**Within areas of knowledge, how can we differentiate between change and progress? Answer with reference to two areas of knowledge.**

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"Progress is impossible without change", remarked George Bernard Shaw. Among others, he recognized that progress and change were close-knit and almost always came hand in hand. This essay will explore the slight differentiation between change and progress in the areas of knowledge of natural science and human science. Progress and change in both these areas revolve around contributions to field knowledge, or shared knowledge. However, while progress in natural science is founded on the objective scientific method, progress in human science is based on a more subjective combination of observation and reason. Despite both being science, the differentiation of whether something is change or progress in reference to these areas of knowledge is distinct. Specifically, change is any alteration of knowledge or the way knowledge is applied, while progress is the positive subset of change that appends new and accurate concepts to current knowledge as we know it.

A change in natural science is a development – a new idea that appends to or challenges the existing scientific framework of knowledge and is justified by application of the scientific method, using the ways of knowing of sense perception and reason to introduce or modify objective theories, axioms, or laws. “In general, scientific progress calls for no more than the absorption and elaboration of new ideas”, asserted Werner Heisenberg, a key pioneer of theoretical physics. Because knowing in natural sciences is heavily dependent on reason, if a development supported by the scientific method justifies existing knowledge in a new way, explains a new phenomenon, debunks existing knowledge, or introduces a new application of knowledge, then it is progress in the area of knowledge of natural science. For example, following a period of observation on the Galapagos Islands, Charles Darwin published *The Origin of Species* in 1859, contending that through a process of natural selection, beneficial traits tend to find expression in species because individuals with those traits are more favorable to survive and reproduce (Darwin 78). Over time, species evolve as a whole to become better adapted to their surroundings. Much progress in the natural sciences has stemmed from Darwin’s theory of evolution. Our current knowledge of vaccines – ranging from the traditional flu shot to president-day necessities such as the coronavirus vaccination – need to account for the fact that viruses can evolve and adapt. Selective breeding, the process by which humans pair organisms to further desirable characteristics, is also founded on the premises of the ability for species to evolve. Therefore, because introduction of the theory of evolution is justified by the scientific method, explains a new concept, and also has wide applications within the natural sciences, it is not only a change, but also progress.

However, it can be argued that our perception of whether some developments contribute to knowledge might be inaccurate – scientific “progress” may later be disproven by new discoveries, and conversely an insignificant “change” may be recognized as progress later. It follows that defining progress as a development that contributes to field knowledge is flawed, as we lack a metric for determining whether a development is a contribution. For instance, Niels Bohr proposed a new model of the atom in 1913, holding that electrons orbit the nucleus in orbitals with a set size. It was the latest in a chain of atomic models, following the work of others like Dalton, Thomson, and Rutherford. Albert Einstein, one of the greatest thinkers in natural science, upheld the Bohr model. However, Bohr’s model was later shown to be incorrect. It can be hence argued that the model was only change and not progress as it did not build onto our current understanding of natural science. furthermore, it can be seen that our ability to discern between change and progress requires the test of time. However, as Larry Laudan argued, we should note that field knowledge constantly changes and approaching an objective “truth” is infeasible (Niiniluoto). Bohr’s model extended scientific knowledge in his time, offering a reasonable explanation of an aspect of nature as it was known, and hence counts as progress in that light. Whether a development qualifies as progress can vary over time because changing field knowledge perpetuates emergence of new perspectives. The goal of natural science is to approach complete understanding of the natural world, but the ideal of “complete understanding” is heavily dependent on perspective, which shifts with time. Similarly, it is important to note that Darwin’s theories were widely ridiculed in his time and considered to be only change, but today they are regarded as progress. Therefore, as long as a development expands the current framework of knowledge in natural science, it is progress and not only change.

Comparable to in natural science, a change in human science is a development - emergence of a new idea that extends or challenges existing knowledge in human science, or understanding of human behavior. Similarly, only developments shown to further field knowledge are progress. However, human science is much less objective than natural science – it is nearly impossible to formulate catch-all laws and theories that flawlessly predict human behavior. Instead, human science uses the more subjective ways of knowing of sense perception and language to back up reason, and also frequently relies on general trends in statistics – either as part of the development or as a tool to analyze it afterwards – to differentiate whether it is progress. Methodologies to gain knowledge in human science value reason, but allow the evidence on which that reason is based to be imperfect. Data and observations in human science do not have to seamlessly obey a behavioral pattern to be true and applicable, making the line between progress and change blurrier than that of natural science. In 1967, Aaron Beck introduced CBT, or cognitive behavioral therapy, a form of talking therapy, to treat a wide range of mental health issues. In 2000, Beck reviewed 14 meta-analyses for CBT and found that approximately 80% of adults benefited from the therapy. In the early 2000s, researchers analyzed a representative sample of 106 additional meta-analyses and concluded that CBT was effective (Hofmann). Because statistics support the fact that CBT is overall helpful in treating disorders, the emergence of CBT expands knowledge in human science by offering a new method to combat mental disorders, meaning that CBT is progress. On the other hand, in the 1900s, branching off of Darwin’s concept of natural selection, Herbert Spencer and others argued that the same set of laws governing evolution were applicable to humans, forming what was known as Social Darwinism (Rogers 265). This theory contended that those with power in society are in their positions because they are innately superior. It was widely accepted for decades, but had no sound scientific basis in retrospect. Even though Social Darwinism was used to justify racism and imperialism for much of the 20th century, it is now obsolete and does not form the basis of any major concepts. Hence, as present-day field knowledge is not built upon it, and it does not currently have any applications within or outside human science, the introduction of Social Darwinism was only a change.

However, because knowledge in human science is the understanding of human behavior and not objective facts, knowledge is grounded on the subjective ways of knowing of sense perception and language. Thus, it is often possible to have misleading data that inconclusively defines a development as progress when it is actually change or vice versa. Notably, one of the most popular methodologies today for collecting data regarding human science is self-reporting. Because self-reporting relies heavily on communication with language, it is possible that collected data is flawed due to miscommunication. Self-reporting is also subject to other sorts of biases such as social desirability bias, where participants select more socially desirable options even if the survey is anonymous, or recall bias, when participants provide erroneous responses due to a failure to recollect a past event (Althubaiti). Hence, a variety of reasons can produce bad data that is distorted or unrepresentative, resulting in false positives or false negatives that can cause incorrect differentiation between change and progress. Nevertheless, it must be realized that developments in human science undergo continuous testing, with inaccuracies becoming more insignificant as more tests are done. Because developments undergo continuous rectification in this manner as more data pours in, what is eventually recognized as progress is usually well tested and hence well founded. For example, Beck reviewed 14 meta-analyses before concluding that cognitive behavioral therapy is effective, and many more studies support his point. Therefore, until evidence surfaces to disprove a development that is recognized as progress, the development serves as a part of field knowledge that is operationally effective, and will thus remain classified as progress.

Natural science and human science are both sciences, but they view progress and change differently. In both natural science and human science, any development is change, but only those that advance knowledge are progress. Defining progress is hard because field knowledge and our perspectives rapidly shift, meaning what we see as progress can quickly change. Recognizing how to differentiate between change and progress is important because it allows us to gauge whether our actions have perpetuated progress, or whether they are simply change. As Michael Bloomberg stated, "progress is not inevitable. It is up to us to create it." Only if we know what progress is can we strive to progress. In our quest to obtain more knowledge, it must be recognized that the differentiation between change and progress does not create unchangeable labels – change becomes progress when it introduces new applications or implications, and progress becomes change when it is refuted.

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