Art of Animation used for Imparting Education to the Illiterate

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Abstract

To help the world's illiterate and semi-literate computer users, we share research towards an understanding of the best audio-visual representation for presenting ideas. To the best of our knowledge, our user study is the first of its kind. We showed 200 illiterate participants one representation of 13 different health symptoms, chosen at random from among the next ten: text, static sketches, static pictures, hand-drawn visuals, and video, with or without voice annotations. The objective was to test how well each kind of representation would work with a non-literate audience. A procedure for producing each representation used in the experiment that reliably compares one representing style with another. Three main conclusions can be drawn from this research: (1) richer information is not inevitably better understood overall; (2) the relative importance of dynamic pictures versus static pictures depends upon a number of factors; and (3) voice annotation generally aids in speed of understanding, but bimodal audiovisual data can be perplexing for the target population. The significance of these findings is discussed, and other, more in-depth findings are offered.

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Introduction:

Recent efforts under the rubric of "information and communication for development" have explored the potential of IT to aid in the economic growth of underprivileged regions. Much of this effort goes into developing software for use in fields like agriculture, medicine, and teaching. Because of the correlation between poverty and other variables like low levels of education, many groups share traits even when separated by great distances. One such characteristic is illiteracy.

There are more than a billion individuals who cannot read or write, according to even the most conservative estimates, and many more who are just marginally literate. Therefore, if accommodations were created for illiterate users, any computer programme with the intention of helping underprivileged groups would be more accessible. Due to the large volume of text included in most interface

standards, creating text-free software may provide major difficulties. Previous work in creating UIs for illiterate and semi-literate groups has focused on high-level components including the use of graphical icons, limited use of text, voice annotation, simple navigation, and the use of numbers for individuals who may be illiterate but are not innumerate. All this research points to the need of providing information in a visual, as opposed to textual, format, with voice commentary on mouse-over. The majority of these characteristics are self-evident and natural. What is less clear is which representation is best for elucidating a specific idea. Do you prefer photography over hand-drawn, abstracted images? Do moving pictures provide any advantages over still shots? Does it matter how something is represented visually if the voice annotation is clear? Etc. This article presents a collection of work that begins answering these and related concerns.

We found that health personnel were unable to adequately monitor health information during our early field research to establish an application area. There were comparatively few paramedical personnel relative to total households. Long lines of people waiting to be seen were commonplace at government-run hospitals owing to a severe lack of physicians. Doctors and other health care providers thought they could save a lot of time if members of the population they were studying were encouraged to keep personal records of basic subjective indications of sickness.

A total of eleven representations (including text, static drawings, static pictures, hand-drawn animations, and video) were compared for their legibility to a non-literate audience, with and without voice commentary. 200 illiterate participants were recruited for a user research, and they were shown 13 health-related ideas, each in one of the 10 aforementioned representations, and asked to identify them. Some surprising findings emerged from the tests. It was found among the observations that:

i. Even though voice annotation aids in speed of understanding, certain illiterate users may be confused by the combination of audio and visual content;
ii. When comparing hand-drawn cartoons against photorealistic depictions, it seems that the former performs better.
iii. There are a lot of variables that affect how valuable moving pictures (video and animation) are compared to still pictures (photos and drawings). In the next part, we shall give further findings.

Approach and Method Applied : The work was carried out in five different slum areas in Bangalore, India. A non-governmental organisation (NGO) and a hospital owned by the that have been serving residents of these slums for 15+ years facilitated our entry into these areas. The majority of the slum dwellers could read just a few words per language. Everyone there had no trouble communicating in Kannada, the native tongue, and several even spoke Hindi or Tamil as well.

Challenges Faced and Surmounted : When planning the experiment, we encountered a lot of obstacles. The first step in comparing our 10 representations was to choose a suitable domain. It's a good idea to try contrasting video with still images, but what kind of footage

should we show our participants in order to elicit useful feedback? Second, we had to make sure that our participants could understand the visual representations we employed to the fullest extent possible.

Working in the Health Domain : Finding and operating in a field where ideas would:

1. Recognise the importance of pictures
2. Include things students don't often learn in school
3. Meanings that are understood all around the world
4. Make available a spectrum of mental challenge
5. Provide a spectrum of visual complexity.

More importantly, the study is in a field where the immediate outcomes of the studies have direct practical application. Healthcare seemed to be the greatest match among the several fields evaluated, which included education, job-related data, government programmes, religious ceremonies and rites, and so on. The models were put to the test using data on symptoms of common diseases. Symptoms in the medical field are easily represented visually, and their meanings cross cultural boundaries. They vary in their mental and aesthetic challenges they provide.

Some of these symptoms need motion over a certain time period to be properly depicted, while others include colour, temperature, and proprioception. Finally, our research in the field indicated the critical need for more effective medical data collection. It would be really helpful if there were a more efficient approach to collect health data than via in-person interviews.

Representations that are Culturally Appropriate : After deciding to utilise health symptoms for a test domain, we had to make sure the visual and auditory representations we provided were sufficient. This was possible since we included a sample design group of people drawn from the same community as our actual testers. (It's important to remember that neither the planning nor the evaluating teams shared members.) By using participatory design techniques, we had the design team come up with movements to use as icons for illustrating health issues.

Generating Gestures for Graphics : Our design team was tasked with conceptualising gestures along with additional visual clues to stand in for each ailment. Twenty people took part in this experiment. Each person did the activity alone, with no communication between them. There were two methods utilised to get the right responses:

2D paper cut-out dolls: These dolls had movable limbs. Paper dolls were provided to the exercise participants, who were tasked with creating representations of certain symptoms.

Enacting: Without using any words, participants were to act out the symptom described. Participants arrived one at a time and were given the option to do any of the two activities. A lot of photos were taken throughout the session so that an artist may use the recorded motions in the final design of the graphics. It was comforting to see that most people had the same physical reactions to each condition.

Assessment of Impact Through Cultural Observations: Some words and phrases

were shown differently than they were originally portrayed by the design group members. For the symptom "weakness," for instance, we saw a guy who was feeling lightheaded, clutching his head, and maybe fainting. However, the results of the participatory design activity showed a different picture: all of our participants linked weakness to experiencing pain in their limbs. This seems sense, looking back, given that their work consisted mostly of strenuous physical activity.

The last consideration was uniformity. The following procedure was undertaken to achieve uniformity:

i. **Video:** To start, we made a high-quality video clip featuring our design team's motions. Our design team recommended using videos in which a lead actor performs activities that illustrate a condition. The videos also picked up incidental details like skin tone and setting. The resulting videos have an average length of 13.5 seconds.
ii. **Photograph:** Then, we used a still image to depict the symptom, selecting a single clip from the video that was deemed to be most representative of the notion by the design team.
iii. **Animation:** We commissioned a professional animator to adapt the films into an animation of the idea. When creating these animations, the animators made cartoon drawings, outlining just the visual components that were pertinent to the condition.
iv. **Static Drawing**: At last, we used the sketch that matched the photograph's chosen key frame to create the static drawing. Motion was plainly lost, but static colour and texture were kept if they were necessary to illustrate the disease.
v. **Text:** Words of written material in the native language of Kannada made up this edition. The symptom's written description matched the voice comment used to describe it.

Designer Biases for Representations in Health Care : We also built a framework to indicate whether we believed a dynamic or static representation was more suited for capturing each symptom, so that we could compare designer intuitions with real testing outcomes. An animated journey from a normal foot to its extreme swelled condition, for instance, is far more instructive than a static picture, thus the designers opted for animation as a dynamic style of representation to show swelling in the feet. The designers also decided an image would be the best way to depict skin pigmentation because of the importance of colour and texture in the process of accurately recognising this information.

The Model Framework: Subjects were in excess of 200, and they were all either illiterate or semi-literate people living in the same area as the target population. The vast majority of them had never used a computer before. The examinations were held at community centres in the same general area as their houses or in the comfort of their own homes. The goal was to evaluate a total of 10 different representations by combining the five visual examples (text, drawing, picture, animation, and video) with the two auditory representations (no sound, voice annotation). We shuffled the order of the participants such that every argument

would be evaluated on 10% (20 individuals total).

The three-step process of testing was as follows:

i. The participant was then asked to describe the first word or phrase that came to mind while thinking about the symptom that the individual in each depiction was experiencing after seeing the image on a computer.
ii. The representation's intended symptom would then be communicated to the subject.
iii. The last step would be to have the individual act out or draw a picture of the desired symptom in a way that they felt was most accurate. The goal of this process was to give depth to the investigation of the data.

Only one of the 10 depictions was shown to each participant. We kept track of how long it took for people to react to each symptom and how many people got it right. As an added bonus, all participants' comments given verbally were recorded and transcribed for review.

Findings and Derivations : The following conclusions are backed by the conventional Students t-test and are based on the data we gathered from user research. The total accuracy and responsiveness statistics are summarised.

The five representation forms that included sound were significantly more easily comprehended than the five that did not. Voice annotation was shown to be useful, as had been hypothesised in prior research. Recognition rates for all graphical representations increased when voice annotation was included. The findings demonstrate that accuracy improves across the board with the addition of sound (t=2.461).

While voice annotations may seem useful at first glance, it's important to keep in mind that some individuals picked up the habit of imitating the voice annotations without fully grasping what was being said or shown. Some participants, in particular in the text + speech annotation representation, said they didn't know the Kannada word for "lockjaw" and were instead only repeating the voice annotations they heard. This hints to the continued relevance of high-quality visual representations for certain ideas.

The greatest successful recognition was achieved using hand-drawn representations supplemented by spoken commentary. This was a little improvement (just 1% more accurate) over the closest competitor, animation with speech. Semi-abstracted drawings in which just the relevant information is portrayed are better understood than photorealistic artwork that incorporates additional visual characteristics, which may explain the success of hand-drawn static graphics and animations.

Among the five forms tested, animation had the highest percentage of correct classification. The overall success rate was 7.35 percent (13 accurate identifications). When comparing accuracy, animation (t= 2.2782) far outperforms the next competitor, static drawing (5.95 accurate identifications). Photo is the closest competitor to static, falling just short (5.45). Photos were the least correctly recognised, followed by videos and static graphics. Although this finding was rather modest, it was nonetheless statistically significant (t=0.606) since animation +

speech, which requires finite time to provide, also resulted in the shortest reaction times.

Quality and Quantity of Information matter Most : Sometimes, more information was not better for readers' comprehension. The designers selected video (a dynamic style of representation) when displaying weakness so as to set the stage with vigorous physical activity preceding showing the condition of lethargy brought on by weakness. However, static drawing was superior because viewers were puzzled by the rich information (of strong physical activity) shown before the key action (the main character feeling weak).

The value of static vs dynamic images is altered by an unrelated context laying activity: The subject of whether or not certain symptoms are better represented by various representation methods remains intriguing notwithstanding the display of aggregate data above. Best-guess representations by symptom indicate a qualified "yes," it appears. In studies using visual representations without auditory cues, it was shown that individuals were confused when a secondary action was introduced into the scene that had nothing to do with the primary action cue. The video shows an attendant wringing a cloth and then applying it as a cold compress to a patient's forehead to illustrate the symptom of moderate fever. Images depicting the same condition often only include a "action cue," such as a patient laying down with cold compresses on their forehead. The respondents had an easier time understanding the second version.

Socio-economic conditions correlated with cognition: Our research was conducted in five low-income neighbourhoods in a major city. Each neighbourhood was made up of people who had similar social and economic backgrounds. In general, the experiment's outcomes were better for participants from from the better-off sections of the slums, who also happened to have higher levels of formal education.

Some participants had trouble coordinating their auditory and visual processes; this was especially evident in the representation types when voice annotation was included. Subjects living in the poorest slums were disproportionately affected by this phenomena. Even though the participants were completely illiterate, they paid attention to the text+voice depiction.

Obstacles faced : A There were a number of difficulties that arose throughout the studies that might have influenced the outcomes. We do not believe them to be fatal enough to render the findings useless, but we are disclosing them here for completeness. When subjects were shown a series of symptoms in which each successive symptom was linked to a complaint of the same type (e.g., pain or aching), they tended to focus on that category of symptoms.

If a user saw three consecutive pain symptoms, such as a headache, backache, and sore throat, they were more likely to interpret the following sign as pain, too. The fact that all modes of representation displayed the same problem helped to some extent, as did the fact that the symptoms appeared in the same sequence regardless of the topic or mode

of representation. 4.5.2 Subjects with at least a high school education showed considerable test/text anxiety when given the text-based version, perhaps due to a resurgence of memories of the stress they experienced in the classroom.

Other Area Investigation : We find significant relevance in four linked fields of study. The first is the wide range of visual representation methods and media. The second category includes studies of audio-based information exchange. The third category is the research published in the health care field that focuses on creating a certain kind of symbolism for a particular demographic. For our fourth example, we'll look at the research done on GUIs for the illiterate. To the best of our understanding, our study is at the uncharted junction of all four of these streams, with some key distinctions from prior studies. There's been a lot written on this topic for decades. There are two broad types of literature:

i. Analyses that focus on a single mode of representation
ii. Studies that classify or compare different representational styles or strategies to determine which facilitates better communication. i.

The majority of effort has been put into creating iconography, pictorial and pictorial symbols, which fall under the first group. These include design concepts andii. a framework for creating new symbols for use in graphical user interfaces as well as worldwide graphic symbol handbooks for visual symbols, icons, and symbolsiii. However, very few of the suggestions made in this corpus of work are backed by thorough studies with actual human subjects, and certainly not with illiterate communities.

The second group is the huge amount of literature that contrasts the two types of representation. Once again, one study provides a cohesive, progressive paradigm for classifying representational motifs. The vast majority of research comparing representational styles does so by contrasting animated and still images. Some of these publications include articles that defend the use of animation in educational settings. Other works have also tried animation without success. Literature demonstrates that static drawings may be just as powerful if carefully schematized. This study lends credence to our contention that static imagery may convey meaning when it is concisely shown without distracting features.

Conclusion

We showed 13 health-related indicators to a group of 200 illiterate participants and asked them to identify them in order to get insight into the most effective audio-visual representation for conveying ideas to illiterate users.

Thus, the results show that:

V In most cases, voice annotation improves readability, however audiences may be confused by the combination of audio and visual content;

The more information available, the less likely it is that it will be used effectively; hence the superiority of hand-drawn cartoons over photorealistic depictions.

There is some debate about whether moving pictures (video and animation) are more effective than still pictures (photos and drawings).

The statistical significance of these findings supports the idea that these principles may be used when building user interfaces for non-literate users in any area of knowledge.

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