National culture and the design of medical technology

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It has long been understood that people of different national cultures can think about the same thing in quite different ways. Science and engineering have worked hard to develop methods for assessing the universal truths of various phenomena or designs, often determining that various "truths" passed on socially or through national folklore are incorrect. When the truth of some phenomena is defined down to the readings on some meters in a clear protocol, researchers and designers around the world tend to get the same answer. As long as engineering and science discussions focus on elements for which there are clear protocols and metrics, consensus on decision making is fairly easy. However, technology is not a success until it fits the people that will select it, operate it, and use it. As science and engineering attempt to convert technical discoveries into technologies, devices, and systems that provide benefits worth their cost, culture based differences in belief, behavior, relationships, and thinking style can have profound impacts on the benefits and costs of any particular design. It is likely that the world will reap the greatest benefits of health related technology from those designers who understand how culture impacts their design efforts, impacts the selection of technology, impacts the use of technology, and determines even the very definition of health.

Belief and science

Science has always seen itself as rising above superstition and socially constructed beliefs, with few admitting the obvious fact that opinion puts filters on what scientists can begin to research or be funded to research. Koestler (1978) points out that at one time, any scientist who sought to study meteors was considered insane. Everybody knew that rocks could not fall from the sky. Those who reported seeing such things were labeled as mental defectives or liars. (Identical to our reactions to those who claim to experience or research contacts with extraterrestrials.) Then, in 1776, a large meteor shower in France was seen by everyone in a respectable town, including the doctors and the police and the priests and the mayor. Suddenly society changed its belief and meteors could be researched.

One of the sad times of medicine was when women were frequently dying soon after childbirth from "puerperal fever". Doctors refused to consider that they were killing the women with their lack of handwashing. More recently, pharmaceutical firms invested millions in acid-conquering drugs for ulcers, seeing a great market in overstressed managers with ulcers and medical plans. Apparently they ignored what veterinarians had known for years -- when something gets ulcers, an antibiotic clears it up. The phenomena was finally confirmed in humans, so now the pharmaceutical companies resort to consumer advertising to sell their "wonder drugs" as a way for people to eat foods like chili and pizza that might otherwise upset their stomachs.

Many doctors, firm in their education, loudly denounce people exploring alternatives to pharmacy and surgery as being unscientific and untested by double blind studies, when many of their most effective medicines are high volume copies of herbal medicines, and when many of their methods, such as chemotherapy, have never been subject to double blind studies. Some of these same doctors use powerful medicines with proven dangerous side effects, because they have been assured that the side effects never really happen and don't really cause all that much trouble when they do.

According to Weinberg (1979), most fish that have the ability to generate light were discovered about the same time period, except one which was discovered decades later because it uses its light emitting ability in the daytime not at night when the scientists were looking for light emitting fish.

It is critical to utilize the methods of science and technology to clarify as many truths as possible, but it is also critical to recognize that before the science is applied, politics and social beliefs have restricted the truths that can be looked at. Further, in the study of health, disease, and medicine, different cultures can set very different playing fields.

Medicine and Culture

Payer (1996) makes a strong case that beliefs about diseases and cures are strongly affected by cultural backgrounds, not just modern doctor versus third world witch-doctor, but among "First World" countries such as the United States, England, and Germany. There are quite different attitudes toward what health is, different beliefs of where diseases reside, different beliefs about what to do about disease, and different beliefs about what is an acceptable side effect.

Lorig (2002) discusses a growing tendency to shift from a model of ignorant patient helped by expert doctor to a concept of an intelligent patient who works collaboratively with the doctor to address medical issues. One large and growing market for medical technology consists of these "intelligent" patients who are willing and able to pay for medical devices they can use at home, at work, and throughout their day to monitor important metrics. Diabetics can already routinely monitor their blood sugar levels, and similar devices are being purchased to allow home monitoring of levels of blood thinners and other health related measures.

The growing "alternative" or "complimentary" health cultures seem eager to acquire technology which guides them as they use non-pharmaceutical approaches to reduce blood pressure, cholesterol, and other threats to heart and blood vessel function. As other tests of blood chemistry and body processes become available, patients can constantly adjust to maximize effectiveness of their health building activities while minimizing negative side effects.

The cultural assumptions of medical technology firms and design teams can prevent them from recognizing large areas of opportunity that can not only build organizational health but fund continuing development. Deliberate efforts to expose key decision-makers and key creators to the multiple mindsets of the patients and health care deliverers of the

areas they would like to impact can greatly increase organizational success. It can also result in designs whose better fit to the culture means greater health impact.

It is important to note that there is an essential difference between the economic realities of medical practitioners and medical technology producers. A practitioner well enmeshed in the local cultural assumptions about medicine can have a long and prosperous practice, regardless of the beliefs and practices of other cultures. However, medical technology can generally reap the benefits of economies of scale. Products or services which attract well funded users beyond the limits of a particular culture result in production volumes which quickly bring the costs down, thus extending the health benefits to far more people, while generating larger cash flows to fund more interesting research. If your competitor outreaches you, it is hard to stay in existence.

Cognitive Complexity and Cultural Knowledge/Beliefs

It is easy to say that people should understand and accept the cultural values and beliefs of others, but people vary in their ability to simultaneously process conflicting beliefs. This is a dimension which psychologists label "cognitive complexity". Those lower in this dimension have difficulty with conflicting beliefs and are more responsive to a process called "cognitive dissonance" in which people shift their beliefs to get them to be more congruent. If a person we like has an opinion we do not like, those lower in cognitive complexity either reduce their liking of the person or increase their acceptance of the opinion.

Cultures make distinctions that are absolute, often tacitly held truths, and therefore difficult to question. Food is a great example. There is little in biology to eliminate most possible foods from the human diet, but cultures make a great distinction between what is and is not food. As an American, I was astonished when a colleague from Czechoslovakia refused my offer of a slice of that great American favorite, pumpkin pie, because in her country, pumpkin was fed to pigs, not people. My American students have a hard time understanding how Hindu students could turn down a cheeseburger, but the American would be shocked if offered a horsemeat sandwich. In our minds, whether a cow or a dog or a pumpkin is people food is absolutely true. Culturally learned truths about medicine, science, and technology are just as absolute, and often of as little validity.

This does not mean that I must accept and adopt the beliefs of other cultures, or be tolerant of their intolerance. If I want to host people from many cultures, it is not necessary that I join them in their beliefs, but it is helpful if I am aware of their beliefs and maintain respect for their desires. This does not mean that I am going to serve horse or dog at my picnic, but that I am not going to have a pig on a spit when I invite over those who would be offended. If a guest is from a culture that expects women or people of a certain background to be subservient or invisible, I am going to explain that other cultures get respect, not obedience.

In the same way, as medical technology develops, it is important that designers and decision-makers are aware of and comprehend the culture based "truths" of customers

and healthcare deliverers. This often requires increased cognitive complexity on their part. While some may simply be incapable of this diverse perspective, many have had their perspective limited by their cultural setting and life history, but have the mental capacity for cognitive complexity once they have some enlightening experiences.

The Challenge of Teams

Science and/or design efforts reflecting the breadth of relevant technical knowledge as well as the breadth of issues impacting those involved in health are beyond the scope of knowledge and capacity of any one individual. This leads to the requirement for collaborative efforts by people of diverse backgrounds and knowledge, whether in structured organizations, cross-functional teams, or simply passing sub-solutions to others in the marketplace. Of course, collaboration and teamwork actually conflict with the cultural assumptions of some, but most successful science and design supporting organizations recognize the value of well managed teamwork and collaboration.

To deal with reality effectively, these collaborations consist of people from a great variety of disciplines and knowledge bases. Researchers in teamwork have long understood the importance of trust in team effectiveness, but these "cross-functional" teams have a special aspect that interferes with trust building. A great deal of research has been based on sports teams or work teams. In these teams, the competence of the various team members is obvious very quickly. However, in cross-functional teams, because the various team members come from different disciplines and knowledge domains, they cannot assess the quality of work of their colleagues. An accountant is unlikely to be able to check the calculations and logic of the engineer and thereby know to what degree the person's engineering competence should be trusted.

Therefore, in these teams, trust can only be built personally, in social ways which allow each team member to assess the character and integrity of team members, to decide whether to allow each of the other team members to influence the team members thinking. This is a difficult task in any team but most teams attacking complex issues such as medical technology draw their members from many different cultures. These cultures may provide quite different "truths" about who to trust, how to work with others, and how to organize creative work, as well as different views on health and healthcare.

Culture styles of Hofstede

One of the more interesting writers about cultural differences in thinking and values is Geert Hofstede (1996), who gathered data from managers in a large technically oriented multinational company. The managers were very similar in jobs and training but represented most of the cultures of the world. He found that along four dimensions, people of the same culture were more like each other and different from other cultures. More recent work to include Chinese managers has led to a fifth factor.

Note that these are not types, but rather ranges across which people are positioned, with different averages for each culture. Note that since we are discussing the average, the

central tendency for each culture, there are many individuals in any one culture who are closer to the average of another culture than to their own.

Power Distance

Some people are more comfortable with hierarchy and authority relationships. In countries such as Malaysia and Guatemala, people find it normal for someone to have a great deal more or less power than they do. In countries at the other end of the spectrum, such as Israel and Austria, it is very uncomfortable to have anyone in authority over you. The United States scores 40 on his standardized 100-point scale, leaning toward less acceptance of authoritarian relationships. Note that this factor is not one's need to be high in a hierarchy. Both those who accept being on the lower rungs of society and those who feel they have been born to rule are high on this dimension.

Individualism/Collectivism

Ties are weaker between members of more individualist societies such as the United States and Australia. People are expected to take care of themselves and not rely upon others. In more collectivist societies like Ecuador and Guatemala, people have strong ties with family, village, society, etc. and success of the whole is far more important than the success of any one member. People from a collectivist culture see teams as a great chance to work with and help each other. Americans tend to value teams where they can best show off their abilities.

Uncertainty Avoidance

People differ in the degree to which they feel threatened by uncertainty. Those from cultures high in uncertainty avoidance, like Portugal and Greece, take strong steps to increase predictability, often with written and unwritten rules everyone must follow. Those low in uncertainty avoidance, such as Jamaica are far more comfortable with change, even when they cannot reliably predict the results of the change. The United States leans toward less uncertainty avoidance, scoring an index of 46 out of 100.

Masculine/Feminine

This factor has nothing to do with sexual preference. Hofstede has labeled as masculine those cultures in which there is a strong distinction between the task oriented male role and the nurturing female role, such as Japan and Austria. He has labeled as feminine those societies in which men and women are equally willing to be strong and nurturing, such as Norway and Sweden. The United States leans more toward the masculine with an index of 62 out of 100.

Time Horizon

In his more recent writings, Hofstede has been exploring the fit of these factors to the Chinese and other Asian cultures not included in his original sample. In addition to the four factors mentioned above, he is looking at a dimension he discusses in terms of Confucian values, but which seems strongly similar to the time horizon factor of Elliott

Jaques (1976). Some people tend to consider only the immediate impact of ideas and decisions, while others look far into the future. Jaques has found that generally, the higher a person is in an organization, the further they are looking into the future. It is obvious that cultures also differ in their focus on the future. Some only consider today, while others consider generations far into the future.

Real world implications: the "global"

Some people learn of these differences and attempt to apply these population averages to individuals, often to strange results. I am aware of a recent joint engineering project between a Japanese and an American manufacturer. After intensive "multi-cultural training", the engineers met for the first time. The Americans entered bowing and holding out their business cards, while the Japanese greeted them with a big hello and a hearty handshake. They had been trained to **be** each other.

People diverge from the average, so the individual you are thinking about might actually be far from the average. This is especially likely for people who have moved out of their country for school or work. Basically, if they were close to their home values, they would still be there. International travel seems more likely among those who feel at odds with their home culture, so an individual is less likely to match those still at home.

Another process takes place with travel and experience. Many people become what might best be described as a "global". They are aware of the breadth of cultural differences and prepared to cope with them. Their style is likely to deviate from the home culture and they are more able to work with people of different styles.

Of course, even when team members do not match their home culture or when all the team members come from the same background, there is generally going to be variation along the five dimensions within the team.

Design Team Dynamics

It should be readily apparent that people differing on these dimensions will be challenged when attempting effective collaboration. High power distance people try to get the hierarchy established while low power distance people try to avoid any such structure. High uncertainty avoidance people try to move fast to get decisions made and to clarify specifications, with low avoidance team members are trying to keep the limitations on their thinking open as long as possible. What is very interesting about these dimensions and differences is that these are identical to the factors which process facilitators try to manage when trying to maximize the effectiveness of teams and design projects.

Brainstorming as a Culture Shift

Alex Osborn was an advertising executive who noticed that junior people with interesting ideas were not saying them in the meetings. He realized that the usual meeting environment discouraged people from both flexibility and fluency, so he designed a meeting environment called brainstorming to get the creative ideas out for discussion.

He realized that people kept silence because of their fear of the opinions and criticisms of others. With Osborn's four basic rules, groups were able to work together and generate 50 to 500 ideas in five minutes. His groups were so productive that no secretary could keep up, so sessions were tape-recorded and typed transcripts given to those attending for later evaluation.

Osborn's brainstorming technique can be seen first as a call to reduce people's avoidance of uncertainty. They were encouraged to contribute ideas of which they were not certain. It was also as a request for people to reduce their power distance. You were encouraged to contribute ideas that conflicted with those of your boss and those of people with more credentials in a discipline.

It is important to note that the brainstorming only works on people who need it. Its success depends on the team members' acceptance of the power distance of the facilitator; on the certainty given by the guarantee to judge the ideas very carefully later; by the individual goal of generating ideas high in quantity and diversity. The people we label as "creative" rarely follow the rules of brainstorming. They judge constantly, refuse to listen to the facilitator, etc. Like judo, the best facilitation techniques use the energy of the tendency they are trying to overcome to beat it.

Many other facilitative approaches can be seen as movements along Hofstede's cultural dimensions. When people are taught to solve problems in teams, they are often encouraged to define the problem in broader terms, considering who else might be affected (being more collective) and how it might affect the future (extending the time horizon). In addition, a great many techniques of "facilitation" of team creativity are more of a nurturing type, affecting the social and emotional interactions of the team members. To deal with these issues simultaneously with task issues requires a move more toward what Hofstede calls the feminine. Again, facilitative techniques work by plugging into cultural values to shift behavior to a type that is normally blocked by cultural values. This goal is based on the assumption that different ideas are available to people of different styles, so creativity consists of looking where you have not already looked, in the place that is not "normal" or "habitual".

Of course, if different cultures are positioned at different points on the dimensions, the direction they need to go to these "hidden" possibilities might be quite different, and the techniques would have to be anchored in their own cultural styles. It leads one to question whether techniques invented for American managers and engineers are the optimum choice for teams from other backgrounds.

American Style Problem Solving?

It may be fair to say that most of the techniques used for team leadership and deliberate creativity are attempts to shift, at least temporarily, away from the more usual American style. They seek to reduce the power distance, decrease the avoidance of uncertainty, extend the time horizon, take a more collective view of success, and utilize the nurturing skills of a "feminine" society.

How effective are the techniques with people from cultures that are already different from the American style? It may be that they are already "creative," or it may be that

creativity actually lies in exploring the areas outside one's habitual thinking. So maybe creativity for a Jamaican is to be a little less tolerant of uncertainty, etc.

Leading Multi-Cultural Teams

If the different types of thinking and discussion that make up effective problem solving are similar to cultural differences, it would seem that the solution is to select people of the right mix of cultures for each team. However, of course, the real issue is what styles they can adapt together deliberately. Lets all be Jamaican for some brainstorming, now be Austrian for idea evaluation, etc.

It seems likely that people of different cultures will react differently to the various components of facilitation and leadership attempts. Some will love one part of the process, others will love another. However, if the techniques rely upon American cultural habits for their power, these methods are unlikely to be effective with those of different habits.

Therefore, it seems critical for anyone attempting to lead deliberate creativity by teams that they have an understanding of the ways that team members differ. It is also important to understand both the effects and the anchors of various methods, and be prepared to design and use methods with different effects and anchors with people whose styles are different.

It is probably even more useful if the team members understand the issues and differences so that they can make adjustments to each other's perspectives and values. When team members understand and are able to discuss their differences in style, culture, and personality, it becomes possible for each team member to participate more effectively in each different aspect of the creative and problem solving processes.

Designing and managing a collaborative team for medical technology

A team assembled to develop a product or service of medical benefit should not only include competence in the various technical knowledges relevant to the problem and solution, but also include awareness of the values and paradigms of those people involved in utilizing the technology.

Almost inevitably, that team is going to be multi-cultural, so it is critical that they are flexible and of adequate cognitive complexity to manage conflicting values and thoughts during the design process. It seems very likely that the same flexibility that allows one to work effectively with people of different cultural assumptions is the flexibility that allows a team to discover the most creative and advantageous design possibilities.

Team cohesiveness is not designed and managed, like assembling a fine watch, it is a process in which the team members create their own compromises, their own team culture. The friendships, trust, and respectful relationships that arise among the team members are unique to that team and must be developed by the team as it watches itself proceed.

As to process for the team, one model might be to do both ends of each of Hostede's dimensions, a sort of yin/yang as appropriate to the situation. Therefore, the team gives high power distance to the expertise of people talking in their own knowledge domain, but totally equal on synergy issues and team management. The team might be high in uncertainty avoidance on key issues like schedules and quality and remain as open as long as possible on design features. The team might check to make sure that the product makes strong contributions to health of the patient in the short term and the long term. Certain team members might focus on task while others focus on social process of the team (masculine style) while everyone is aware that both task and process need to be supported by everyone (feminine style). And each team member would strive for individual excellence in the part they contribute, while working to make sure the issues brought forward by the many different team members are handled well and the team is a success as a whole.

Conclusion

Dynamics of culture, including those of national origin, have a great deal to do with the relative success of different design efforts in medical technology. It would seem that organizers and leaders of these efforts would benefit greatly from understanding cultural differences and dynamics and from helping the design collaborations understand and manager the cultural dynamics of the teams and their interactions.

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