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A World in Darkness

Development of an Exhibition for the Visually Challenged People

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Abstract

Museums and Science Centres are important places of learning and development of mutual understanding among people. All these institutions of informal education are working with definite goal for enrichment of knowledge and promotion of harmony between communities and different sections of the society. Despite of their earnest efforts, deficiency in attending to the need of the underprivileged sections is quite evident. For instance, development of a full-fledged gallery or an exhibition, addressing to the need of the visually challenged group, is scarcely taken up by the museums and science centres, unless they are established for this purpose. This particular section of our society thus hardly finds any museum or a science centre a noteworthy place of their visit. The paper describes the development, design challenges and display of an exhibition entitled 'A World in Darkness' at Birla Industrial & Technological Museum, Kolkata, primarily for the visually impaired people. No museum or science centre so far in India was found to develop such an exhibition.

Development of this exhibition containing exhibits on celestial sphere, constellations, solar system, earth and its atmosphere and so on needed intricacy in making them comprehensive to those whose visual windows to the outside world are closed forever. A lot of hurdles had to overcome in designing and developing the exhibition to address the need of such a group. The conventional method of making raised physical features to interact with the exhibits was not only done, supports were given through touch sensitive voice-over arrangements and write up in Braille. In addition, arrangements were made to raise or lower the temperature of some of the objects, helping the visitors feel the temperature differences and figure out the learning process.

Introduction

We make sense of the world based on what we see, hear, smell, taste and feel. Visual information is most important in forming this worldview. However, for many of us visual windows are closed forever. Yet they form a worldview of their own based on the information they received in partial or complete darkness. Louis Braille contributed immensely in forming their worldview[1,2]. He was born on January 4, 1809 in Coupvray, France. An accident made him blind when he was three years old. He devised a system of raised dots known as 'Braille' that helped visually impaired people read by running their fingers along on the dots[3,4]. His invention continues to inspire new and innovative methods[5] in helping the people with disabilities to figure out the world. They make out an impression in their mind about the objects surrounding them, both animate and inanimate; and also about the planet earth, solar system and far beyond, and all these depend upon the information they receive through tactile[6] and audio support.

Planet Earth is gigantic to us, yet it is a tiny object in the universe. Our nearest star, the Sun, is one of the thousands of stars in the Milky Way Galaxy[7]. Millions of Galaxies formed the Universe. Mother Earth is a unique planet. Its location in the solar system, temperature and other factors helped in the formation and evolution of life[8,9]. It is the only planet in the solar system where life exists. The human is its supreme creation. Since the dawn of civilization he has tried to figure out and describe the world in a verity of ways. Understanding the world is much more difficult to them who make sense of everything in complete or partial darkness.

Background

It was in 1609 that Galileo first turned his telescope into the sky (Fig. 1) and opened up a new era in exploring the

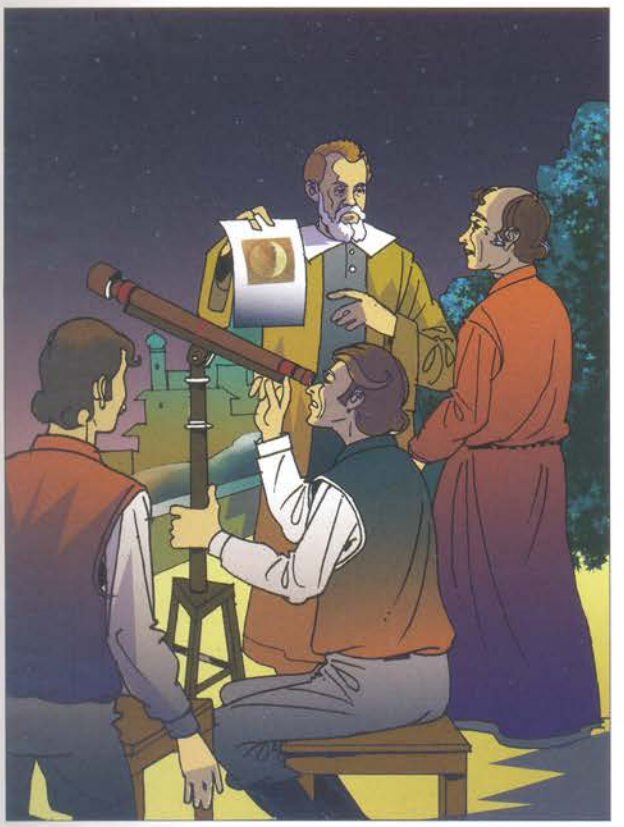

Fig. 1 Galileo built several simple telescopes, turned them towards the sky and discovered a whole new world. He made careful sketches of how the moon looked through his telescope and explained to the people.

Universe[10]. To mark the completion of 400 years of this great event, the year 2009 was declared as the 'World Year of Astronomy'. The year 2009 was also celebrated worldwide to mark the 200th birth anniversary year of Louis Braille who contributed immensely to the development of Braille. It is in this background that an exhibition entitled 'A World in Darkness' has been developed in 2009 at Birla Industrial & Technological Museum for the visually impaired people in particular and common people in general. The exhibition is an attempt to help them explore a world in the darkness (Fig. 2).

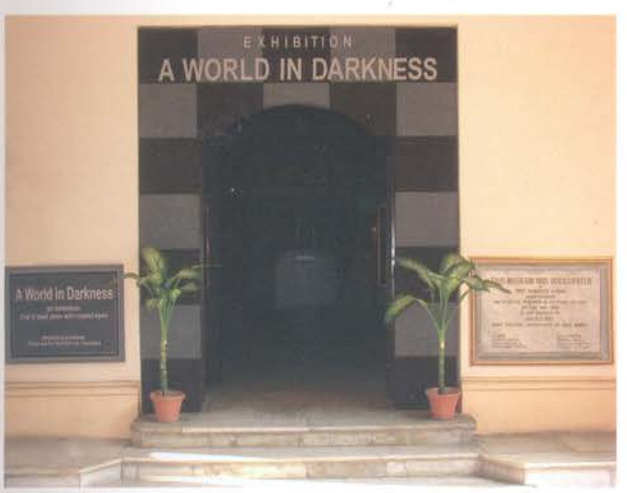

Fig. 2 A view of the facet of the exhibition, 'A World in Darkness'

Homework

Most of us are aware that Braille is used to help visually challenged people read and write. But many of us have little idea about this and the way teaching is imparted in Blind Schools. In fact, I was in this category prior to the development of this exhibition. I had, therefore, visited some blind schools in and around Kolkata, especially to Ramakrishna Mission Blind Boys' Academy at Narendrapur for a number of times to educate myself a little bit in this area. I had had discussions with the principals, teachers and the students, and had looked over the gadgets and tools used to teach the students. Some relief maps and models are there to teach geography and basic astronomy. The models are obviously smaller in sizes for keeping them in places such as in racks. Some of them are fragile too. The relief maps are made of embossed paper or plastic. To make out the subject students touch and feel the raised features, and over the years, as thousands of fingers run along them, the maps lose their relief characteristics. It prompted us decide making the features with hardy material. Listening to the visually challenged students and discussions with them helped me bring myself, as far as possible, to their stage to feel their necessity. Discussion with the teachers helped me realizing what they were looking for as teaching aids in demonstrating the subject effectively. Suggestions were received to make the exhibits equally meaningful to the common visitors to sensitize them. It was decided to use only black and white colour in the exhibition with a view to remind the general visitors that their sightless friends visualize the world in the darkness. Suggestions were also received to keep some provisions to demonstrate the ability of the visually challenged students. It is to inform the citizens that if opportunities are given to the disadvantaged groups they can also do marvel.

To Begin With: Louis Braille

The exhibition started with the display of a half bust statue of Louis Braille (Fig. 3). Visitors could touch and feel the profile of the statue. On both sides of the bust labels in Braille and English were suitably placed to

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Fig. 3 Bust of Louis Braille displayed in the exhibition

facilitate visitors, both visually challenged and common people, to know about Louis Braille. Other exhibits were placed serially to enable them touch and feel while they move on from one exhibit to the other. Following this a reception counter was set up in which a visually challenged Brailler would sit with a Braille Machine. He would welcome the visitors, type their names in Braille on a piece of paper and hand over the paper to them. Common visitors would see only some dots on the paper. Arrangements were made to demonstrate the exhibits by a number of visually challenged students. They would collect the piece of papers from the visitors, run their fingers along on the dots and greet the visitors by names. This arrangement, particularly their demonstration ability, impressed the general visitors to a great extent. Interactivity was kept in most of the exhibits as it is a creative process11 for learning. Visitors were given option to explore the exhibition in darkness and a 'blind fold' option was given to them. But not many visitors opted for that.

Fig. 4 A view of the exhibition

Development and Design Challenges

Making an exhibition for the visually challenged group with interactive audio feedback and simultaneously making it interesting to common visitors needed an innovative approach in designing the exhibits. As tactile

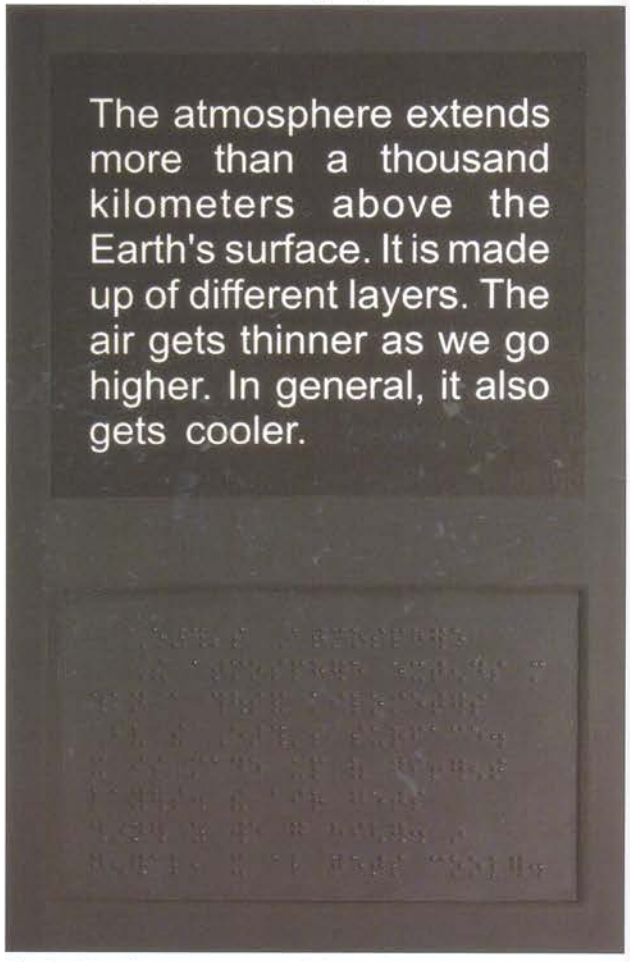

Fig. 5 A Braille write-up on a metal plate in the exhibition

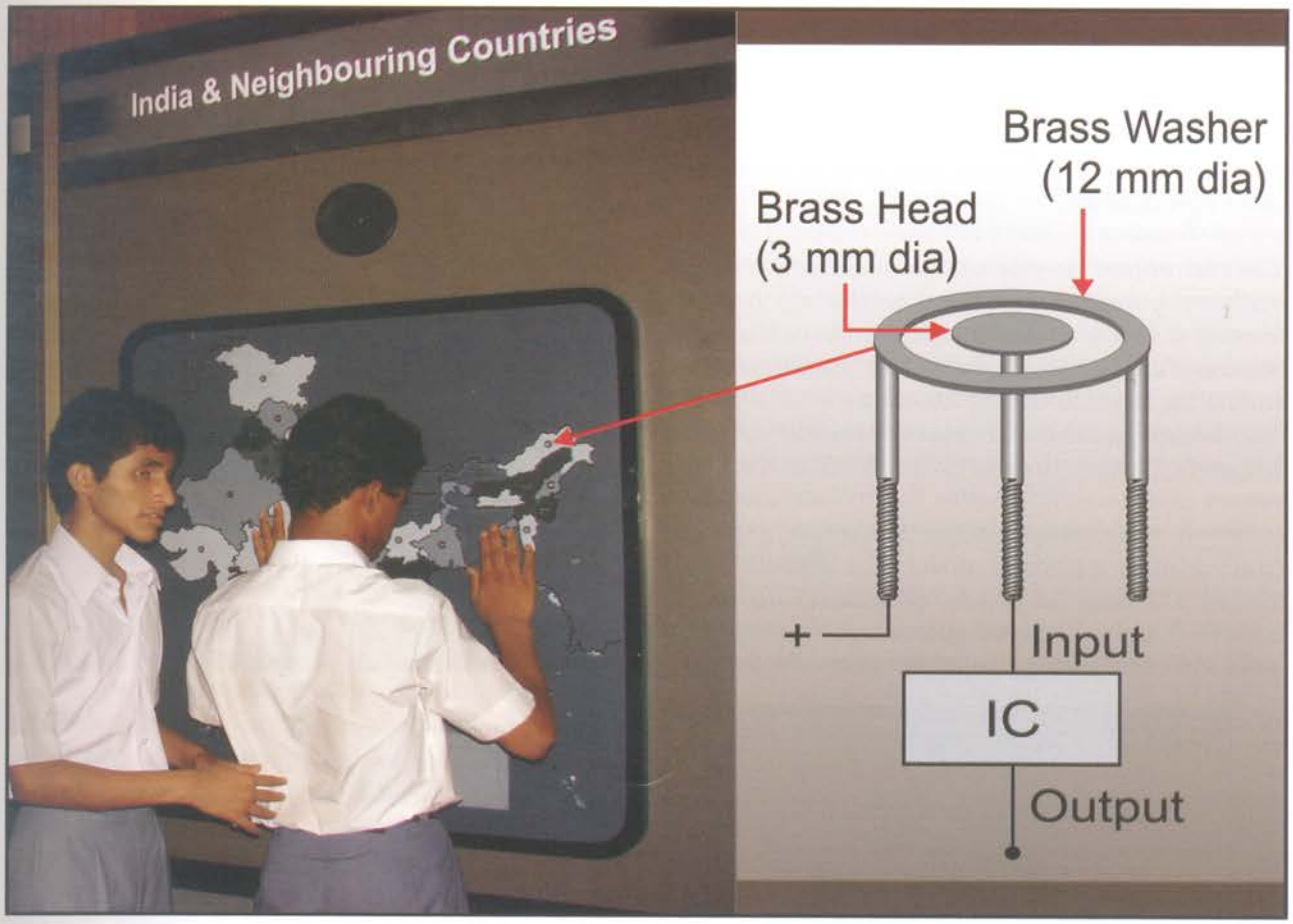

Fig. 6 Schematic diagram of a touch sensitive switch. Visitors are seen to use the switches for listening to voice-over.

information[6, 12] is one of the vital inputs to the visually challenged group in grasping the subject, all the exhibits (Fig. 4) were made with raised features on flat or round surface. Fibreglass, acrylic sheet, metal, and wooden laminates were used to fabricate the exhibits. A short write up, both in Braille and English, was provided with each and every exhibit. As thousands of visitors would touch the labels in Braille, write up made on paper would not work. With this view in mind, to avoid smoothing of the dots, Braille labels were made on metal plates instead of paper (Fig. 5).

A touch sensitive voice-over retrieval system has been developed for audio explanation of all the exhibits and each of the exhibits is fitted with a number of touch sensitive switches. The switches (Fig. 6) are placed in close proximity to all interesting objects of an exhibit and in specific locations in such a way that when a visitor runs his fingers on the exhibit he will invariably touch

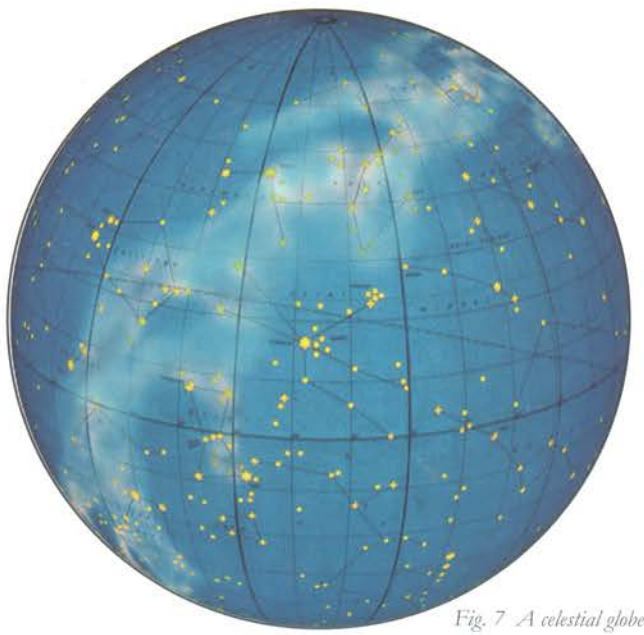

Fig. 7 A celestial globe

the switches. Once a switch comes in touch with his fingers instantly an audio narration describing the name of the object or commentary whichever it may be will be played. Moreover, a telephone receiver is placed with every exhibit for listening to voice-over to know more about the exhibit.

'Celestial Sphere' is one of the important thematic exhibits to portray the stars and constellations in the sky. Stars are at widely varying distances from the Earth, but because of their remoteness they seem fixed on a sphere around the Earth in the sky known as celestial sphere. Astronomers divided stars into 88 groups and drew imaginary pictures around them. Such a distinctive pattern of stars is referred to as a constellation. For common visitors a celestial sphere is generally represented by a physical model of a celestial globe[13] marked with stars on which constellation figures are outlined (Fig. 7). A celestial globe maps the stars on its outer surface, resulting in a mirror image of the night

Fig. 8 Celestial hemispheres - on the inner surface stars are depicted as raised dots

sky as seen from Earth. Such a model, though effective for common visitors, is not workable for visually challenged people. For them stars should be represented by raised dots. The easy way of doing so is to replace the stars printed on a celestial globe by raised dots. But to a visually challenged person, correlating these dots in making out the stars and constellations in the sky above, based on the tactile information he receives from a table-top globe is a difficult task. To portray the star-filled sky in a more realistic way we have taken a different approach.

Fig. 9 A sightless visitor is trying to figure out the star-filled sky

In our model displayed in the exhibition the sky is represented over the head and the stars are depicted by round dots on the inner surface of two large hemispherical domes made of fibreglass, one for representing the northern hemisphere and the other for the southern hemisphere (Fig. 8). About 1200 round headed and nickel plated bolts of different sizes were

Fig. 10 In the making of a celestial hemisphere using reverse gores

used to represent the stars of different magnitudes. Obviously, heads of bigger bolts represent bright stars. Important stars in a group were joined by wires to depict a constellation. Name tags in Braille and English were attached with every constellation and important stars. Standing under the domes visitors can adjust its height by pulling it gently so that they can touch the entire inner surface of the dome. Normal visitors will see glittering

stars and constellations above their head on a dark background and visually challenged visitors will feel the raised dots representing the star-filled sky (Fig. 9).

Fig. 11 Demonstration of the exhibit 'Solar System'

Making such an exhibit, depicting stars and constellations on the inner surface of a 1.0 m diameter globe, quite large compared to the globes available in the market, needed ingenious approach. A celestial map made on a 10 cm globe was divided into 12 segments gores[14]. They were reversely projected, enlarged to appropriate sizes to fit on the inner surface of the domes (Fig. 10). Round headed bolts of varying sizes were then fitted in the places of stars. Bolts of four different sizes were used in making this exhibit to represent stars of varying brightness. Two such domes were installed by suitable mechanical means in depicting the star-filled sky.

Fig.12 The exhibit 'Relative Size of the Planets' provides a multi-sensory experience

The exhibit 'Solar System' comprises of the sun at its center and the planets around the sun in different elliptical orbits. They are all mounted on a vertical board. The orbits are made with 3 mm diameter metal rods. The sun is represented as a hemisphere and the planets are as round balls. The planets are placed in such a way that fifty percent of each of them is projected outside the board (Fig. 11). Visitors can rotate the planets about their axis. The sizes of the planets are made different, as well as their axis of rotation. This is with a view to present a rational picture of the solar system as far as possible. As stated earlier, each of the objects is provided with touch sensitive voice-over switches and name tags in Braille and English. In between Mars and Jupiter an asteroid belt with uneven texture is created and also a heating arrangement is attached to the sun to feel its warmth.

In some exhibits arrangements were made to vary the temperature of the objects. Some of them were made warm, and some were cooled to provide additional degree of information to the visitors to offer an

Fig. 13 Demonstration of different layers of atmosphere with thinning of air particles and decreasing in temperature with altitude

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immersive experience[15]. In the exhibit 'Relative Size of the Planets', Sun and Mercury manifest themselves as warm objects and of course, in this case, degree of warmness of the Sun is more than Mercury. In general, the farther a planet is from the sun, the cooler it is. To demonstrate the decrease in temperature with distance, the outer planets are thus cooled to different extent by adopting differential cooling arrangement. Obviously,

Fig. 14 The process of making raised dots on a metal plate

when the visitors touch the planets they discover that the farthest planet Neptune is colder than the gas giant Jupiter. Compared to Earth, Jupiter is approximately eleven times larger[16] in diameter, whereas Mercury is less than half. In this exhibit, in order to maintain their relative sizes, Mercury is portrayed as a 1.5 cm metal ball and Jupiter as a 33 cm (Fig. 12).

Temperature variation is also incorporated in the exhibit 'Earth's Atmosphere'. The atmosphere extends more than a thousand kilometer from the Earth's surface. It is made up of different layers. The air gets thinner as we go higher. In general, it also gets cooler. In this exhibit air particles are represented as raised dots on a metal plate. The plate is mounted on a vertical board (Fig. 13).

Fig. 15 Political and Physical Earth-globes being examined by the visitors

To demonstrate thinning of air particles with increase in altitude a technique of making raised dots on a large metal plate was developed using emboss powder followed by heat treatments at different stages. In the first step silk screen printing of the visual depicting air particles was done on the plate. Then emboss powder was spread onto it. The powder stick only on the ink-exposed dots, which ultimately transformed to raised

Fig. 16 'Quiz' game seems to be an attractive exhibit to all the visitors

dots following a series of heat treatments (Fig. 14). Arrangement was made for differential cooling of the plate. When visitors, especially visually challenged visitors, touch the plate and move their hand upwards they not only feel a gradual thinning of particles in different layers of atmosphere, but also feel increasing coldness with increase in altitude.

The Earth surface comprises of oceans, islands, planes, deserts and mountain ranges. There are many nations across the world. To portray the political and physical Earth to the visitors, two large Earth-globes were developed and displayed in the exhibition (Fig. 15). All the countries were highlighted by raised boundary lines supported with interactive voice-overs. Also for physical globe main physical attributes were made with raised markings. For making the maps on the political and physical globes 12 segment gores[14] were used.

Most Attractive Exhibit

The exhibition 'A World in Darkness' comprises of 22 exhibits. Some of them, other than the exhibits already mentioned, are Continental Drift, Earth's Interior, Ocean Floor, Water Cycle and so on. But none of them are so frequently operated as the audio 'Quiz'. It has always been observed that a crowd gathers around this exhibit and visitors are seen standing in queue to operate this. In this quiz game eight cut-out figures, namely lightening cloud, rain, sea waves, cat, elephant, parrot and cricket are displayed. Visitors are guided by audio feedback which is activated when they touch any of the figures (Fig. 16). They are required to identify the figures and match the sound with the correct one by pressing a button attached to it. Both common and visually challenged visitors were seen to enjoy a lot and to stay with the exhibit for longer time. This is due to the challenge associated with the exhibit which is equally accepted by both the general and visually challenged visitors. It means that a museum should give its visitors opportunities to feel challenges[17] in the

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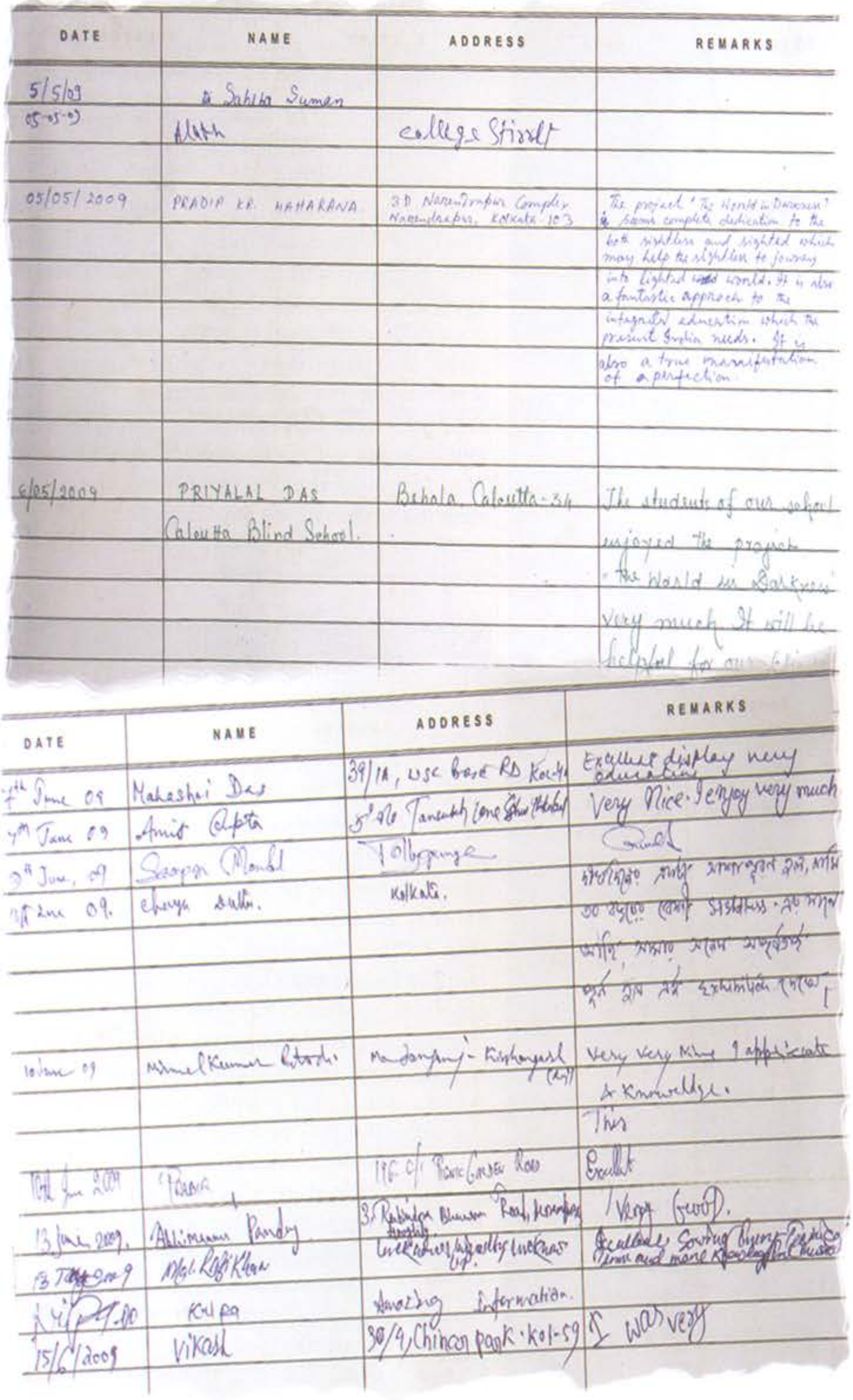

DATE	NAME	ADDRESS	REMARKS
5/5/09	Sahila Suman		
05-05-09	Alokh	college Street	
05/05/2009	PRADIP KR. MAHARANA	3D Narendrapur Complex, Narendrapur, Kolkata-103	The project 'The World in Darkness' is a complete dedication to the both sightless and sighted which may help the sightless to journey into lighted world. It is also a fantastic approach to the integrated education which the present India needs. It is also a true manifestation of a perfection.
6/05/2009	PRIYALAL DAS Calcutta Blind School.	Behala, Calcutta-34	The students of our school enjoyed the project 'The World in Darkness' very much. It will be helpful for our [illegible]

DATE	NAME	ADDRESS	REMARKS
7th June 09	Maheshwari Das	39/1A, USC Bose RD Kol-4	Excellent display very educative
7th June 09	Amit Gupta	[illegible]	Very Nice. I enjoy very much
9th June, 09	Swarup Mondal	Tollygunge	Good
[illegible] June 09.	[illegible]	Kolkata.	[illegible] Exhibition [illegible]
10 June 09	Nirmal Kumar [illegible]	[illegible]	Very very nice. I appreciate & Knowledge. This
[illegible] June 2009	[illegible]	116 C/1 [illegible] Road	Excellent
13 June 2009	[illegible] Pandey	[illegible]	Very Good.
13 June 2009	Md. Rafi Khan	[illegible]	[illegible]
[illegible]	Kalpa		Amazing Information.
15/6/2009	Vikash	30/4, Chinar Park Kol-59	I was very

Fig. 17 Pages from the comment book

exhibits. When visitors invent ways to use an exhibit in their own ways they get a sense of discovery[18]. This is very much appropriate especially to sightless visitors in discovering the correct figure that matches with the sound in this exhibit.

Feedback

Since inauguration in 2009, the exhibition has been visited by about seven hundred thousand visitors. Students from blind schools in and around Kolkata visited the exhibition in groups. A number of dailies published reporting that helped increase family visits, especially families of the visually challenged people. A comment book was kept for having feedback from the visitors. Though comments were not written by the sightless people, but they were the reflections of their mind as many of them were written by their escort teachers or family members. From the comments it appears that our approach in presenting the exhibits was well accepted by the visitors. A comment written in Bengali from a family member seems a touchy one (Fig 17). The transcription of what she wrote would be, "A dream is fulfilled. I am living with a sightless person for more than 30 years. The exhibition helped me satisfying many of my desires that I longed for". A

teacher from Ramakrishna Mission Blind Boys' Academy wrote, "The project 'A World in Darkness' seems complete dedication to both sightless and sighted which may help the sightless to journey into lighted world. It is also a fantastic approach to the integrated education which the present India needs....". Along with commendations, a few remarks have been received for using exclusively black and white colour in the exhibition, and of course these are from general visitors. An exhibition may be regarded as successful when outcome matches intentions[19]. The comments from the visitors are therefore the indicatives of the outcome-based evaluation, a method which has become popular in recent years. In light of this the exhibition has achieved its desired outcome.

Conclusion

The exhibition 'A World in Darkness' was developed to bring to light some of the facets of the world to both general and sightless visitors. It helps increase social inclusion[20,21]. In the exhibition, in contrary to the conventional method of making only raised physical features on the objects, additional support was provided by introducing touch sensitive voice-over retrieval system, which is very much effective in imparting education to the sightless people. In addition, temperature variation of the objects provided an immersive experience and extended another dimension in figuring out the learning process and comprehending the subject. Development of such exhibitions in museums and science centres has also social implication in sensitizing common people that help building a welcoming attitude towards a particular section of the society whose visual windows are closed forever.

Acknowledgement

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