

# An Investigation of Issues Facing Human Computer Interactions: Blind People Perspective

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**Abstract**—This paper examines and investigates on issues that facing human computer interaction (HCI) on blind people perspective. Due to advance in technology now days almost everything uses computer. Blind people have one disability but they can be potential on other area in society if they'll use assistive technology. This paper is aiming to reveal the capabilities of blind people on the way they can use computer. As you study a human being has five common sense organs. Then by using them; a person can provide inputs to computer hence interaction. By using normative writings on this paper, we are going to look on those issues on how to design the computer that will bear in mind that the user has no sighting capability. In this paper it has been observed that blind user can use computer, and perform tasks in computer as others do. Bad designs, effect of the depression from the society have made them not to show their abilities. As a result it has hindered growth of HCI to the blind people. We believe that blind people if they are given chance and time to learn thing they can do it perfectly.

**Keywords**—Human Computer Interaction, screen reader, HCI design for blind, HCI education, assistive technology.

I.

## INTRODUCTION

“Human Computer Interaction (HCI) can be viewed as two powerful information processors(human and computer) attempting to communicate with each other via a narrow-bandwidth,highly constrained interface”(Tuftte, E.R., 1989; Dix, A.J., et al, 2004). Communication between those two is established by the process of exchanging inputs/outputs to each other. User's outputs become computer inputs and computer's outputs become user's inputs (Dix, A.J., et al, 2004). Hence by that process we get human computer interaction (HCI).

Human Computer Interaction (HCI) is defined by (ACM SIGCHI, 1996) as "a discipline concerned with the design, evaluation, and implementation of computing systems for human use and with the study of major phenomena surrounding them" (Dix, et al, 1998). Another definition given by Preece, J., (1994) that Human Computer Interaction (HCI) is “the discipline of designing, evaluating and implementing interactive computer systems for human use, as well the study of major phenomena surrounding this discipline”. “HCI involves the design implementation and

evaluation of interactive systems in the context of the users' task and work”(Dix, et al, 1998).

Now HCI for blind people is discipline concerned with the design, evaluation and implementation interacting computing system for blind people's uses, with the study of major phenomena surrounding them associating for computer machinery.

The study of HCI to the blind people is relatively new area of research. In this paper we look on the issues that face HCI on blind user perspective(Sri, H. K., et al, 2003).This paper based on blind people issues concerning computer uses on how they interact with it in day to day activities of computing. We will look on design for blind people, technology for them and affordance of that technology to the blind user.

Many technologies about HCI for blind people come to existence. Designers have made a certain contribution to the HCI for blind users by bringing some product on the world. But high cost of those emerged technology has brought even more problem to the HCI for blind users. Many of blind people are living dependent life. Thus sometimes is not easy to buy product of high cost. Product like screen reader and screen magnifier are in high relative price for blind user to afford compared to what most of them can afford.

Blind user motivation and participation on computer uses is also a problem to the improvement of computer uses in the HCI to blind users. Blind people have not got knowledge of tools and technology made for them. For a new technology to blind person without training; is useless even if he/she can afford to have that technology. So the clear understanding and skills on those tools is still challenge to the blind user.

Blind users are capable and have talents of doing a lot of things which other people cannot do. Some of them have lost their sight when they are adult people. Thus you can find them still potential in the society. If they could get assistive technology they can do a great contribution on their society. Thus they must be considered in design of technologies so that to suit for them. And it has been

In this paper we are going to answer the question that will add value to the HCI based on blind user perspective, which is: -

- What should be done by designers, society and blind users themselves to make sure that blind user are effectively involved in Human Computer Interaction process in their daily life?

## II. METHODOLOGY

We began our analysis by passing through a number of paper work of other scholars on the related work of HCI for blind people. The materials used in this work were the published papers, non-published paper, articles on websites of vendors concerning the blind user perspective on HCI. Also websites of vendors who provides services on tools (software and hardware) for the blind people was visited and we read on them and get to understand their contribution on blind users of computer.

Computer searching on databases of various publishers used to get the right paper for this work. Tools like websites used to make analysis of this paper. Knowledge and skills on searching related material on web have highly been involved on looking the related paper.

From the gathered material we looked on the related titles that explain on the work that we were going to make research on it. Any unrelated titles their work were banned and not even added on the work. We looked on the related title but also we based on the publishers of that paper so that to satisfy ourselves that the work we are going to refer has passed through the hands of standards of well known publishers.

Based on literature review, we have answered the research question. Many writers on the reviewed papers have talked about several of factors that face blind users in daily life. By studying many things that are in daily lives of blind people psychological, physical and social thing we have seen that there some things to be done to involve blind user effectively in uses of computer.

## III. HOW DESIGNERS CARRY ON THEIR MIND BLIND PEOPLE

**Designing** itself can be defined from deferent point of view. You can define it from noun point of view or verb point of view. As a noun; design is a specification of an object, manifested by an agent, intended to accomplish goals, in a particular environment, using a set of primitive components, satisfying a set of requirements, subject to constraints; As a verb; designing is to create a design, in an environment (where the designer operates)that put user needs into consideration (Ralph, P. & Wand, Y., 2009).

Another definition for design is a roadmap or a strategic approach for someone to achieve a unique expectation. It defines the specifications, plans, parameters, costs, activities, processes and how and what to do within legal, political, social, environmental, safety and economic constraints in achieving that objective (Don, K. Y., 2011).

Designing is transforming conceptual user needs/requirements to the desired output to meet those needs. In designing you must put your user on the mind so that to design on his/ her point of view.

In designing there is goal and constraints have to be meet so that to come up with good design. The **goal** is, it must be kept on mind the purpose of design that is interested to be designed, who is the intended person or group of people of that design, what is exactly the reason behind the push factor for them to need that design, and the **constraints** is, what material must be used, what standards must be adopted, how much can it cost, how long will it take to develop?, are there health and safety issues to consider?.

A blind person is a person with sighting disability. But that person can have functioning others sense organs like sensing (touching), smell, testing and hearing. That person can have skills on those other sides of sense organs that can enable him/her to provide inputs to the computer and get to understand some outputs from computer hence they bring the term Human Blind Computer Interaction. As we know that human outputs become inputs to the computer and vice versa.

In blind people perspective we look designing as to bear with blind person capability and transform his/her needs of computer uses to meet those capabilities and get the services of computer as one gets with no blindness. We look to design for them. We look on how the blind user's needs or requirements can be transformed from concept based up to the really working tools to assist them in the daily computer uses.

In HCI for blind people designers have put into consideration hardware and software matters. There are special devices and special software that help them in interaction with computer. By put into consideration those left sense organs the design came and try to bring into the family of computer user those with sighting incapability. These according to (Alasdair King et al, 2008; ,freedom scientific, 2014;&DO-IT, Universty of Woshington, 2002-2014) have shown that there is a lot that have been done to make sure that the blind user are involved in HCI. They have show hardware and software designs for the blind user in different categories.

Let's now get to look some of the technologies that have tried to involve blind users of computer in Human Computer Interaction. Here are hardware and software technologies evolved: -

### A. Hardware

Here we look on how various devices have been developed to support blind people in interacting with computer. Those hardware we look even in computer themselves, and see if there are special computer hardware that have been designed for blind people. There are some hardware technologies that have emerged to support those people just like large print keyboard, PAT mate omni<sup>TM</sup>Plax talk®, JAWS training Bundle.

**Focus Blue** is Braille Displays hardware. It has been shown in (freedom scientific, 2014) focus blue is very useful to blind people. It has stated that "These world-class refreshable Braille displays provide access to information from a computer" (freedom scientific, 2014). The devices have a Bluetooth technology in it. The robust Bluetooth connectivity provides seamless use with Windows, Mac, phones, iPads, and Android smartphones and tablets. The Braille keyboard has agood controllable environment layout for comfort and control uses for blind person.

**Large Print Keyboard:** According to freedom scientific (freedom scientific, 2014) the Large Print Keyboard provides low vision computer users an easy-to-read keyboard with bold, high-contrast keys for fast, accurate typing. This keyboard was designed and developed to enhance the user experience with MAGic and JAWS. The blind user can touch and feels the keys and get to know what exactly what will be inputted in the computer after hitting that key. It is the best for the user with the knowledge of Braille technology.

**PAC Mate Omni™:** Ultimate Mobile Computing Solution for the Blind. This portable and reliable computer device provides speech or Braille access to Windows Mobile applications for people who are blind. Seamlessly synchronize the PAC Mate Omni with your computer to update your email, contacts, appointments, files, tasks, and even Web favorites every time you connect (freedom scientific, 2014). A user can opt to use a sound input/output or Braille input/output technology. So it is multipurpose devices for the blind use who wants to have it.

**PLEXTALK®:** Pocket DAISY Player/Recorder. Listen to books, play music, keep memos, and record on the go with the PLEXTALK recorder and DAISY player. According to freedom scientific (freedom scientific, 2014) the PLEXTALK Pocket is perfect for school, the workplace, hanging out with friends, or at home reading a good book.

**JAWS® Training Bundle:** According to freedom scientific website (freedom scientific, 2014) the JAWS Training Bundle, developed by the Freedom Scientific Training Department, contains over 50 hours of high-quality one-on-one JAWS training. The training was produced in audio format and uses the DAISY standard, which allows for easy navigation and bookmarking of the training material.

### B. Software

From software point of view also the designers have made a great role concerning blind people. Some of softwares have been developed to meet blind user needs. Great and complex technology on programming languages have been used to make sure that the blind people get what a normal people with sighting capability get blind people can also get. The software of reading screen (screen reader) use speech synthesizers to read text from screen and produce voice to the user. Screen magnifiers are software used by visual impaired people. They are used to magnify an area on screen and make it bigger for one with little sighting capability can see it. Here is some of software from their vendors.

**JAWS®:** The world's most popular screen reading software. JAWS enable people with vision loss to independently use a computer with a keyboard, speech, or Braille display. With JAWS, you can navigate the Internet, write a document, create spreadsheets and presentations, email correspondence, and much more from your office, remote desktop, terminal servers, and from home.

**OpenBook® and PEARL®:** Scanning and Reading Solutions. This scanning and reading system instantly converts printed materials to speech or Braille output on your computer. OpenBook gives you access to what you need to read, whether it's a book, classroom assignment, bill, or PDF document.

**Screen magnifier** application, such as ZoomText from Ai Squared, magnifies a small area of the display, potentially filling the entire computer screen. Many people with a significant visual impairment have some degree of residual vision. These are assistive technology solutions for them.

The user can move the area being magnified around the desktop. This allows the user to control the computer interface directly, and is a good solution for people with gradually-degrading vision, especially those who are already familiar with their computer interface but are starting to have trouble seeing it (Alasdair King et al, 2008).

By looking on those two perspectives of hardware and software we can see that designers are doing a lot of design tasks to make sure that blind people are included in HCI. The use of Braille to integrate it with computer, the use of speech synthesizers to read all the text and output it in audio form make the user to feel that they too are the part of HCI.

### IV. HOW BLIND PEOPLE MANAGE INPUT/OUTPUT ACTIVITIES WITH COMPUTER.

We know that the human output is an input to the computer and computer output is an input to the user. These two have their own ways of processing those input/output from each other. If the input/output process will be effectively conducted by each side and every side gets to understand the inputs provided by the corresponding side then there is where we get the Human Computer Interaction (Dix, A.J., et al, 2004).

Now we will look on how blind people can interact with computer and manage to make it do what he/she wants. According to (DO-IT, University of Washington, 2002-2014) stated that "Individuals who are blind cannot access visual material presented on the computer screen or in printed materials. Fortunately, specialized hardware and software can make computer systems usable by individuals who are blind". They can use those technologies to make the mechanism stated up above of human output to be input to the computer and vice versa (Dix, A.J., et al, 2004) to interact with computer.

Previous we saw that a blind person has missed only one capability on his/her body which is sighting. But on other side they have those four sense organs to use them for HCI. We have tried to look on other sense organ, and see on how by using those sense organs; blind person can interact with computer.

We have seen human in general input occur through the senses organs and output through the motor control of the effect. Among the five major senses, which are: sight, hearing, touch, taste and smell the first three are the most very important to interact with computer (Dix, A.J., et al, 2004).

For the case of blind person, they have four sense organs: hearing, touch, taste and smell and first two to them are very important to HCI. As we have explored from those two perspectives of hardware and software on how the designers have put in their mind to consider the blind people in their design, we have seen that in each of design technology they have dealt with those two senses. Which are hearing and touching (feel).

By using Braille technology with key labeled keyboards can be used to provide input to the computer (DO-IT, University of Washington, 2002-2014). Because blind people can touch and feel, hence they can be able to learn new things. Thus they can feel what has been in the labeled keys of Braille keyboard.

Also in computer there is microphone which can take user sound. User voice is an input to the computer. Voice recognition software that allows the computer to be instructed by using voice. As the computer can understand human voice that means blind people can also use computer by using voice as an input means (Dix, A.J., et al, 2004).

Artificial Intelligence (AI) is the robotic computers that can learn and act hence do as human. The computer can learn human characteristic and act as instructed. The system can detect the action that user repeat several time and it can do by itself. The computer which uses a natural language to communicate (Dix, A.J., et al, 2004) makes it easy to blind people to command computer for their needs. So in that case the computer can produce the input for itself for users' sake. Thus blind user can teach his/her computer to perform task for him/her.

**Screen reader** software provides blind people with the audio format output of all text displayed on screen (freedom scientific, 2014). A user can listen from his/her computer to get what is presented on the screen and user gets to know exactly what is required to do at a particular time. By using earphones, the process can make user to control voice for the unintended user or people (DO-IT, University of Washington, 2002-2014).

So there we have seen that blind people can interact with computer in some aspects. Developed technology has enabled blind people to supply input to the computer and get output of understandable form. Braille display also has made the HCI to the blind person to be friendly. Somebody can read from Braille display without even bothering other people with noise pollution.

By using consistency designing: consistency design can make a blind person to know where certain key are usually placed. And this is done by using a touching sense capability. User can touch a key by using human-main memory recalling, getting what he/she intended to perform. For example in mobile HCI, you can find a blind person uses his/her phone comfortably. This is due to consistency design (Dix, A.J., et al, 2004). Placement of key make them to remember exactly what they are pushing is a navigation button or something else. So here we get to know that consistency of placement of keys can make the blind people to interact with devices easily helped by (HIP) Human Information Processing Model (usabilityfirst.com/usability-methods/, 2002-2014; Eberts, R. E, 1994; Card, S., & Newell, A., 1993), (Dix, A.J., et al, 2004). Mental model make user to go straight to the key because it is stored in the memory. Mental model are very important they make user to predict commands and make easier of interpret system actions (Sri H. K. et al, 2003). For a blind user, this mental model is acquired by audio-mediated experience.

## V. ISSUES FACING HCI

There are many things that have been discussed in this paper concerning blind users of computer. We have discussed about technologies and designs deployed to make sure that blind people use computers and get services as people with eye sight gets. Despite of these technologies and design that we have seen before but still there are a lot of issues that facing HCI on blind people perspective.

### A. Technology

Technology has been an issue concerning HCI to blind people. According to Thomas C. Weiss (2013) blind people clearly face a big challenge when they access the web page in website. Challenges in compatibilities of software like screen readers and web contents. Screen readers usually have issues when designers fail to place appropriate text tags on links, graphics, tables, or forms. That it has been seen that is not easy to interpret some of those mentioned thing like video, tables, images to voice output. Things like figures and images can not be translated to narrative form.

The ambiguity in different platforms of Operating System lead to complexity of some software for blind to work to suit the user needs. The companies that produce OS have nothing to share to each other. That is you cannot install software designed for a certain OS to another OS. You might find that user has a certain kind of device with pre-installed OS. But find that the software that fits for his/her needs belongs to another vendor. And technology does not allow user to use it until he/she buys a compatible device with that software of blind user.

### B. Cost

We have seen that the product are ready on market and designers have made the great role to bring the product into existence. Software like screen reader, screen magnifier, JAWS and many more, are the software for assisting blind user. But the products that have been brought to the market their price is very high for an ordinary blind person to afford. Most of people with disability are not well being in economical aspect. Thus the equipment to be in high price is like to forbid them to use it. According to (sightandsound.co.uk., 2002-2014) JAWS professional suit costs £845.00 (excluding tax) approximately 1.5 million Tanzanian shillings.

According to (nfb.org/technology-resource-list., 2002-2014), super nova access suit is a package which is a combination of the SuperNova screen access program and the SuperNova screen magnification program. Price of Supernova Access Suite, \$1,195 which is approximately like 2 millions Tanzanian shillings.

By looking at those systems/ software we can see exactly that cost of these tools is an issue to the blind people. A normal person cannot afford to pay that amount of money. Only few people will be able to buy this software.

### C. Education

Despite of availability of tools; and has been seen that the blind people can be use computer and be the part of HCI, but the matter of education/training to them is still a challenge. They are not educated or trained enough to use these tools made for them.

According to (Andrew L. assistivetechology.about.com, 2013-2015), "No matter which technology one chooses, a blind person cannot simply purchase a computer and screen reader and expect to use it effectively without training. The sheer number of commands within JAWS constitutes a new language. You could figure out a few things, but likely wouldn't get as far as you want".

We know that for a blind user it is difficult to learn new things of technology by themselves. Especially in the first time of using a new technology a blind user really needs help in it. Thus the training to them is an issue which hinders their participation on HCI.

There are training resources, but on other side they too have been a challenge to these users. Some of them to be used it needs some training first. Some of it adds cost to the user because they are the tools to be bought. And they need to be leaned too. According to (Andrew L. assistivetechology.about.com, 2013-2015), some of training tools include:

- Webinars on manufacturer sites and institutions such as the Hadley School for the Blind
- Training materials in accessible formats from companies such as Handy Tech North America in Columbia Heights, Minnesota
- Post-assessment programs through a vocational rehabilitation agency or hospital
- Phone tutorials and talk-throughs from experts such as Roger Cusson of Seeing Hands Enterprises, Lewiston, Maine
- Local continuing education courses and computer user groups.

As you look carefully on these training tools you can find that all of them are involving some cost to it. Thus as we are dealing with issues that facing HCI in blind people perspective cost is one of issue that hinders the process.

#### D. Accessibility

In any system that is intended to interact with human the matter of accessibility must be put in mind. In this paper we are looking on the issues that face human computer interaction on blind people perspective. And accessibility is among the issues that faces it. Many of tools for HCT to the blind face or have challenge on accessibility.

As you look on Braille inputs or output devices you can find that not all blind users can access the brailled material. Less knowledge to the blind user, leads to the challenge of accessibility. Very few people among the blind can understand Braille mechanism. Thus is not easy for the system that made by using Braille technology is easily accessible to all blind user.

According to (Alasdair King et al, 2008) web pages rich of full feature and their arrangement completely non-standard. And blind user understands complex application by using hotkey and learning user interface. And by using screen reader due to the richness of features in web pages the screen reader itself sometimes can cause misunderstanding to the screen reader. The immediate response might be to use the user's screen reader to access a conventional browser like Internet Explorer. This has problems: we know that each

application makes different demands on the screen reader, and the heavily-visual and non-standard interfaces of web pages pose considerable difficulties to a screen reader. Navigating the web can be compared to trying to use the largest and most complex application that a blind person will ever attempt. A specific problem with Internet Explorer is that the need to allow the user to move around the document we have described is complicated by the lack of a **caret** on a web page, an indicator of the position at which you will enter or delete text usually shown as a flashing vertical bar in a text editor.

#### E. Psychology Affects On Users Themselves

Many of blind people have been affected by the environment. To be isolated by the society that leads to make them feel inferior. Blind person suffers much on psychological self-conflicts.

According to Tunde, A. M. et al (2011) they stated that "Blindness can cause psychosocial distress leading to maladjustment if not mitigated. Maladjustment is a secondary burden that further reduces quality of life of the blind person. Adjustment is often personalized and depends on nature and quality of prevailing psychosocial support and rehabilitation opportunities. This study was aimed at identifying the pattern of psychosocial adjustment in a group of relatively secluded and under-reached totally blind people in Ilorin, thus sensitizing eye doctors to psychosocial morbidity and care in the blind."

According to their study (Tunde, A. M., et al, 2011) revealed that most of the blind people were reasonably adjusted in key areas of social interaction, marriage, and family. Majority were considered to be poorly adjusted in the areas of education, vocational training, employment, and mobility. Many were also considered to be psychologically maladjusted based on the high rate of probable psychological disorder of 51%, as determined by SRQ. Factors identified as risk factors of probable psychological disorder were poor educational background and the presence of another medical disorder.

Due to those psychological effects to the blind, it has made some of them to lose confidence in learning some things. In some society blind people are not given time and chance to exercise their abilities. That is big challenge to them to learn on how to interact with the computer. Thus it has been a challenge to HCI to the blind user.

#### F. Self-denial

According to (free dictionary, 2013) self-denial is sacrificing of one's own desires or interests. Self-denial is situation where by a person sees himself/ herself that cannot do anything and less of worth. In this paper we are trying to check on issues that faces HCI on blind user perspective. Issue of self denial to the user of system can make him/ her not to be able to use technology that has been made for them.

According to (Tunde, A. M., et al, 2011) many of the blind people in some societies face denial from the society and some kind of humiliation and isolation. That as a result led to the low self esteem to them. In performing anything a performer must have courage in himself/herself that can do that. And he/she must be ready to do that. Self denial as an

issue to the HCI to blind people because it kills the idea to try from within a person.

#### G. *Disregarding in Design*

According to Thomas C. Weiss (2013), in his research based in America, he said that regardless America to have the world's most comprehensive policy related to internet accessibility. Also has clear guidance for creating accessible technologies and many more resources including human resources, material resource, government and money to do development of good design. But much time it has been observed that they exploit gaps in existing policy to ignore the need of people with disability. The result is that the majority of Internet-related technologies are created inaccessible and cut out some or even all users with disabilities.

Although the designers have shown that they make something for the blind, but because in reality the designers have never experience the blindness, thus it is so hard to design from blind users' point of view. And that became an issue to those blind users in the product they use. Bad design can lead to destruction even death sometimes (Bruce T. asktog.com., 1999).

Designing for blind people does not involve graphical interface. It involves some sound interface and Braille interfaces. So in designing for blind user is somehow difficulty, the qualified designers must follow all the designing rules correctly in order to design for their users (blind).

#### H. *Target Market*

According to (entrepreneur.com/encyclopedia/target-market, 2014), Target Market is a specific group of consumers at which a company aims its products and services. The targeted customers are those who are likely ready to buy from that company.

Blind user market is very small community of people. So to target as a market is quite a challenge to the vendor. And that has become an issue for the company to produce for the small number of people hence is a hindrance to the HCI to blind people. Thus as a targeted market to be on the producer mind it has to be relatively big.

For that case, it has led for the companies not to produce in large quantity so that to make big sales, hence high prices of the product for blind people. As we have seen above cost of the equipment including software and hardware is so high. And many of the blind people their economic status is not good. Thus it is so hard for them to buy those products from the vendors. And that is a big challenge to the HCI.

## VI. DISCUSSION

In this paper we have seen that blind user as a group of human are capable of using computer. They use computer by using two most important sense organs remain to them, which are touching and hearing. They can use computer and solve their problems as they allowed by factors, environment, tools, technology and society to which they live in.

Some initiatives have been seen to support this process of HCI to the blind users by providing some technology, tools and designs to fit blind user needs. But still there have been some issues on HCI to the blind users even though those initiatives are there.

Psychological issues over blind users themselves are user based issues. Blind people have been affected by the perception of the society toward them. Many of them have lacked self-esteem and confidence to try new things and/or technology, but they have an ability to do things. The great tension should be taken to make sure that we do not underestimate blind user in our world.

By doing things like of the followings can improve the HCI for blind users:-

**Putting reasonable price** on the product designed for them. The vendor of technology should put reasonable prices on the equipment of computing to the blind people. This goes together with the government to have a clear policy on tariff on the tools of computing to the blind people, because many of blind users have got hindrance in financial income compared to the people with sight capability (Tunde, A. M., et al, 2011). Most of them are leaving dependant life. They depend on somebody else for everything for their living.

Thus by putting reasonable price it can raise the rate of blind computer users. Because they have ability to use it and they can learn to use it.

**Education and training** should be provided to the blind user. An affordable education should be given to the blind users. The self-descriptive help should be provided by the vendors of the related equipments. Help on the software is a task-oriented kind of help (Dix, A.J., et al, 2004). A user gets help while working with the system. When a fault occurs he/she will get the help immediately from the software used.

Thus the developer of the software for the blind should provide that kind of user friendly help to the user on how to use the system and when they counter some error. At any time and environment that system help and manual guide should be of understood to the blind user.

**Society should empower them.** In many societies, people with disability have not been given chances to perform some things in their society (Tunde, A. M., et al, 2011). This can make blind people to lose their confidence and self-esteem to dare doing innovative things. Most of the societies especially in Africa they tend even to hide blind people in their society so that to avoid shame (Tunde, A. M., et al, 2011). This makes blind people not to learn new things on technology and as a result they remain behind in everything going on in the world.

Now the society has to make changes on how they perceive blind people. Society should give them psychological empowerment so that they may have trust on themselves that they can do greater things. Society should expose them in new ways of life based on the age we are so that blind people should be part and parcel of changes of technology in the world.

## VII. CONCLUSION

In this paper we have reported on blind users' interaction with computer. We have seen that blind people have ability and capability to interact or to work with computer. Some products have come to the market of blind users to assist them in using computer. Braille display, Braille inputs keyboard, screen reader, screen magnifier are some of the software and hardware for blind people to interact with computer. Many issues investigated in this paper are seen as the hindrance to HCI to the blind people, have been observed that are blind user based issues, societal and designers/vendors based issues. Things like high costs, bad design, and difficulties in technologies are issues based on designers of those tools.

## VIII. AUTHORS

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