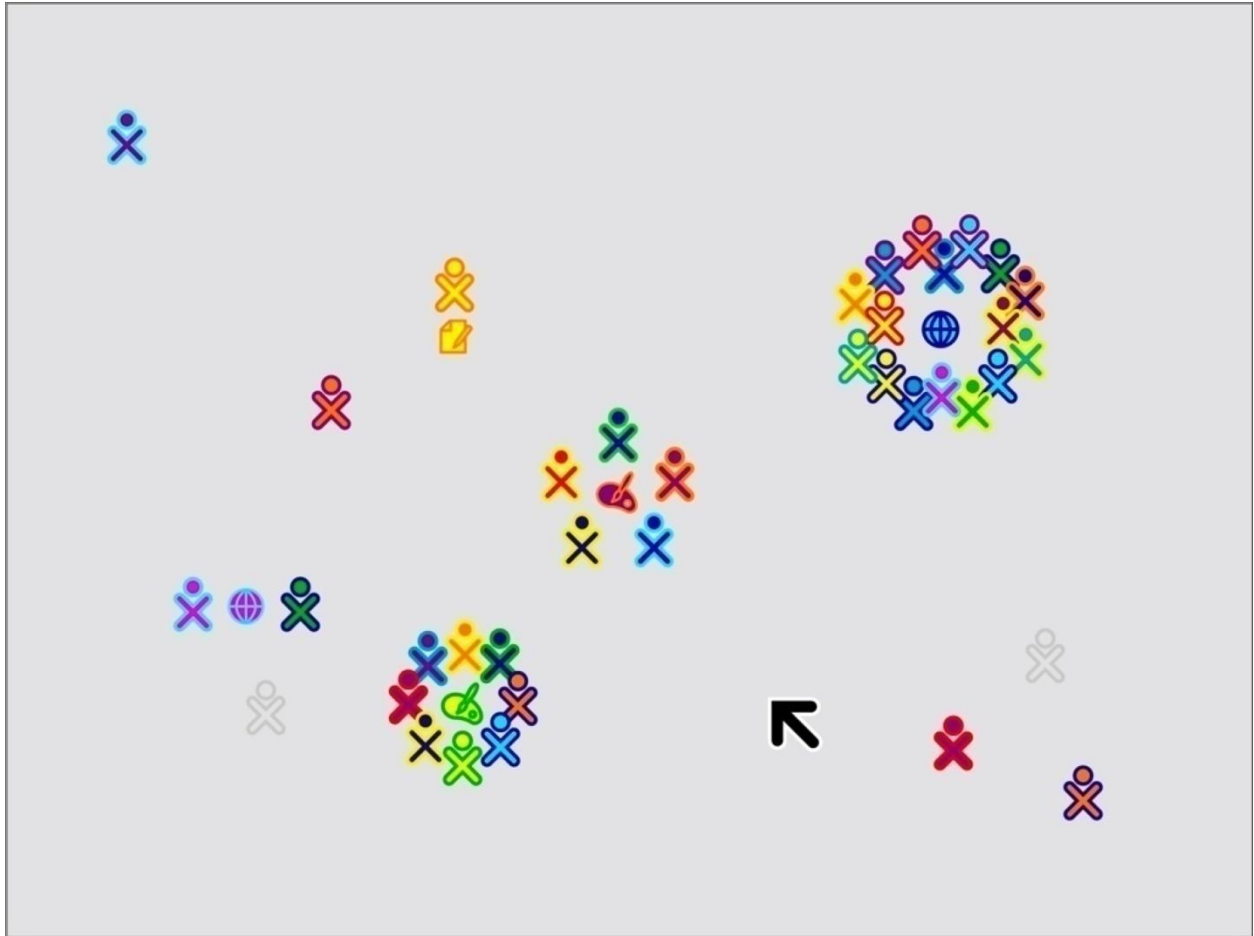
Figure 4 – The 'Neighborhood'

The outermost layer is the 'Neighborhood' view, a geographical representation of the social network as seen in Figure 4. This shows the child local activities, their participants, and network resources. Through clicking on the icons the child can join an activity or talk with a friend.
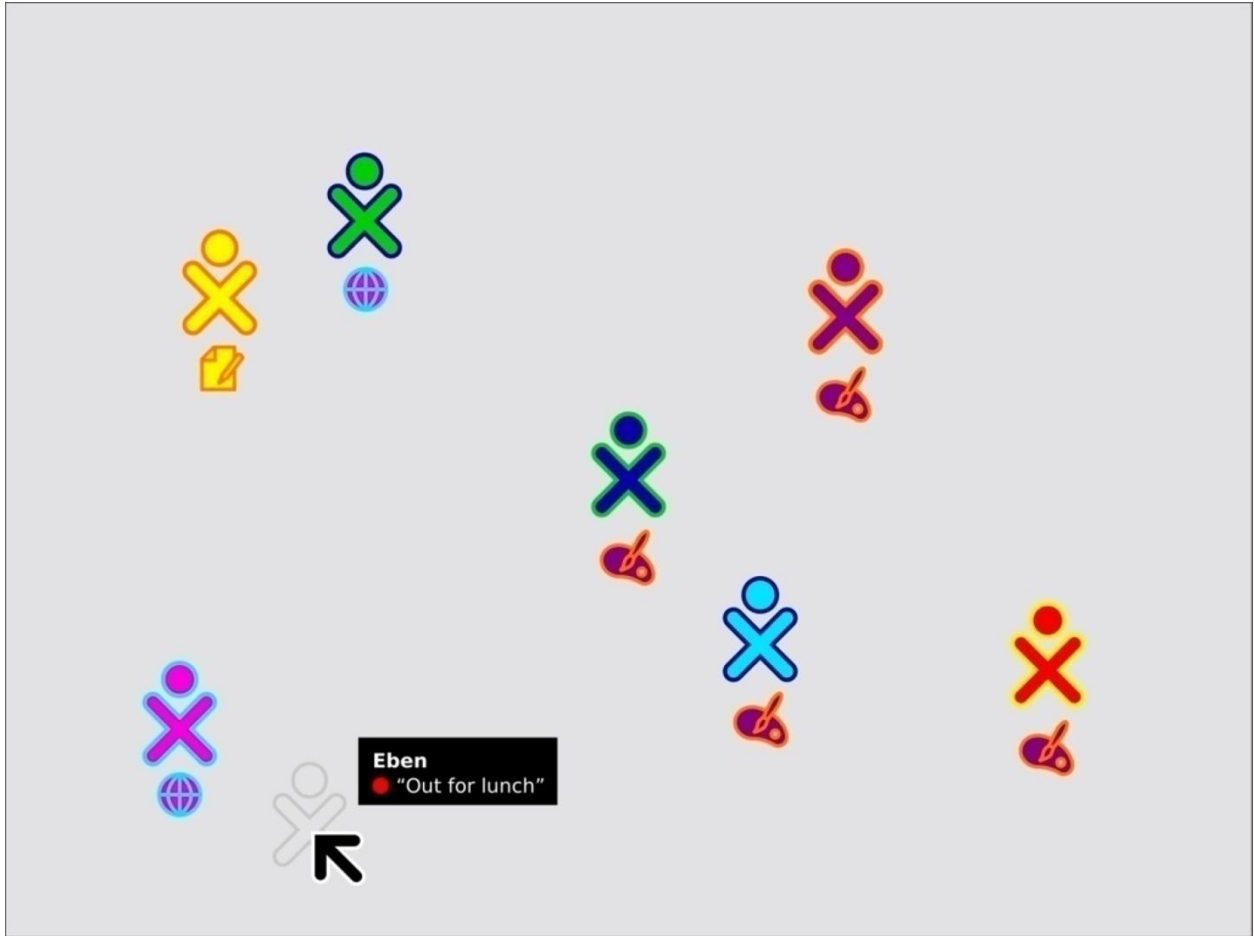
Figure 5 – A View of the Group 'Friends'

The next outermost layer is the 'Groups' view. This is a graphical representation of any groups to which the child belongs. An example of one such group view is the 'Friends' group. Here, as shown in Figure 5, the child can view all the people they choose as friends and see what they are doing.
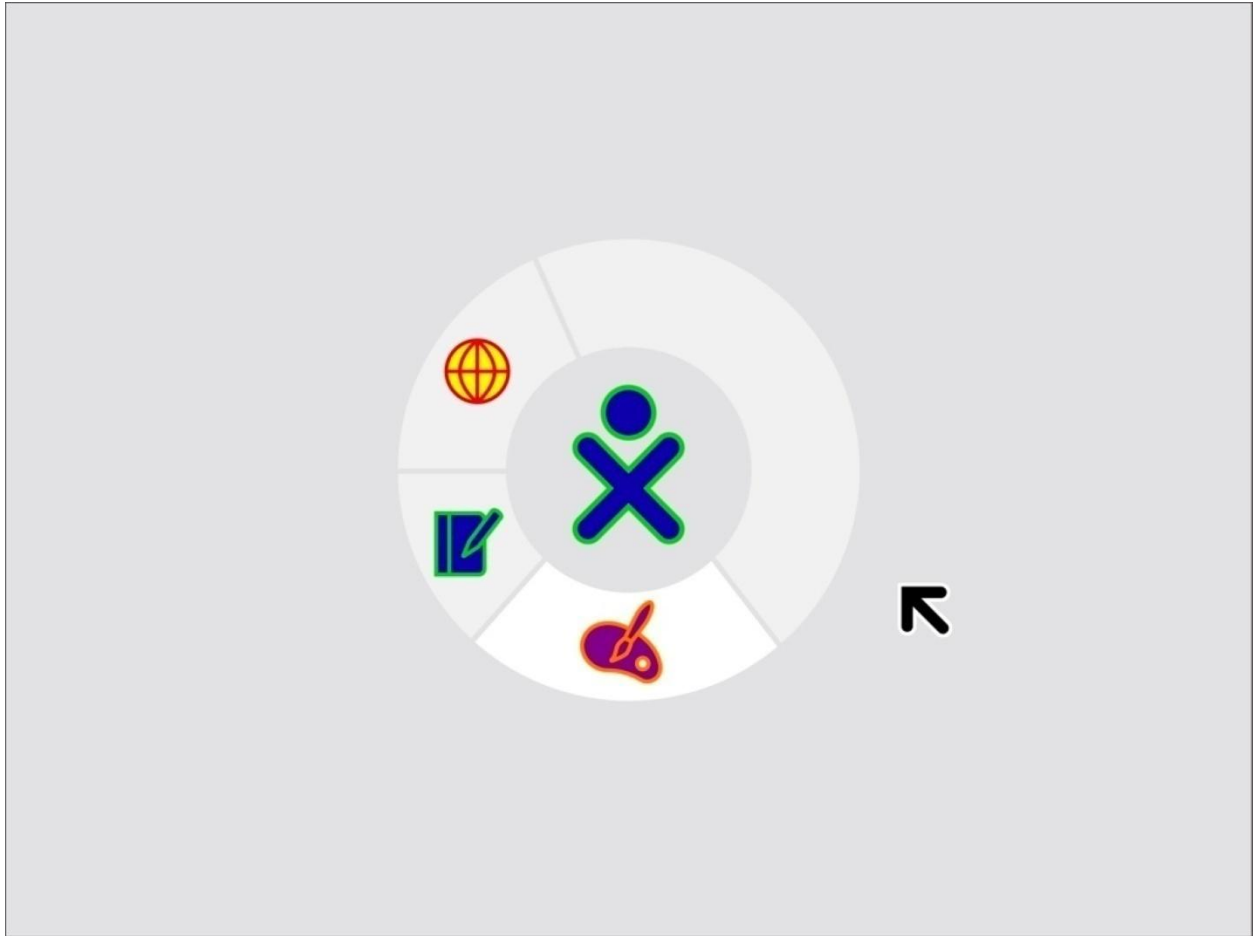
Figure 6 – 'Home' View

The intermediary layer, called 'Home', facilitates multi-tasking and allows the child to switch between running activities, see Figure 6. The center icon is a representation of child's own personal XO character and the colors are chosen by the child. Clicking on this icon gives the child more options, including turning of the XO. The icons around the character are recent activities that the child was involved in to allow fast navigation to items of recent interest.
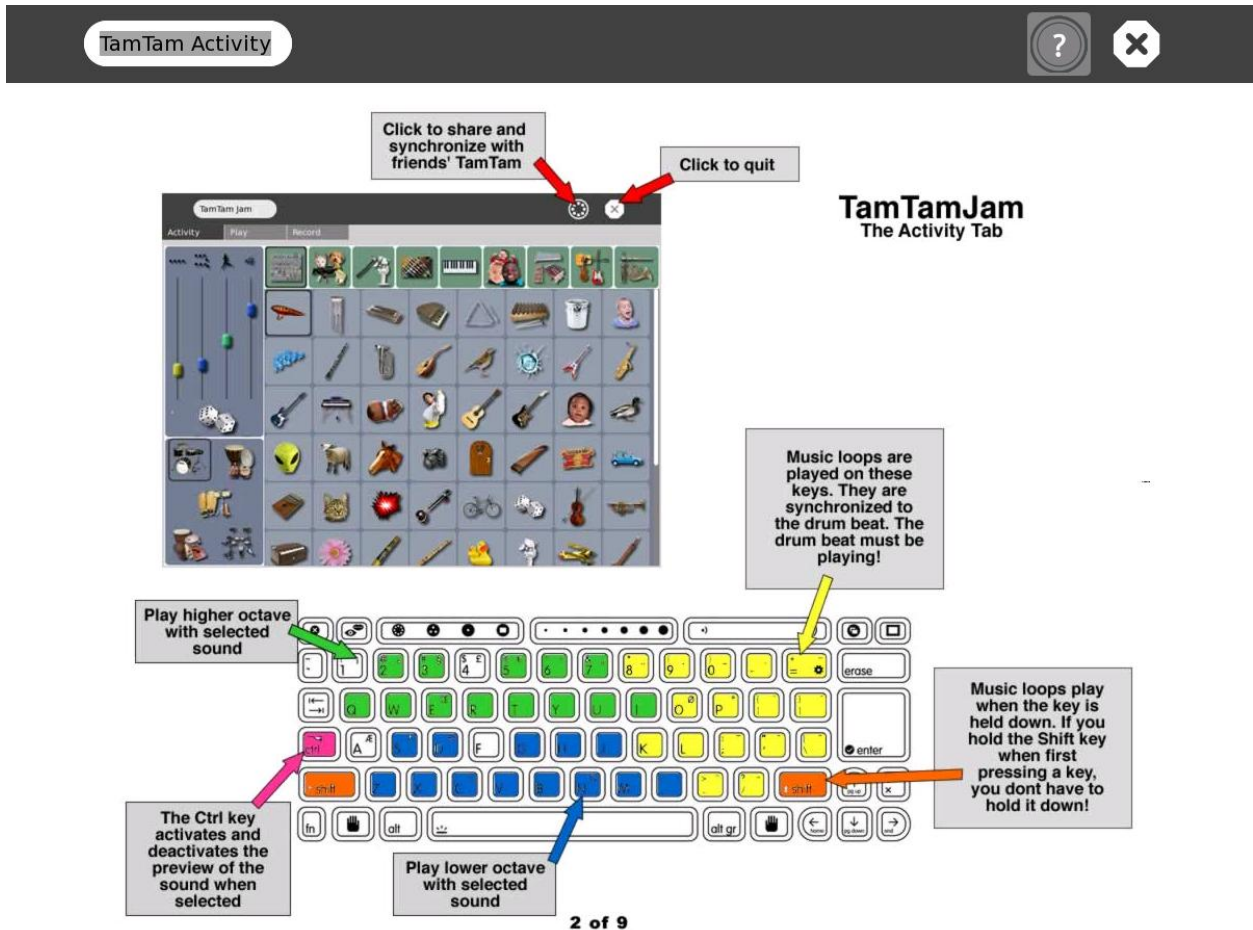
Figure 7 - TamTam Help

The innermost layer is the current activity of the child. An example of one such activity is TamTam, a music creation software, shown in Figure 7. As the figure shows, the user can utilize both keyboard controls and a cursor to select musical instruments and manipulate their sound through choice of octaves and the use of looping specific sounds. There are also buttons to allow the child to share activities with friends and to allow the child to exit the activity,

Throughout all the views the child has access to a collapsible frame that allows the child to start new activities, manipulate the clip-board, and add or remove friends. Each activity also includes a menu bar that allows the child to share the activity with the child's peers. (OLPC, Laptop>Interface)

In addition to the new interface, the operating system uses new metaphors for

storing information. Information is stored as activities that may be resumed by the child in their journal. As these 'paused activities' grow old, ones that have not been singled out by the child will be deleted to make room for new paused activities. If a school server is available, these old activities will be archived on the server. (OLPC, Laptop>Interface)

Many of the design decisions that went into Sugar as well as the inclusion of the Etoys educational programming language try to create a constructionist learning environment where children learn by interacting with the subject material and developing an intuitive understanding instead of a repository of static facts. This type of active, constructionist learning environment has never been made available to the majority of Nepalese.

2.2.3 Programming Languages

Three of the commonly used programming languages for OLPC are Python, Squeak Etoys, and Squeak. Each has their strengths and weaknesses for various applications and makes tradeoffs between their intended user audience and functionality.

Python is a mainstream programming language with the support and documentation that comes with that category. It is general-purpose and high level language supporting object-oriented, imperative, and functional programming styles. There are also many physics engines with support for Python because of its mainstream nature. However, because of this very nature it would make it more difficult for the individual user in the intended audience to adjust, customize, or enhance the game to their specific needs. Nevertheless, the user interface of the XO, Sugar, is written in Python. (OLPC Python Environment)

Squeak Etoys is designed to be so simple to use so that the teachers and even children can modify and adapt activities created in that environment to better suit their needs. It is a child friendly object-oriented programming language designed for use in education and implemented in Squeak. In addition, a lot of the previously made educational software has been done under this format.

Squeak is a modern implementation of Smalltalk and is derived directly from Small-talk-80. It is a highly object-oriented programming language. Squeak was named by OLPC

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Nepal as their preferred programming language for future development of educational software and gives more flexibility and control to the developer than Etoys. (Squeak:Squeak)

2.2.4 Criticisms

There has been criticism of the OLPC project and the XO laptop itself. The majority of this criticism is not directed at the laptop but at the OLPC project in general. A PC magazine columnist, John Dvorak, has stated in one of his articles that there are more present problems, such as starvation, in many of the countries OLPC targets. He believes that these problems should be addressed before distributing the laptops, which could be classified as a luxury product.

Recently a paper was published by two researchers from the University of Chicago on their study of a government sponsored program in Romania to provide computers to underprivileged children (Malamud, Ofer 2008). The results of this government program showed that lower test scores were associated with the students who got personal computers through the program. Many articles have cited this paper using it to refute the claims made by the OLPC program calling the laptops, "$100 distraction devices." However, there are significant differences between the design of the XO and any other computer, which make XO's far more education friendly. Some articles have expressed concerns that the laptops would be used primarily for games. This ignores the fact that most of the games developed for the XO are educational in nature, involving logic puzzles, demonstrating ideas, and otherwise involving the child in the learning process. At the same time, a lot of the same articles suggest the funds allocated to the deployment of the XO would be better allocated to books, food, or other necessities. These articles forget that the XO can store and access far more information than a single book and act as an e-book reader. They also forget that education is necessary to raise the standards of living in these countries in the long term, and that funds for food are only a short term solution. The goals of OLPC echo the old adage "give a man a fish feed him for a day; teach a man to fish and feed him for a lifetime."

2.3 Educational Games

Active learning involves students more in the learning process than other methods. Rather than being lectured at or assigned reading the students are challenged to find information on their own through observation, experimentation, and in this case play.

A basic understanding of physics is such a simple topic that it can be grasped by young children. You drop an apple - it falls. A greater understanding of basic physics can be gained by play and observing the effects of objects connected to each other and what shapes give greater structural stability. However, the raw materials for such play are not always available. There is a similar situation with the availability of an environment conducive to such experimentation. Frequently an environment full of materials for children to play with and adults to make sure they stay safe is a rare, especially in developing nations.

2.3.1 Physics Simulation Games

Educational games are frequently targeted towards a specific age group since it is difficult to maintain appeal, let alone the quality of subject matter over wider ranges. However, there are some with mass appeal. Of those covering topics in the field of applied physics, *Bridge Builder* and *Armadillo Run* approach this coverage of age ranges.

Bridge Builder is a simple bridge simulator. Given a budget and a gap to cross the user must create a bridge to get a train from one side to the other. The user can test the design by running the train over the bridge. If the strain put on the beams is beyond a specific threshold they will break. To complete a level the train must get to the other side; however, multiple attempts are allowed. The user can also view the stress on individual beams and thus observe the distribution of the load. This gives the user a decent qualitative view of how structures should behave. An example of one such scenario with a possible solution is shown in Figure 8 below.
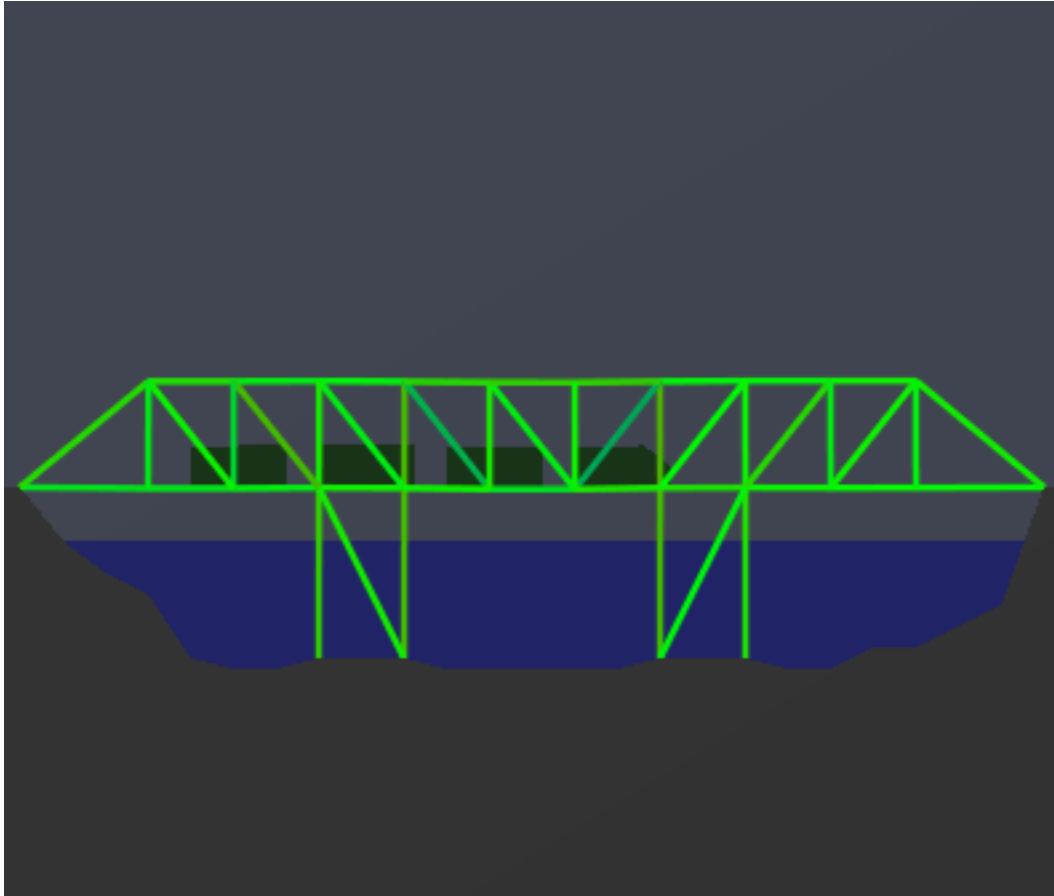
Figure 8 - An Example Bridge Builder Activity

Armadillo Run is a more complex physics simulation game. The goal of this game is similar to that of *Bridge Builder*, to get an armadillo from one point to another point on the field of play on a budget. However, Armadillo Run increases the variety of play by introducing start and end positions all over the field of play. For example, the armadillo may start at the bottom of the field of play and need to get to the top. The player must then devise a means to overcome the pull of gravity and at the same time stop the armadillo at the specific place it needs to get. In another level, it might have an entirely different situation. *Armadillo Run* also supplies the player with a variety of realistic materials to deal with, each having its own respective price and physical attributes. Some of the materials can even be placed under variable compression or be set to break after a user defined time delay. This increases the variety of possible solutions and encourages individual experimentation for an optimal solution. An example Armadillo Run situation with possible solution is shown below in Figure 9.
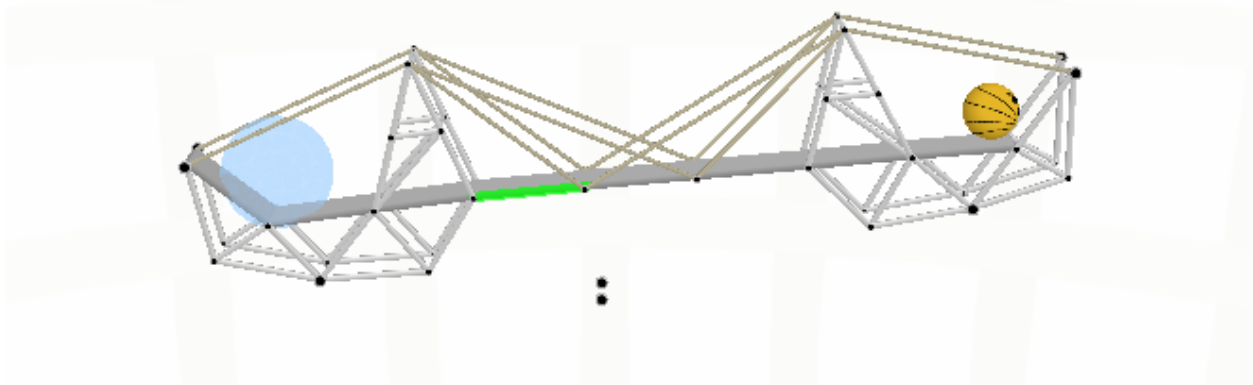
Figure 9 - An Armadillo Run Activity

An educational game drawing on aspects of both these games has the potential to teach kids many basic mechanical principles while having fun. A lot of basic structures are easily discovered through experimentation, like the use of pulleys and weights to raise a platform. More complex structures can be discovered using less complex structures, previously discovered, such as the use of gears in the creation of conveyor belts.

Such a game encourages children to find novel solutions to problems and helps them develop problem solving strategies. It also gives them a venue to play and experiment in nurturing creativity and individual thought. With these thoughts in mind the team's game concept was initially conceived. Squeak's Journey is a game where the child must guide the main character, Squeak, from one location on the screen to another only using the physical forces available to them in the given scenario, most commonly just gravity and normal forces. In each scenario, there is a preexisting environment given to the child, which contains resources for them to build contraptions with, to get Squeak to its destination. In later scenarios the child is also given a budget with which they can purchase other items to complete the task. An example of a simple scenario is the basic suspension bridge scenario. The child is shown a large gap between the platform Squeak is currently on and his portal to the next scenario, each platform has anchor points from which things can be hung or otherwise attached. Also shown on the screen are an icon for the creation of rope and an icon for the creation of solid beams that can support Squeak from falling. To complete this task the child must combine the rope with the beams so that the tensile strength of the ropes supports the beams, the beams being too heavy to support themselves over such a

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large gap, and there aren't any gaps so large that Squeak falls through.

2.3.2 User Interfaces

In part, due to the variety of platforms educational games are created for number and types of user interfaces that they have also vary greatly. A user interface is a means by which the person interacts with a computer program. The choice of a user interface is especially important for educational games since the way people interact with things frequently affects what and how they learn about them. Three common user interfaces include a Graphical User Interface (GUI), a Web-based User Interface (WUI), and a command line interface.

A Graphical User Interface takes input from devices like keyboards, touch-pads or screens, and computer mice, and provides graphical output through a computer monitor or other screen. The popularity of Microsoft Windows and Mac OS are testaments to how easy GUIs can be to use and how the use of graphics exploits the visual nature of human beings. Those GUIs which use touch screens may also be known as Touch Interfaces. These interfaces further take advantage of the wonderful dexterity found in human hands and the ease of use found in directly utilizing their motion.

Web-based User Interfaces, also known as Web User Interfaces (WUI) involve the use of an internet browser. They accept input and generate web pages for the user which are transferred to the user via the internet, as its form of output. This allows a single application to be available to many people possibly geographically isolated from each other otherwise.

A command line interface takes input in the form of a command string through typing and outputs a text response. This is the most direct interaction between a computer and a human of those discussed in this paper because of this a command cannot be mistaken but the user must learn to interact with a purely logical interface.

2.3.3 Physics in Games

Physics in games is frequently dealt with through one of two approaches. One

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approach is the use of a physics engine which is mostly separate from the rest of the code. The other is the incorporation of physics simulating code directly into the game. Those instances where the physics is incorporated directly into the game tend to be specific to individual games and thus the results tend to also be specific to the game.

A physics engine is a computer program that simulates Newtonian physics. Frequently, individual physics engines are constructed with a specific task in mind but there are several multi-purpose physics engines in existence. The most common trade offs for physics engines are between realism and computational time. For example, physics engines designed for use in games frequently trade some realism to allow the player to have real-time interaction with the game. However, a physics simulation for use in science more frequently exchanges the time the computations take for accuracy, especially when safety is a matter of concern, yielding higher precision results.

An example of a common open source physics engine is the Open Dynamics Engine (ODE). It is a physics engine designed more towards the game end of the spectrum of physics engines and thus takes some allowances from realism for allowing faster simulation. It is also an open source library for rigid body dynamics having advanced joint types, integrated collision detection, and friction. It has a C/C++ Application Programming Interface (API), is stable and is platform independent (Open Dynamics Engine - Home).

2.4 Summary

The current political situation in Nepal is unstable; what this means for the children of Nepal is unknown. At the same time, the education system has been improving but still needs great improvement. The telecommunications infrastructure is in a similar state. OLPC is trying to help address these problems through providing children with XOs, which are designed specifically for this situation and are very different from any other computer. However, OLPC is not without criticism and educational software is important for its success. Specifically, the genre of physics simulation games shows promise for the development of educational games.

3. Methodology

Prior to the development of objectives for the development of this project, a crucial decision had to be made. This decision was what development process should be used. Due to the time constraints of a one term IQP and the nature of a constructive project, the team decided to utilize action research with a prioritized list of major objectives from background research and the initial game concept as a development strategy.

Action research is an iterative problem solving process which utilizes a progressive cycle of reflection and refinement of ideas. Ideas are first generated, then formalized and tested. The results of these tests are then used to seed the next iteration of the cycle as shown in Figure 1.
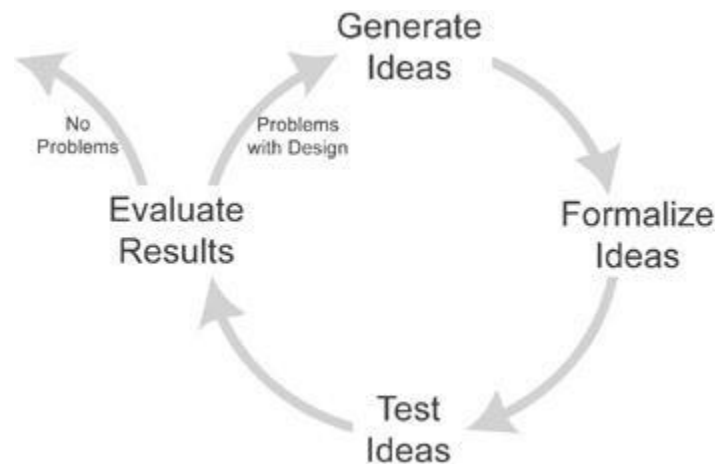
Figure 10 - Iterative Process Diagram (Fullerton, 2004).

If problems are found in testing the topic the next round of iteration continues on the same topic. New ideas and solutions for the problems found become the new starting point. If no problems are found the next topic is then addressed. Thus, there is testing at every step of the design process and not just at the end. This potentially, significantly reduces the amount of debugging in end and allows for greater flexibility in the design process. This is especially beneficial to this project because of the time constraints on the project. The team realized that creating the basis for an educational game of this complexity was a more reasonable goal than finishing such a game. Action research allows the team to leave a firm basis for the game and allow future developers to start off with a functioning and tested starting point. It also allows them to view the structure of the game as a relatively simple

sequence of decisions and see where we were going with the game, through the prioritized list of goals. The prioritized list of goals can be further utilized by future developers, most likely open source developers, allowing them to take small chunks of the development process at a time.

The list of objectives was prioritized by the dependencies of the following goals. For example, the development of levels was put later in the list because the framework of the game was a necessary pre-cursor due to the information about the game contained in its framework. Likewise the creation and development of the intermediaries between the user interface and the physics engine was put earlier on the list because of all the actions that need to utilize that interface.

While there is a prioritized list of objectives, multiple objectives were utilized simultaneously when not directly influencing each other. The compiled list of prioritized objectives used to accomplish the goal of this project follows.

- Determine an appropriate development environment for this game
- Create simulations of the XO environment on other platforms to serve as a development and testing environment
- Determine the most appropriate physics engine for this game
- Design and implement the following game actions
    - Create a game environment in which the user can play with building elements
    - Create building elements for the user to utilize in game play
    - Create levels to supply the user with appropriate goals and resources

3.1 Determine an Appropriate Development Environment

For the purposes of this project a development environment is a specific combination of: a programming language, a collection of resources, and an environment in which to create the product. Three programming languages were considered due to their relevance to the XO. These options included Python, Squeak Etoys, and Squeak. The choice from these was determined through a comparative analysis of each and consultation with the OLPC organization.

3.2 Create Simulations of the XO Environment on Other Platforms

Due to the arrangement of the XO distribution program, outside areas of need it is difficult to get a XO. Our group was lucky enough to be granted access to one XO. However, to properly model the interactions of multiple XO's another means was needed.

Simulation of the XO environment was determined to be the most economically feasible means of creating a development and testing environment for this project. Simulation of the XO environment on other platforms involved choosing what level of emulation would be appropriate, choosing a version to emulate, and what accompanying optional software to load. Choice of emulation was based upon the computer systems the group had access to and would be using for the emulation and project, compatibility with available physics engines, stability of the version, and how up to date the version was.

The options for emulation included partial or complete emulation, and what version to emulate. The benefits of partial emulation include faster emulation, making it easy to develop for, and it is the same machine. However, with partial emulation the environment is not the same as the XO. With partial emulation only the top layers of Sugar are emulated. The host Operating System (OS) is still different as are the hardware limitations. The benefits of compete emulation include: the entire OS is emulated, there are proper libraries, and multiple XO's can be emulated as long as the host system has enough resources. However, there are drawbacks to complete emulation. Complete emulation is considerably slower than partial emulation. The performance of individual emulated computers decreases when more are being emulated than the host computer's number of processing cores.

3.3 Determine an Appropriate Physics Engine

The physics engine options were compiled after searching the internet and other resources for options. The most appropriate physics engine was then chosen after consideration of language support, documentation, and time constraints.

The choices available for a physics engine included the Open Dynamics Engine Construction kit (ODECo) and creating our own physics engine. ODECo is a tool kit or making physics simulations based on the Open Dynamics Engine (ODE).

The challenges involved in creating the teams own physics engine included thoroughly learning an appropriate programming language; developing and finding appropriate algorithms for physics calculations; developing and finding appropriate algorithms for collision detection; developing appropriate pathways for the program to interact with other programs; implementing the program; debugging the program; and testing the program. It was ascertained that the time necessary for the completion of these tasks would consume the time allowed for this project, not giving the team time to work on its primary goal of creating the basis for a physics simulation game. Thus, the team decided against building its own physics engine and in favor of using a preexisting one.

3.4. Creation of a Game Environment

For the purposes of this project a game environment is the user interface and everything in the program that affects the user interface, directly or through another part of the program. Before deciding on the specific components of the program the decision on whether segmentalization would be utilized in the design of the program was decided based upon a comparative analysis. Segmentalization, in the context of this project, is the separation of the program into different parts that are completely separate from each other. So as long as their interface code is carried over to the next revision each segment can be completely swapped with future segments while leaving the rest of the program the same. The advantage of a non-segmentalized design is a reduced memory imprint, which could be important in computer systems with limited computational resources. However, the advantages of a segmentalized design include a greater ability to upgrade individual segments, a greater possibility for backwards compatibility, and a reduction of the need for massive version revisions.

The segments of the program were then decided with future expansion to multi-player capabilities in mind. In these segments, the user interface and physics engine needed to be included. In addition, a consistent means for the physics engine to communicate with the user interface was deemed necessary, for future multi-player expansion, increased segmentalization, and efficient communication between the physics engine and GUI(s). Means of accomplishing these tasks were tabulated and choice was based upon a comparison looking for the factors of simplicity and reduction of duplication of elements.

Options for the user interface were narrowed down to include only those options which could be implemented using the XO and no additional peripherals. The options for user interface included:

- Graphical User Interface (GUI)
- Touch interface
- Web-based User Interface (WUI)
- Command line interface

The advantages and disadvantages of each were considered in the context of developing for the XO and the decision of which to go with was based upon the results. The possible connectivity available to users of the game is a necessary consideration for the effectiveness of the game deployment and thus was considered. Similarly the ease of use for the user and keeping the program along the style of an XO application were other considerations. Finally, the future compatibility of the program with future XO designs was the last consideration used for this decision.

3.5 Creation of Building Elements

For the purposes of this project building elements are the components with which the player of the game constructs structures to meet the goal of the given scenario. The choices among building elements could be divided into two categories. Those based upon real materials and those based upon imaginary materials. The advantages and disadvantages of these two categories were then tabulated and compared. The number of elements to construct was then determined after an examination of the time available for proper development. The elements to be created in this version of the game were then decided based upon the results from the previous two investigations.

3.6 Creation of Levels

For the purpose of this game a level is a scenario presented to the player which the player must solve. The choices involved in level design included those specific to individual levels and those considering the general flow of game play between levels. The issues considered in the development of levels individually were what specific topics would be good

to illustrate. An example of one such possibly level is a scenario where the child explores the properties of a pulley and understanding of the knowledge is necessary for the task to be completed. In addition introductory levels could be used to introduce the player to the interface and game, but the specifics of how many levels and what difficulty they should be at need to be considered. Similarly, issues concerning the overall flow of the game that were centered around the choice between there being an overarching story connecting the individual levels and having the levels be completely separate. The benefits and drawbacks of each option were analyzed and used in the decision with for which direction to take. The number of levels designed in this version of the game was then decided based upon the expected complexity of the levels and the time constraints of the project.

4. Results and Analysis

Decisions were made through action research and development proceeded with these decisions in mind. The design analysis resulted in the choice of a three section program.

4.1 Determine an Appropriate Development Environment

Since our application was using a physics engine, Etoys was too restrictive for our needs. There were minimal documentation and options for Squeak with physics engines, but it was highly recommended and preferred by OLPC. Python, though it had thorough documentation and was fully supported on many physics engines, was decided against due to the preference of OLPC for consistency in material for the XO. Thus Squeak was chosen as the language the program would be developed in and for consistency and physics engine plug-in support version 3.8 was chosen. (ODECo Package)

4.2 Create Simulations of the XO Environment on Other Platforms

The team decided to use a combination of complete and partial emulation to fully utilize the advantages of each while mitigating the disadvantages.

For full emulation the team chose to run version 659, the latest version for the ext3 image, in QEMU. QEMU is an open source process emulator, and is the recommended means of full emulation for Linux based computers. The ext3 image was chosen because it was not for on-board NAND flash memory, like the JFFS2 image, but for running disk images on an emulator. JFFS is a file system designed specifically for flash and utilizes compression and load balancing to prevent wear on various sectors and increase the life of the drive. This makes it specifically specialized for solid state drives and less appropriate for a system that utilizes a hard drive instead. The ext3 image is more general and can be used on a number of system configurations. Since most computers currently use hard drives rather than solid state drives, the ext3 image was chosen. However, the latest stable version of Sugar was not available for the ext3 image so this was kept in mind in the development of the program. With this set up the team was able to have 4 instances of Sugar running on one 4 core server.

To allow these XOs to communicate, virtual network cards and virtual LAN were merged with an existing wireless network to allow communication between the real XO and the virtual XOs on the server. This was done by giving each emulated XO, also known as a Virtual Machine (VM), its own tun/tap Ethernet card. (Krasnyansky, 2000) These cards show up as Ethernet cards in Linux allowing connections to be made between them. This is analogous to connecting the virtual XO via an Ethernet cables or wireless connections, to the host Operating System (OS), other virtual machines, and any other device on the local network. This allows the virtual XOs to interact and communicate with other computers on the local network as if they were real, and allows us to test the software on the real XO, on the VMs and on the computer at the same time and in any combination.

For partial emulation of the Sugar window manager was run in Ubuntu Linux.

4.3 Determine an Appropriate Physics Engine

The team decided that, because the time commitment these tasks would take would require the duration of the time period this project was to be completed in, developing our own physics engine was not a viable option. Thus, this option was decided against and ODECo was chosen by the team for the physics engine.

4.4 Creation of a Game Environment

The team decided to approach the design of this game with segmentalization. This allows the game to be upgrade piece-wise, an important feature for a program whose future maintenance is likely through open source developers and charity workers. The duplication of structures and slight increase in memory usage was decided to be an acceptable trade-off for this feature.

With segmentalization in mind, the application was developed around the data model. The data model represents the state of the structure built by the player and any environmental elements built into the level of the game. It contains node classes and edge classes that contain position information and allows other components of the software receive data from it and edit the data it contains. The code of the data model is self

contained, containing no code from the GUI(s) or physics engine and only contains a representation of the structure and active environment of the game.

The interface of the data model allows the physics engine and GUI(s) to interact with the data model. It contains of pointers to the elements (downstream) and the subscriber notification system (upstream). Any element wishing to interact with a data model element sends a message to the data model element, with reference to itself, asking to be added to the list of recipients of status information. After this initial transaction of data, any future changes to that data model element result in a message being sent to the subscriber. The data model container which is a list of all the data model objects also keeps a list of subscribers. Any subscribers to the data model container are sent updates about data model structure change. The subscribers then use this data to alter the output given to the player. This conversion is done through the user interface.

A graphical user interface was then chosen to be the user interface and was designed using Squeak's morphic system. The morphic system is the default GUI toolkit in Squeak. However, other options included the Wonderland 3d graphics toolkit which was decided against due to its lack of resources for the XO. It was then decided that the GUI would be clearly separated from the data model allowing multiple GUIs to be interacting with the same data model, and as a result, the code of the GUI is independent of that of the data model.

The GUI is a data model editor. It represents the structure of the data model by placing GUI elements on the screen and updates the data model when these elements are manipulated by the user. This allows multiple GUIs to interact with a single data model, as in multiplayer play, but lets the data model have the final say on the data that is given back to the GUIs, creating consistency across views of the game. The GUI then translates the position of the elements given by the data model to the reference frame of the GUI allowing the GUI to be used in any position/rotation.

The physics engine uses the same interface as the GUI. It registers itself with the data model container, and when elements are added it creates wrapper objects which relate a portion of the structure to physics engine constructs. Then during simulation, after a simulation step, the physics engine updates the effected data model elements. Due to the well defined nature of the physics engine interface, the physics engine can be replaced with

any other that can use the interface.

Networking will be achieved through "proxy objects" These objects will masquerade as data element objects but any changes will be sent back to the owner. This way from the point of view of the GUI and the physics engine the data model looks like it exists locally when in reality each local data model consists of the user's own elements and proxy elements and changes propagate to their local authority.

5. Conclusion

Through completing the basis for the game, Squeaks' Journey, the team has met the key goals from the prioritized list of goals and enabled the future creation of a game with a play environment conducive to learning. Of the goals on the prioritized list of objectives the following were completed:

- Determine an appropriate development environment for this game
- Create simulations of the XO environment on other platforms to serve as a development and testing environment
- Determine the most appropriate physics engine for this game

The last major objective, the design and implementation of a game environment and interactions, was partially met. The team got to implementing basic controls for the construction of a game environment but not the actual game environment. Interactions were set as far as the incorporation of the physics engine, but specific scenarios and materials were not developed.

The team has created a list of features which is based upon the unmet goals and will increase the effectiveness of the next version. Overall, the team leaves a good framework for elaboration and enhancement of features in the future.

General suggestions for version two include the following and are described in greater depth below: addition of multiplayer options; enhancement of game efficiency through study of optimal physics engine use; development of game play; development of realistic building materials; improvement of the GUI; improvement of feel as an XO application.

5.1 Addition of Multiplayer Options

The use of segmentalization will allow for networking to be easily added to this program with few changes to the physics engine and GUI. The addition of this ability will better utilize the XOs power as a collaborative tool. This ability was not added due to the time constraints of the project.

5.2 Enhancement of Game Efficiency

Again due to the use of segmentalization the physics engine can be optimized for greater performance while leaving the rest of the program alone. A short study of optimal use could, in the future, better determine appropriate time steps for the simulation steps, and in the future, a physics engine might be developed in Squeak or a better alternative might be found and could be swapped in for the current physics engine.

5.3 Development of Game Play

Game play can be enhanced in the future through the development of a storyline to better keep the user's attention and interest. This could include a better tutorial and a progression of levels paralleling a progression of difficulty. The development of side stories would leave the development of levels open to the more casual developer.

5.4 Development of Realistic Building Materials

The development of realistic building materials could be a major boon for this program. Allowing kids on the small scale to model things on the computer and see how they act in real life. Research would need to be made into the accepted physical tolerances of given materials and also waivers to make sure that kids don't try to use the physics simulation as engineering software, not its intended or appropriate use. Due to the time requirements and the legal knowledge necessary to complete these tasks, they were left for more qualified hands.

5.5 Improvement of the GUI

The GUI can be improved to create a more intuitive environment for the children to play and build. More in depth research into child psychology and the development of interfaces would be needed to optimize controls and ease of use for the children. In addition, child testing and feedback would greatly improve the targeting of the game towards the intended age group and the effectiveness of the game for teaching the desired concepts.

5.6 Improvement of XO Integration

Aesthetic changes could be made in the future to better make the program fit in with the XOs design and the design guidelines put forth by OLPC.

Annotated Bibliography

"A Terse Guide to squeak" http://wiki.squeak.org/squeak/5699 accessed (Friday, Aug 8th).

This guide contains a multitude of small examples of Smalltalk syntax. It served as a reference during development.

"Activity sharing - OLPC." http://wiki.laptop.org/go/Shared_Sugar_Activities (accessed Wednesday, Jun 08 20:12:01).

This article talks about the presence framework and how it integrates with telepathy. This reference contains necessary information for compliance with the guidelines specified by Sugar.

"Bid to Suppress Media in Nepal: Prachand Unable to Face Truth." http://www.centralchronicle.com/20080603/0306281.htm (accessed June 9, 2008).

This website article reports on the warning by the top Maoist leader Prachand toward the media. The warning the media against any reporting negatively reflecting on his party. The website also comments on the Maoists confidence even though they could easily be voted out of a majority.

"Bill Okayed on Ceremonial President." *The Rising Nepal*, May 29, 2008, sec. Recent News.

This article briefly remarks on the first meeting of the new legislature of Nepal. It describes, without going into detail, the passing of a bill provisioning for an office of the president and the responsibilities held therein. It also acknowledges and briefly describes the office of a vice president. The bill also describes briefly what will happen to the property of the former King of Nepal. The translation of the article is a little difficult to read but understandable and the content seems sound.

"Bitfrost - OLPC." http://wiki.laptop.org/go/Bitfrost (accessed Wednesday, Jun 08 20:12:05).

This article talks about security software in use on OLPC laptops and how the Unix security model is outdated and needs revision. This is important information to know if one is writing software for the platform.

"Central Bureau of Statistics." http://www.cbs.gov.np/about.php (accessed May 29, 2008).

This is the main website of Nepal's Central Bureau of Statistics. The data is from a national report from 2001 and is inconsistent with other websites such as the CIA's World Factbook and Microsoft's Encarta. It provides data in table form about Nepal's population divided by age, sex, and/or region.

"Deadlock Over Power Sharing in New Republic of Nepal." http://afp.google.com/article/ALeqM5h-lrl1DDnvgsgjo6I04uiFQRn0vA (accessed June 9, 2008).

This article comments on the deadlock in Nepal over power sharing in the government. It also states that the Maoists have not given up the possibility of going to arms over the issues.

"Developers manual - OLPC." http://wiki.laptop.org/go/Developers (accessed Wednesday, Jun 08 20:11:57)

This website contains the developer's manual for the OLPC laptop. It is a getting started document and provides links to various other, in depth development articles as well as providing a brief description for each. This document served as a good reference for the team, concerning information about developing for a specific part of the operating system.

"Developers/Setup - OLPC." http://wiki.laptop.org/go/Developers/Setup (accessed Wednesday, Jun 08 20:11:57)

This article goes into depth about setting up the different development environments. This includes emulation, real hardware, and running the GUI under another OS. This document served as a reference for information on simulating XOs on a server in order to test our software.

"Emulating the XO - OLPC." http://wiki.laptop.org/go/Emulation (accessed Wednesday, Jun 08 20:11:58)

This article is an overview of emulating the XO it briefly talks about what versions of the ext3 image work on what platforms and mentions issues with presence over Jabber. This will serve as a springboard for us if we wish to get more in depth information about emulation.

"Emulating the XO - OLPC." http://wiki.laptop.org/go/OS_images_for_emulation (accessed Wednesday, Jun 08 20:11:55)

This is an article about emulating the XO on your computer. It's an overview and does not contain any specific instructions. This web page will be beneficial to our project by allowing us to obtain further information about setting up an emulation environment as well as providing us with a rough understanding of the process.

"Fitts's law - Wikipedia, the free encyclopedia." http://en.wikipedia.org/wiki/Fitt%27s_law (accessed Wednesday, Jun 08 20:12:02)

This is an article about Fitts's law. It talks about the speed-accuracy tradeoff and it was used in determining the position of elements in the OLPC's interface. This will serve as a rule when we design our user interface.

"Government of Nepal." http://www.nepalgov.gov.np/ (accessed May 29, 2008).

This is the main website of the Government of Nepal. It contains links to the websites of various divisions of the Nepalese Government and includes a country profile for itself. The translation of the information into English is dubious but understandable. It individually does not have much information on it but links to sites that do.

"Government   of   Nepal   -   Ministry   of   Education   and   Sports."
      http://www.moe.gov.np/index.php (accessed June 7, 2008).

This website contains information on the structure of the education system, its operations, and provides links to auxiliary websites. It also contains information on foreign contributions to their education system and links to related organizations. The news section is current. However, a lot of the actual data has not been updated in the past 5 years.

"Head to Head: Nepal's Monarchy." http://news.bbc.co.uk/2/hi/south_asia/7419863.stm
      (accessed May 29, 2008).

This article contains the opinions of two people who work in Kathmandu on the recent change in government. The first against the change sites the monarchy as part of Nepal's identity, key to reducing outside influence and a symbol of Hindu unity. The second does not consider this to be true. That person sites the growing dislike of the power grabbing by the last monarch and the potential for the Maoists to become a successful mainstream political party.

"How   to   set   up   for   development   on   Linux   emulation   -   OLPC."
      http://wiki.laptop.org/go/How_to_set_up_for_development_on_linux_emulation
      (accessed Wednesday, Jun 08 20:11:55)

This article talks about setting up a VM using the ext3 development image and includes various fixes to make the environment more closely resemble the hardware and to ease development. This article will be beneficial to us because it will provide information as to how to set up an environment that closely resembles the hardware of the actual computer.

"Indian Speaker Greets Nepal for Historic Step." *The Rising Nepal*, May 28, 2008, sec. Recent News.

This article briefly remarks on the congenial response by India to the recent official overturn in government in Nepal. It also remarks on the successful formation of the Constituent Assembly (CA) for the drafting of the new constitution. However, the translation is horribly awkward in some sentences and the last paragraph is all but illegible. There is also little said on the remarks of the Indian representative which seems to be the main topic of the article.

"Major Parties Agree on Power Balance." *The Rising Nepal*, May 28, 2008, sec. Recent News.

This article vaguely references a power balance that was agreed upon by the leaders of the seven major political parties after a marathon session to thrash out the power sharing

between the president and the prime minister. However, the specifics of this balance are nowhere in the article discussed or referenced.

"Nepal in Crisis." http://news.bbc.co.uk/2/hi/in_depth/south_asia/2001/nepal_in_crisis/ (accessed July 1, 2008).

This website is the main page for the BBC's coverage of the Nepal Palace Massacre. It contains links to their collection articles concerning the massacre and aftermath. It also contains links to a Forum on the topic, video, analysis of the situation, profiles of involved members, background on the events around the massacre, and external websites pertinent to the situation. Most of the information seems to be fairly portrayed and is important to understanding the recent political events in Nepal.

"Nepal Hard Hit by Climate Change."
http://timesofindia.indiatimes.com/Global_Warming/Nepal_hard_hit_by_climate_change/articleshow/3103301.cms (accessed June 9, 2008).

This article reports on the dangers brought on by Global Warming in Nepal. It comments on the melting of the Himalayan glaciers, the largest reserve of ice outside of the polar region. The dangerous results include glacial lake outbursts, deadly floods, and falling ice. Other problems include too much rainfall and drought.

"Nepal Maoists make Offer to End Political Deadlock."
http://afp.google.com/article/ALeqM5iIbaKbPPJkMpsjT-4ql3dJ-HrXrg (accessed June 9, 2008).

This article reports on the Maoists revoking their claim on the first presidency of Nepal to resolve the political deadlock. The article also reports on the conflict in the government, with people acknowledging the size of the Maoist party but stating that it should still not dictate things like this.

"Nepal may Earn $3 Mln by Cutting Carbon Emission."
http://news.xinhuanet.com/english/2008-06/05/content_8315938.htm (accessed June 9, 2008).

This article reports on Nepal's use of small hydro-electric projects to get money from various countries an organizations that will provide the monetary equivalent of the cost of the carbon saved by using this source of electricity. It think comments on the rest of the carbon trade.

"Nepal to Raise Fuel Prices to Counter Shortages."
http://uk.reuters.com/article/oilRpt/idUKDEL5592420080609?pageNumber=2&virtualBrandChannel=0 (accessed June 9, 2008).

This article comments on Nepal's government sanctioned raise in fuel prices. This is an attempt to reduce losses by the state-run oil firm and overcome oil shortages caused by fuel prices. This follows Bhutan's price hike on Sunday. The article then comments on Nepal's low oil consumption.

"Nepal Votes to Abolish Monarchy." http://news.bbc.co.uk/2/hi/south_asia/7424302.stm (accessed May 29, 2008).

This article discusses the official turnover in Nepal's government. It is a brief overview of most topics related to the event. It mentions the involvement of the Maoists, what will happen to the royalty, and recent attacks in the run-up to the vote. It also discusses the vote itself briefly and its consequences.

"Nepal's Reclusive Maoist Leader." http://news.bbc.co.uk/2/hi/south_asia/5087004.stm (accessed May 29, 2008).

This article discusses the Maoist rebel leader, Pushpa Kamal Dahal, as a person and a leader. It describes briefly the bloody conflict that he has taken a part in. It then describes his elusiveness and individual person. There is then a brief treatment of the vision of the Maoists and their beginnings.

"Nepali Police Halt Pro-Tibet Protests, 450 Detained."
http://in.reuters.com/article/southAsiaNews/idINIndia-33954820080607 (accessed June 9, 2008).

This article remarks on the Nepalese police's break up of a pro-Tibet rally in Kathmandu. It comments on the use of batons and the brief detainment of 450 exiles, the highest since the earthquake in China. The article then comments on the large number of Tibetan refugees found in Nepal, even though Nepal considers Tibet a part of China.

"Newly Republican Nepal Hopes for a Peace Dividend."
http://afp.google.com/article/ALeqM5jvNlBlGUEEXo6Jnun5AiyGS3KWBw (accessed June 9, 2008).

This new-site reports on the hope following the change in government that a new period of peace and stability will foster economic, educational, and infrastructure increases. It acknowledges the challenges that will face Nepal in getting to that stage but is generally hopeful.

"OLPC Human Interface Guidelines/Activities/Activity Basics - OLPC." http://wiki.laptop.org/go/OLPC_Human_Interface_Guidelines/Activities/Activity_Basics (accessed Wednesday, Jun 08 20:12:03)

This article describes the way activities should behave and how it should look so that it would properly integrate into Sugar. Since our application will run on the XO following the user interface guidelines would be strongly recommended. This document would serve as a reference in that case.

"OLPC Human Interface Guidelines/Activities/Activity Bundles - OLPC." http://wiki.laptop.org/go/OLPC_Human_Interface_Guidelines/Activities/Activity_Bundles (accessed Wednesday, Jun 08 20:12:05)

This article describes how applications for the OLPC are packaged and the difference

between signed and unsigned applications and their propagation through the mesh network. These will be important concepts to understand so that they may be dealt with when developing the application.

"OLPC Human Interface Guidelines/Activities/Introduction - OLPC." http://wiki.laptop.org/go/OLPC_Human_Interface_Guidelines/Activities/Introduction (accessed Wednesday, Jun 08 20:12:03)

This article describes the Sugar activity. An instance of an activity is treated as a file. It is a slightly different metaphor that acts like a combination of application and saved file. Since our application will have to exist in this form this article will help us achieve that goal.

"OLPC Human Interface Guidelines/The Laptop Experience/Bulletin Boards - OLPC." http://wiki.laptop.org/go/OLPC_Human_Interface_Guidelines/The_Laptop_Experienc e/Bulletin_Boards (accessed Wednesday, Jun 08 20:12:03)

This article talks about bulletin boards and how they serve as an efficient means of collaboration between multiple members working on a project. They organize messages geographically instead of temporally allowing posters to refer to portions of the document in question by placing a message on top of that object. If we develop an application that involves collaboration of some sort this type of interface would probably be implemented, in that case this document will serve as a reference and starting point.

"OLPC Human Interface Guidelines/The Laptop Experience/The Frame - OLPC." http://wiki.laptop.org/go/OLPC_Human_Interface_Guidelines/The_Laptop_Experienc e/The_Frame (accessed Wednesday, Jun 08 20:12:01)

This article talks about the frame, the role it plays in the Sugar interface and how it is subdivided into different sections (people, applications, clipboard, and mesh network). Since our application could possibly integrate with the frame this document would be a useful resource.

"OLPC Human Interface Guidelines/The Laptop Experience/The Journal - OLPC." http://wiki.laptop.org/go/OLPC_Human_Interface_Guidelines/The_Laptop_Experienc e/The_Journal (accessed Wednesday, Jun 08 20:12:03)

This article talks about the journal which is a new storage metaphor for storing files similar to the way the human brain retains memory. Files are displayed temporally and unless marked as keep get removed after a certain portion of time. The journal also functions as a rudimentary calendar by allowing for future events. Since our application will have to interface with the operating system we will have to understand this interface in order to be able to save any sort of state.

"OLPC Human Interface Guidelines/The Laptop Experience/View Source - OLPC." http://wiki.laptop.org/go/OLPC_Human_Interface_Guidelines/The_Laptop_Experienc e/View_Source (accessed Wednesday, Jun 08 20:12:03)

This talks about taking advantage of the open source nature of the software by providing a

mechanism to allow the user to look into the source of the application and modify it without much of a penalty. Since the laptop has a physical key for this feature this might be something we would want to implement. In that case this document would serve as a reference.

"OLPC Human Interface Guidelines/The Laptop Experience/Zoom Metaphor - OLPC." http://wiki.laptop.org/go/OLPC_Human_Interface_Guidelines/The_Laptop_Experienc e/Zoom_Metaphor (accessed Wednesday, Jun 08 20:12:01)

This article describes the metaphor used for differentiating between the 4 Sugar windows. The child can zoom from their current activity all the way to a two dimensional social representation of the mesh network. This will give us an understanding of the interface of the operating system and the visual metaphors it uses to represent information. It will help us when we develop the user interface for our application.

"OLPC Human Interface Guidelines/The Sugar Interface - OLPC." http://wiki.laptop.org/go/OLPC_Human_Interface_Guidelines/The_Sugar_Interface (accessed Wednesday, Jun 08 20:12:06)

This article goes into great detail about how various elements of the Sugar interface should look, act, and function. It even mentions a recommended color scheme and diming for animations such as hiding items and other technical details. This will serve as a reference for us because we will need to implement these details.

"OLPC Human Interface Guidelines/The Sugar Interface/Colors - OLPC." http://wiki.laptop.org/go/OLPC_Human_Interface_Guidelines/The_Sugar_Interface/C olors (accessed Wednesday, Jun 08 20:12:06)

This article talks about colors in the OLPC interface and mentions Munsell values which can be used to create color pairs that will work in monochrome mode and in color mode. We will have to follow the methods described in this article if we want our application to be usable in both display modes of the XO.

"OLPC Human Interface Guidelines/The Sugar Interface/Controls - OLPC." http://wiki.laptop.org/go/OLPC_Human_Interface_Guidelines/The_Sugar_Interface/C ontrols (accessed Wednesday, Jun 08 20:12:07)

This article talks about how controls like buttons and toolbars should look and behave and how toolbars should be grouped and oriented. Since we might possibly have toolbars and buttons, the guidelines in this article will be applied in our application

"OLPC Human Interface Guidelines/The Sugar Interface/Icons - OLPC." http://wiki.laptop.org/go/OLPC_Human_Interface_Guidelines/The_Sugar_Interface/I cons (accessed Wednesday, Jun 08 20:12:07)

This article talks about how to properly make icons and how to structure the SVG so that the icons are properly colored by the OS. IF we intend to have an icon for our application we will need to follow these guidelines.

"OLPC Human Interface Guidelines/The Sugar Interface/Layout Guidelines - OLPC." http://wiki.laptop.org/go/OLPC_Human_Interface_Guidelines/The_Sugar_Interface/Layout_Guidelines (accessed Wednesday, Jun 08 20:12:06)

This article talks about the Grid system which is a layout tool to prevent bad placement of controls and the proper way to lay out icons. This is a guideline we will have to follow when designing the user interface.

"OLPC Human Interface Guidelines/The Sugar Interface/Text and Fonts - OLPC." http://wiki.laptop.org/go/OLPC_Human_Interface_Guidelines/The_Sugar_Interface/Text_and_Fonts (accessed Wednesday, Jun 08 20:12:06)

This article talks about the proper text and fonts that should be used in a Sugar interface. We will have to implement these suggestions if we want to comply with the design guidelines specified by the OS.

"OLPC Human Interface Guidelines/The Sugar Interface/Toolbars - OLPC." http://wiki.laptop.org/go/OLPC_Human_Interface_Guidelines/The_Sugar_Interface/Toolbars (accessed Wednesday, Jun 08 20:12:06)

This article talks about the layout of toolbars and how they should function in order for an application to properly integrate into Sugar. Since our application could possibly include a toolbar, this article will serve as a reference.

"OLPC New York - OLPC." http://wiki.laptop.org/go/OLPC_New_York (accessed Wednesday, Jun 08 20:12:04)

This is an article in the OLPC wiki about OLPC metro-area grassroots group. This group is involved in many XO related projects and the experience would be beneficial to our project.

"OLPC in NYC." http://olpcnyc.wordpress.com/ (accessed Wednesday, Jun 08 20:12:05)

This is a weblog detailing the deployment of a large amount of OLPCs in a New York City public school. The experiences written about in this blog will aid us in the development of our software by providing us with information on how these laptops are used by children.

"One Laptop per Child (OLPC), Laptop: A learning tool created expressly for children in developing nations." http://laptop.org/laptop/ (accessed Wednesday, Jun 08 20:11:56)

A subsection of the OLPC website with information about the laptop itself. This page and its subpages provide information about various aspects of the laptop. They briefly talk about the operating system and the design and what the design goals where. This website will function as the spring board in our search to understand the goals and capabilities of the XO laptop in order to make our project reflect them.

"One Laptop per Child (OLPC), Laptop: A learning tool created expressly for the children in developing nations." http://www.laptop.org/en/laptop/hardware/features.shtml (accessed Wednesday, Jun 08 20:11:56)

This goes into some light detail about the OLPC hardware. It mentions all the things about the XO that make it capable of functioning in the environments of the target audience. They talk about how it is capable of functioning in places with a lack of infrastructure by accepting a wide range of power and by creating a self sustaining mesh network. This article will help us better understand the mission of OLPC as well as provide us with information about the limitations and pros of the computer such that we can better design the software.

"One Laptop per Child (OLPC), XO is built from free and open-source software." http://laptop.org/laptop/software/index.shtml (accessed Wednesday, Jun 08 20:11:56)

This is an article about the software on the XO. It mentions the open-source nature of the software and talks about the importance of this choice and their commitment to not imposing boundaries. They talk about their choice of open software and open formats and how these will be beneficial to the project by facilitating interest in computers and not imposing limits on the children with the hopes that they, one day, will be able to contribute to the project too. This section of the website will aid in our understanding of the project's goals.

"One Laptop per Child (OLPC), a low-cost, connected laptop for the world's children's education." http://laptop.org/ (accessed Wednesday, Jun 08 20:11:56)

This website is the main website for the OLPC project. It contains source code, a wiki, and a general project description among other things. The resources provided by this website will aid us in the development and targeting of our software.

"Profile: Nepal's King Gyanendra." http://news.bbc.co.uk/2/hi/south_asia/4225171.stm (accessed May 29, 2008).

This article provides a brief history of the last king of Nepal starting from his ascension to the throne. It briefly describes his appointment of a series of prime ministers and dealing with the Maoist rebels before sacking the government and taking absolute power. It then discusses the public reaction to this move as negative and seriously criticized. The article then moves on to discuss the escalating violence due to the Maoist insurgency and the king's eventual downfall. The article raps up in discussing the king's future as a business man and normal citizen.

"Q&A: Nepal's Future." http://news.bbc.co.uk/2/hi/south_asia/2707107.stm (accessed May 29, 2008).

This article discusses the official overturn of the Nepalese government through a question and answer format. It discusses the purpose of new governmental bodies, the Maoists, the elections, the future of the former king, why these events have come to pass, and the human cost of the events. The article seems to give a fair-handed account of events,

criticizing both sides for their shortcomings.

"QEMU - Debian - Linux - TUN/TAP - network bridge."
http://compsoc.dur.ac.uk/~djw/qemu.html (accessed Wednesday, Jun 08 20:11:55)

These instructions describe the process for setting up a virtual machine. They include sections on networking, acceleration and, various configuration tips and tricks. This will be beneficial to us because it will serve as a reference to us when we set up our test-bed for this IQP

"QEMU Networking." http://www.gnome.org/~markmc/qemu-networking.html (accessed Wednesday, Jun 08 20:11:56)

This article goes into the many different virtual network configurations that we could choose when networking our XOs together. They talk about VLANS, VDE, TAP, and the user mode networking stack and provide examples of how to start a virtual machine using each of these options. In addition to this they provide abstract diagrams to better aid our understanding of these concepts. This article will serve as a reference to us when we determine and implement networking on our test-bed.

"QEMU host «-» guest network bridging."
http://people.redhat.com/berrange/olpc/sdk/network-bridge.html (accessed Wednesday, Jun 08 20:11:55)

This website discusses how to set up a lesser known bridging method. The article talks about the pros/cons of setting up a SLIRP based user space network stack as well as talking about the pros/cons of setting up networking via TUN/TAP with an interface for every machine. This article then goes on to propose a third method which involves a virtual switch on the layer of abstraction of the VM. The article states that this would allow most of the work to lie in user space without compromising security by giving elevated privileges to users so they can set up tun/tap modules for each VM. This method would have the virtual switch connect to a pre-configured tun/tap module. The article then provides instructions on setting up a software router on the host so that the virtual machines can access the external network. This article would be beneficial to us when we determine the means that we will network the Virtual Machines together. We may use some or all of the tips provided in the article.

"Smalltalk Development on XO" accessed (Friday, Aug 8th)

This wiki page describes how to turn a limited EToys development environment into a fully fledged Squeak development environment. The article covers installation as well as some simple Smalltalk structure and syntax. This article will be useful to us because it describes to us how to get an existing Smalltalk code to run on the XO as well as serve as a reference for basic Smalltalk syntax.

"Smalltalk meta programming" http://coweb.cc.gatech.edu/cs2340/6243 (Friday, Aug 8th)

Meta-programming capability is the capability of a language to modify its structure. This

page goes into detail on Smalltalk meta-programming capabilities through Smalltalk's messaging system. This article is useful to us because aside from the abstract concepts it introduces it describes the message passing system in Smalltalk including how errors are handled and how one can implement certain types of behavior using the messaging system. This will be beneficial to our project because it introduces us to some tricks that will help us when we create the data structures in our application.

"Sugar - OLPC." http://wiki.laptop.org/go/Sugar (accessed Wednesday, Jun 08 20:11:57)

This website is an overview of the Sugar UI. Briefly describes elements of the interface such as the frame and the separate views as well as describe the different versions of the user interface available to developers. This webpage will be a good starting point for us when we attempt to develop a Sugar compliant UI as well as helping us find documentation.

"Telepathy Wiki - FrontPage." http://telepathy.freedesktop.org/wiki/ (accessed Wednesday, Jun 08 20:12:00)

This website is the wiki for the communications framework that Sugar's collaboration feature is based on. It connects d-bus tubes together over a network connection and supports both centralized sever modes and distributed networking modes. The former used when a school server is present. If we plan to use the networking capabilities of Sugar this article will serve as a reference for d-bus tubes and Sugar networking.

"Telepathy Wiki - Tubes." http://telepathy.freedesktop.org/wiki/Tubes (accessed Wednesday, Jun 08 20:12:01)

This is a page about the capabilities of the telepathy framework and it talks about different ways hosts using the framework can interact with each other. Knowledge of the underlying framework involved in networking on the XO will help us in the development of our application by providing constraints.

"Ubuntu - OLPC." http://wiki.laptop.org/go/Ubuntu#Option 3 - Deb Packages for Gutsy (accessed Wednesday, Jun 08 20:11:58)

This article talks about setting up Sugar for the gusty version of Ubuntu using packages included in a repository.

"Who are Nepal's Maoist Rebels?" http://news.bbc.co.uk/2/hi/south_asia/3573402.stm (accessed May 29, 2008).

This article treats the identity of the Maoist rebels in Nepal. It cites their beginnings in their anger at the living standards of the rural poor, resentment of castes, and their inspiration from Peru's Ching Path rebels. It describes their beginnings with attacks of government and police outposts and their growth in recognition to one of the most potent rebel groups in the region, including the abduction of hundreds of school children for "re-education."

"X not on the Desktop!" http://matchbox-project.org/ (accessed Wednesday, Jun 08

20:11:58)

This is the homepage of the window manager that Sugar is based on. It is a window manager intended for non desktop embedded platforms with limited resources and/or screen space. This will be a good resource for us because if we ever need to understand the capabilities of Sugar we could study the window manager's documentation. This could aid us in developing our application.

Gurubacharya, Binaj. "Nepal Grants Deposed King Summer Palace Home." http://ap.google.com/article/ALeqM5ga5WjjjXlXf_vRqDUaNe-fQXoqvAD9135JM80 (accessed June 9, 2008).

This article comments on the Nepalese government granting the deposed king the ability to live in the summer palace northwest of the capital city. The palace and most of the royal assets were nationalized in the governmental overturn.

Haviland, Charles. "Nepal's 'Living Goddess' in Limbo." http://timesofindia.indiatimes.com/Global_Warming/Nepal_hard_hit_by_climate_change/articleshow/3103301.cms (accessed June 9, 2008).

This article remarks on the hold up on the appointment of a new "living goddess" in Nepal with the change in government. Previously chosen by the king's priest, a religious panel selected a new girl since the king's priest no longer has any say in the republic. The article the remarks on the many ceremonies, festivals, and other religious occasions that involved the king and the monarchy and their dubious futures.

Labot, Elise. "Changing U.S. Terror Policy in Nepal." (accessed June 8, 2008).

This article remarks on the meeting of US State department officials with the Maoist rebels, previously labeled as terrorists by the US. While the US has not removed the Maoist rebels from its list of terrorist organizations it has decided to help promote a stable democratic country. This differs with the US's stance with other groups like Hamas and Hezbollah.

Lawson, Alastair. "Who are Nepal's Maoist Rebels?" http://news.bbc.co.uk/2/hi/south_asia/3573402.stm (accessed May 29, 2008).

This article treats the identity of the Maoist rebels in Nepal. It cites their beginnings in their anger at the living standards of the rural poor, resentment of castes, and their inspiration from Peru's Ching Path rebels. It describes their beginnings with attacks of government and police outposts and their growth in recognition to one of the most potent rebel groups in the region, including the abduction of hundreds of school children for "re-education."

Mainali, Ambar and Prakash Acharya. "Nepal Declared Federal Republic." The Rising Nepal, May 29, 2008, sec. Main News.

This article reports on the vote to turn Nepal into a democratic republic. It reports the overwhelming majority vote for the change in government. It describes the speeches given in response to the results writing favorably in support of the turnover and less so about

those against. The article also remarks on a bit of controversy during the voting, when one member claimed another had been involved in the murder of her husband. The translation into English is relatively good and though the article is relatively biased it provides good first hand quotes from people involved.

Malamud, Ofer and Cristian Pop-Eleches. "The Effect of Computer use on Child Outcomes." Working Paper, .

This Working Paper describes a study recently done in Romania on vouchers for computer purchase and the outcomes of children. It one of the main sources in the recent backlash against OLPC, even though the study did not utilize the XO but common computers. The article showed negative outcomes for these children but acknowledged that positive family situations frequently mitigated those results. There is minimal data given in the report on what computers were actually used and what applications were on the computers, so the applicability of this study to other cases is questionable. While the article seems relatively unbiased many of the claims others have made based upon it have been, ignoring whether the results are directly applicable to other cases like OLPC.

Mitra, Sugata and Judge, Paul. "Hole-in-the-Wall." (accessed July 2, 2008).

In this article an Indian physicist details an experiment he performed to explore computer use in children. His novel approach was to embed a computer in a concrete wall, giving the public free access to it and monitoring it only through a remote computer and video camera mounted on a nearby tree. The computer was connected to the internet as well. He discovered the primary users were ghetto kids between the ages of 6 and 12. A lot of the kids had no outside influences that would have helped them learn how to use the computer. The article then moves on to an interview with the Indian physicist and where other various findings were detailed. While the author and physicist in this article may be optimistic about future implications of this research; the results help support the relevance of the goals of OLPC.

Ohshima, Yoshiki and Kazuhiro Abe. "The Design and Implementation of Multilingualized Squeak." 2003.

This article describes the design and implementation of the Multilingualization of Squeak and the specific constraints that were faced. It describes the necessary extension of the character set, changes in character and string representation, adaptation of keyboard input, conversion from previous input formats, and lastly the multilingualization of SqueakToys. The article is generally well written but does contain some grammatical and spelling errors

Press Trust of India. "Nepal's Economic Growth Reach a Record High." http://www.business-standard.com/common/storypage_c_online.php?leftnm=10&bKeyFlag=IN&autono=39563 (accessed June 9, 2008).

This article briefly remarks on the recent economic growth of Nepal. It also comments briefly on the lack of increase in real purchasing capacity of the people due to high inflation.

Rajkarnikar, Amar and Tamang, Dipendra. "Head to Head: Nepal's Monarchy."

http://news.bbc.co.uk/2/hi/south_asia/7419863.stm (accessed May 29, 2008).

This article contains the opinions of two people who work in Kathmandu on the recent change in government. The first against the change sites the monarchy as part of Nepal's identity, key to reducing outside influence and a symbol of Hindu unity. The second does not consider this to be true. That person sites the growing dislike of the power grabbing by the last monarch and the potential for the Maoists to become a successful mainstream political party.

Sarkar, Sudeshna. "Pushed by India, Nepal Orders Fuel Price Review." http://www.thaindian.com/newsportal/south-asia/pushed-by-india-nepal-orders-fuel-price-review_10058210.html (accessed June 9, 2008).

This article comments on the unrest triggered in India by the recent fuel hikes and what it means for Nepal. The article also comments on the loss of money due to the Nepal Oil Corporation's policy of buying oil from India at world market rates and selling it in Nepal at a subsidy. It finally comments on the price hike as necessary to keep the organization out of bankruptcy.

Spinellis, Diomidis. "Ameso - the Antikythera Machine on Squeak EToys." http://dmst.aueb.gr/dds/sw/ameso/index.en.html (accessed June 9, 2008).

This website is a project page for the Antikythera Machine. It showcases the use of Squeak Etoys in the computer simulation of this ancient machine. It also contains screen-shots, documentation and open source code.

Vijay, Tarun. "Nepal's New Kings." http://timesofindia.indiatimes.com/Columnists/Tarun_Vijay_Nepals_new_kings/articleshow/3099682.cms (accessed June 9, 2008).

This article comments on the elections held in April of 2008. It rather negatively recounts the atrocities done by the Maoists and speaks well of those people who prevented the Maoists from getting a full majority. It then remarks that the peaceful political parties of Nepal see no issue with the Maoists taking the Prime Minister's post by their being the largest party but have qualms about them also taking the other two high posts. He uses an analogy to Hitler in this description of the situation and then references Stalin.