

Chapter X

Beyond Science Fiction Tales

...by performing better and cheaper, the robots will displace humans from essential roles. Rather quickly, they could displace us from existence.

I'm not as alarmed as many by the latter possibility, since I consider these futures machines our progeny, "mind children" built in our image and likeness, ourselves in more potent form. Like biological children of previous generations, they will embody humanity's best chance for a long term future. It behoves us to give them every advantage and to bow out when we can no longer contribute. (Moravec, 1998, p. 13.)

THE AUTOMATED ARCHAEOLOGIST AS A TIME MACHINE

We have already argued that an automated archaeologist cannot understand past social actions by enumerating *every* possible outcome of *every* possible social action. The need to insert *all* the world within the automated archaeologist's brain and then maintain every change about is impossible. However, if we cannot introduce the world inside the robot, we may introduce the robot inside the world. What the automated archaeologist would need then is to be situated in the past,

and then using observation and attention to learn from human action, because of the complexities of the past, which resist modeling. It leads to a modification of the aphorism espoused by Rodney Brooks (1989): "the past itself should be its own best model." Consequently, the automated archaeologist must travel to the past to be able to understand why it happened. Only by being situated directly in the past, the automated archaeologist would understand what someone did and why she did it there or elsewhere.

This is the classical time machine analogy. If situated in the past, the automated archaeologist would interact with the precise context in which social activity was performed because it would be an integral part of it. Wonderful! Now, the bad news. There is no way of actually going back into the past to test a historical hypothesis. The automated archaeologist exists only in the present, then any activity or action or behavior that happened in the past is now out of its reach. It cannot see in the present what was performed in the past. It can examine only what it perceives within the present, the material objects that surround it, here and now, and, only from these objects, the cognitive robot should infer what it has undergone. Of course, the automated archaeologist can perceive the *effects* of social activity performed in the past, but these are its *actual* effects. Social activity in the

past cannot be perceived in the present, and then, our machine cannot be situated in the context in which the action was performed.

The impossibility of seeing the past affects not only archaeologists but also any discipline dealing with *cause* and *effect*. The past should be transferred to the present if someone pretends to explain the cause of an effect observed in the present. When a pediatrician asks the child's father what his son ate *yesterday*, she is doing "history," because she investigates a temporal dimension to solve a *why* question: why the child has *now* stomachache. The pediatrician uses what the father says (a narration in the present about something he saw in the past) to "see" in the present what the child's ate yesterday. Like medical histories, social researchers have at their disposal texts containing narrative memories existing in the present, but written in the past by real (or supposed) witnesses of past events. In so doing, historians are not traveling themselves to the past, but they build a surrogate of the past, which they interrogate. They are situated in a virtual world extracted from a narration -supposed to be true-, written (or told) by an individual having seen someone doing something in the past, or explaining her intentions when acting. The past is then accessible through the filter of a surrogate built indirectly from personal narratives, written or told in the past and preserved in our present.

In Archaeology, we do not have any personal witnesses. We do not have descriptions of past facts, or explanations of motivations, intentions, nor goals. The only we have are some material traces for some (not all) outcomes of social activities performed in the past. Even in the case of human bodies found in burials, we do not have the *actors* of past activities; they are, in some sense, products, or material consequences of what others did with them. Even in those circumstances, the past can be transferred, partially, to the present.

In general, the automated archaeologist assumes that some initial event in the past has been modified, and what it perceives *in the present*

is just some of those modifications, which have been preserved in some way. In that sense, archaeological sites can be considered as puzzling traces (effects) of long-past events, because all outcomes of social activity have been created and transformed during the development of some activity and they carry with them a historical residue of that development.

Michael Leyton (1992, 2005) argues that a trajectory of changes (a history) can be described as a discontinuous sequence composed of a minimal set of distinguishable actions. The key idea is that what appears to be different in the present speaks about some action in the past that generated such a difference. Variability in the present is understood as having arisen from variability in the formation processes. In an archaeological data set with no variability, nor any differences among its elements, the best hypothesis is that the corresponding causal process has the least amount of variation. If a property is invariant (unchanged) under an action, then one cannot infer from the property that the action has taken place. Any cognitive agent (be a human or a machine) cannot explain the history of water in a lake, because water is spatially and temporally undifferentiated. However, if we can distinguish variation (curvature, or surface irregularity) along the basin lake perimeter, we can follow the geological transformation of this landscape. Therefore, the automated archaeologist should regard the complexity of the spatiotemporal trajectory of visually apparent differences as a measure of the amount of social activity needed to produce perceivable variation.

The automated archaeologist will use perceived "variation" in shape, size, texture composition and spatiotemporal location values to "run time backwards" and *explain* how those variations were *caused*. Distinctions between successive stages of an archaeological trajectory of changes and modifications point to a past event where variation did not exist; sufficiently far back, no difference existed. An automated archaeologist

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