LINFO

Human Variability: A Brief Introduction

Human variability refers to the fact that there is a range of possible values for each of the numerous physical and mental characteristics of human beings.

Fundamental Characteristic

Variation is, in fact, inherent in every living species. It is the result of fundamental biological and environmental processes, and it is an important trait in ensuring the vitality of species, their ability to adapt to changing environments and even their very survival.

The degree of variability can differ considerably according to the species. It is generally believed that it is much greater in humans than that of any other species. This is largely because the brains of humans are far more advanced, thus creating numerous new or expanded categories in which there are variations (e.g., education levels, language and artistic skills).

Individuals in many species, including humans, are highly aware even from infancy of the differences among individuals in their own species, and they are usually far more aware of the variability in their own species than in other species.

The fact that each person is different is so basic to the human experience that it would be difficult to visualize a world in which all people were identical. Yet, despite the fact that variability has been so fundamental to the survival and advancement of humans, it has also had major costs, ranging from subtle discrimination to ostracism to genocide. These costs have been borne disproportionately by some individuals and groups.

Types and Sources of Human Variability

Differences among humans can be classified in a number of ways, including genetic or environmental, transient or permanent, physical or psychological and voluntary or involuntary. Among the many way in which humans can differ are gender, coloring (e.g., skin, hair and eyes), *race*, blood type, body shape and size (e.g., bone structure, height and obesity), physical abilities (e.g., muscular strength, endurance and coordination), mental abilities (e.g., *intelligence*, creativity, musical aptitude, artistic skills and leadership), *disabilities* (e.g., deafness, blindness, color blindness, missing limbs, allergies and phobias), temperament (e.g., extroversion, intellectual curiosity, impulsiveness and risk-taking), vulnerability to specific diseases, sensitivity to specific chemicals, cultural differences (e.g., language, religion, food preferences and spatial preferences), location of residence and ownership of physical possessions.

Differences are often distributed according to certain predictable patterns. Some, such as height or intelligence, have a *normal* (i.e., bell shaped) distribution. Others, such as sexual orientation and handedness, have a *bimodal* (i.e., two distinct peaks and few values in between) distribution. Still others, such as skin color, may vary continuously in a population, but some societies attempt to divide them into several distinct categories.

There is no consensus as to the meaning of some of these characteristics, or even with regard to how to measure them in some cases. For example, it has become increasingly clear that

intelligence is a very complex concept that probably consists of many possible attributes rather than just a single one and that the long-used IQ (intelligence quotient) tests can be only a very crude measure of it. Likewise, race is also a complex issue, in part because there is great variability within each so-called *race*, sometimes more than exists between races, and because there are some groups that cannot be classified into any of the standard race categories (e.g., the Ainu of northern Japan).

The sources of human variability can be divided into two broad categories: biological inheritance and environment. The former includes mutations, *allelic differences* (i.e., any one of a number of alternative forms of a gene occupying a given position on a chromosome), *genetic drift* (i.e., changes in gene frequencies in isolated populations over time), natural selection and cultural selection.

Although many variables are at least partially determined or affected by genetic factors, few of them are controlled solely by simple *Mendelian inheritance* (i.e., a single gene being entirely responsible for a trait). Rather, most are *polygenic* (i.e., controlled by multiple genes) or are determined by a complex combination of genes and prenatal environment.

Environmental causes can be divided broadly into the prenatal environment (particularly nutrition and disease in the mother) and subsequent factors (such as nutrition, culture, disease and accidents).

Some genetic traits can be beneficial in certain circumstances and useless or harmful in others. Among the most obvious is skin color. That is, light colored skin is advantageous in the northern latitudes, where sunlight is less intense, because it facilitates the body's absorption of sunshine and thus the creation of vitamin D. However, it can be disadvantageous closer to the equator because it is vulnerable to sunburn and skin cancer.

Attitudes Towards Human Variability

As is the case with many other species, humans rarely perceive all possible values for a given type of variability as being of equal status, and attitudes about differences can vary considerably according to the society or even according to subgroups within a society. Such status can affect many aspects of individuals' lives, including social standing, reproductive opportunities and even survival.

Examples of differences that are often given different values in different societies include skin color, body shape, disabilities and intellectual curiosity. The status associated with various values can vary greatly depending on a number of factors, ranging from local traditions to individual tastes. However, possession of above average amounts of some abilities is valued by most societies, such as physical strength, leadership and musical aptitude.

Controversy surrounds the boundaries of *normality*, just as it often surrounds the concepts of what is *good* or *bad*. That is, what might be considered normal in some societies might be considered abnormal (and, in some cases, deserving of serious punishment or death) in others.

Entire societies and groups within them typically attempt to minimize human variability. Because of this and because membership or status in a social group may depend on having specific values for certain attributes, it is common for individuals to devote considerable effort to emphasizing or deemphasizing certain of their attributes. Examples include similar ways of speaking, similar ways of dressing, owning similar collections of possessions, hair straightening, skin bleaching, orthodontia, plastic surgery and use of growth hormones (to treat extreme shortness). Among the many ways in which societies attempted (at least until recent decades) to enforce conformity were making naturally left-handed children learn to write with their right hands and prohibiting minority children from speaking their native languages at

school.

Conformity can be useful in some situations, such as in societies in which highly predictive behavior and teamwork are considered high priorities. However, there is often a great cost, often partially hidden, that is borne by people who are discriminated against because they cannot conform and by people who can conform but only do so unwillingly or with difficulty.

in addition to its adverse effects on individuals, discrimination against people with major differences can also have adverse effects for societies as a whole. An example is societies that prohibit women or ethnic minorities from engaging in certain occupations, which can greatly restrict the pool of workers available and waste valuable talent. Particularly affected can be societies that rely heavily on creativity. In addition to restraining economic growth, such discrimination can also contribute to social instability (e.g., increased crime).

Changing Attitudes

Just as different societies have different attitudes about human variations, such attitudes for a society as a whole, and for subgroups within them, can change over time. Societies can become less tolerant or more tolerant.

An interesting development in many countries, particularly in recent decades, has been the scientific study of human variability and the acknowledgment that not only are human differences normal but also that some of them that were formerly considered to be *abnormal* or *evil* are, in fact, *normal* and can even be beneficial in some cases.

In some societies there has been a comprehensive re-evaluation of variations that had long been regarded as *disabilities* or otherwise inferior. Efforts have been made to change attitudes, and laws have been passed aimed at increasing the opportunities available to people with such traits. As part of this, the concept of *differently-abled* has been promoted as a substitute for *disabled* in order to view normal human variations as having little or no negative value.

These changes in attitudes have led to the modification of products (i.e., goods and services) so that they can accommodate a wider range of human differences as well as to the accelerated development of new products suitable for people with specific differences. As part of this trend, the concept of *usability*, which refers to the efficiency, comfort, safety and satisfaction with which people can make use of a product, has been broadened to apply to as wide a range of human differences as practical.

The existence of human variability is clearly an important reason that products should be designed to be as easy to customize and configure as possible while minimizing adverse effects on their cost, functionality, aesthetics, etc. But it is also a powerful argument for having choices with regard to products, and thus for having multiple, competing producers and suppliers for each category of product rather than just a single one. (This is another reason, in addition to the usual economic arguments, for having competition instead of monopoly).

It can be argued that instead of discouraging and punishing variability, taking the opposite approach and facilitating, or perhaps even encouraging, it can be beneficial for a society, particularly a society that places importance on achieving happiness of the population, creativity and economic growth.

The unique benefit of variability in the case of humans is that it has been a major factor in the advance of civilization, such as improvements in technology (including medicine and other disciplines that extend life expectancies and enhance the quality of life), advances in the arts and even the development of democracy. This is because throughout history people with one or more (often multiple) unusual characteristics have made disproportionate contributions to

almost every field of human endeavor. These characteristics typically include an unusual skill level or an insatiable intellectual curiosity and also often include being a member of some minority group (e.g., religious, immigrant and/or psychological).

Advances in technology are increasingly allowing people to survive with variations that would not have otherwise been survivable, and they have been making it easier for people to overcome the effects of variations that give them, or are perceived to give them, disadvantages in some areas of human activity. They have also been making it easier for people with unusual abilities to take advantage of those abilities.

Examples of such technological advances are numerous. One of the most simple and useful was the development of eyeglasses several hundred years ago. Others include hearing aids, improved surgical techniques, pharmaceuticals to control physical and mental problems, Braille, wheelchairs, personal computers and the Internet.

Computers and Human Variability

Computers are an invention that is not only well suited for accommodating human variability but also for taking advantage of the benefits that human variability can offer society and even for fostering human variability.

A major reason is that they are easy to use by people with a wide range of differences, such as with regard to language, disabilities, location and work habits. This, in turn, is largely a result of the fact that both the hardware and the software are extremely customizable; that is, they can be easily modified to accommodate a vast range of human differences and preferences.

Some types of computer hardware and software are more adaptable than others to human differences. With regard to software, *open source software* (also referred to as *free software*) is much more flexible than *proprietary software* (i.e., commercial software). That is, it is far easier to modify or improve open source software because of the availability of the *source code* (i.e., the form in which the software is originally written by a programmer in a programming language) and because everyone has the legal right to modify and redistribute it.

Ideally, people in any particular group or subgroup should be able to play a role in determining how to make software, or any other product, most suitable for their own language, dialect, culture, interests, disabilities, etc. One reason is that such people are often the most qualified to make decisions about the products. Another is that that sometimes they are the only ones with a strong interest or incentive to do so. Such finely tuned customization is possible with free software, but it can be difficult for proprietary software, particularly for programs intended for smaller groups, whose development or modification typically would not be profitable for suppliers of proprietary software.

The understanding of human variability is clearly still at an early stage and much remains to be learned. However, there could be a flood of new information about it in the next few decades as a result of the continued progress on decoding and understanding the human genome.

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