

# Cooperation Between Humans and Robots: Applied Agency in Autonomous Processes

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## ABSTRACT

For humans and robots to successfully co-exist, humans must be able to use and express their creative problem solving skills as well as to make free will choices from options available to them at any given time. Too much automation in combination with too many automated processes, can leave humans without the ability to express themselves and can result in thwarted processes, unhappy humans and challenges to ethical boundaries. Rather than inserting robots into environments simply to complete pre-programmed tasks, we suggest that robots will function most successfully as cooperative partners with humans in environments where they are required. We examine Rethink Robotics' Baxter robot as an excellent example of a cooperative robot.

## Categories and Subject Descriptors

H.1.2 [User/Machine Systems]: Human Factors. I.2.9 [Robotics] *Commercial robots and applications, operator interfaces* J.4 [Social and Behavioral Sciences] Anthropology.

## General Terms

Algorithms, Management, Performance, Design, Reliability, Human Factors, Standardization.

## Keywords

Robots, Interaction, User Experience, Agency, Covert Agency, Disguised Agency, Processes, Scripts, Automation, Algorithms, Ethics.

## 1. INTRODUCTION

Rethink Robotics' *Baxter* [1] is arguably the best example of humans and robots working together that we have seen to date. *Baxter* differs from other manufacturing robots in that it is made to work alongside humans. *Baxter* is a cooperative robot, designed to be programmed on the factory floor in the context of the work it is assigned. The environment it dwells within is considered. This is important as humans also dwell in the same environment and require the ability to make choices to promote their well-being. *Baxter* enables a cooperative relationship between

a human and a robot — in this case balanced in favor of the human. This enables people to have free choice when required to interact with *Baxter* and/or semi-automated processes.

## 2. DISCUSSION

*Baxter* is designed to facilitate positive direction by people and to reduce negative impact. *Baxter* can be programmed directly on the unit by workers on the shop floor without a keyboard. It has soft edges and long articulated arms, that operate with restricted force. For example, if one interacts with *Baxter's* arms, it will resist if it is in the middle of a task, but then it will stop. Rethink Robotics purposefully gave *Baxter* a "screen" face, which has rudimentary digital eyes that move from side to side to indicate direction and focus. Rethink Robotics revealed at O'Reilly Solid in 2014 that users seem to like *Baxter's* graphical facial features. *Baxter* has no "uncanny valley" features at all, which may also be part of its appeal: it looks and behaves like a robot [1].

What fixed automation cannot do (well), but humans can, is apply "agency" to making choices in critical contexts. Agency is the ability to make free will choices, particularly in relation to choosing goals and how to work towards achieving these. Agency implies that some of an entity's future choices are both autonomous and non-monotonic; not intrinsically fixed or stochastically predictable except on the basis of heuristic principles [2]. The presumption is that an agent (person or algorithm) must itself make choices from alternatives it has assembled to advance towards a goal within a complex context in which other agents are making other choices that may directly or indirectly impact this context [3].

Human agency supports the initiative and capacity to creatively solve problems. Fixed automation uses fixed responses from different systems (that may or may not be coordinated by a central routine) and has programmed paths that only represent the products of agency designated by their programmers. Since (mostly) that programming doesn't happen in the work context, and is directed towards fulfilling formal operational plans, potential paths to address new problems are limited [3].

One of the tradeoffs in modern business practices has been to remove agency from workers in favor of processes that can streamline a diverse workforce. This can leave people feeling that they don't have acknowledged agency in the channel to solve problems that arise. This could be considered a type of "programming" that is imposed on human workers to generate predictable outcomes. However, disallowing agency for humans can have ethical implications. Discussion around robots and ethics often frames the argument to consider whether or not robots will

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The Emerging Policy and Ethics of Human Robot Interaction, Mar 2, 2015, Portland, OR, USA.

be sentient. Pared down, "lean" processes that require workers to follow scripts rather than make independent choices based on their better judgement, create an ethical problem, for what is 'right' for business practices and efficiency can simultaneously be 'wrong' for human experience. In any ethics discussion at the moment (due to limitations of AI), robots are neutral entities programmed to follow scripts and processes. In a similar, but reduced way, humans are currently being "programmed" in their work by their companies via requirements to adhere to scripts and processes dictated by their companies. The difference between humans and robots in this context is that robots are incapable of expressing direct agency unless a human helps them, whereas humans do have agency, and are able to use it to solve problems that rigid scripts and processes may create.

Applin and Fischer (2013) use the term "disguised agency" [4] (also "covert agency" [5]) to describe situations in which people take initiative to solve problems outside of a scripted process. Disguised agency or covert agency occurs most often when mandatory processes and scripts are broken, ineffective in completing tasks or where humans desire more flexibility in their work environment and thus create it. In order to remain employed, workers will do what they need to do to make the processes and scripts they are subjected to, successful. If a process or script is ineffective to those ends, workers can and do modify the process to give themselves some agency within it to either address problems or to have more time, flexibility or control over their work.

In "Watching Me, Watching You. (Process Surveillance and Agency in the Workplace)," we discuss how corporations are using scripts and semi-automated processes to collect data from workers wearing sensors, with the goal of streamlining internal procedures. Sensor based tracking and surveillance in the workplace observed in such places as Amazon.com and Tesco's warehouses, along with other industries such as long-haul trucking, has generated discussion around privacy, human dignity, and the boundaries between people and their livelihoods, as people are more frequently being required to support the streamlining of process as a priority over the quality of their own human experience — except where required by law [4].

As corporations increasingly control their image and production processes, the need to disguise agency at all levels of the organization has expanded to protect jobs. Most times larger corporations never know that their process has been modified to make it work better, or at all – they only see the outcome of covert agency and thus have a false sense that their processes are working, when in fact they are actually broken, but being patched in real time by worker agency [4].

When systems are automated, and workers are removed from the system, covert agency goes along with it. Suddenly processes that were thought to have performed flawlessly begin to break because the performance success of the process was derived from workers taking covert agency and not the process itself. As a result, companies are left with processes that break, are inefficient and can't adapt to tiny changes in procedures, and companies cannot understand why their processes fail. When this is a strictly robotic process in a factory, this may not be an issue. However, as more and more robots are being designed to insert themselves into human relations such as hotel, retail, medical, or assisted living environments, the flexibility for robots to express agency becomes

much more critical — if the desired outcome is successful cooperative transactions between the human and machines designed to provide services.

In order for this cooperation to succeed, robots will need to be designed in such a way that the ability for humans to express their own agency through them is afforded. Thus, a more effective solution (as well as one that preserves human ethics) would be for whoever designs robots and robot algorithms to accommodate means for workers to apply agency through the system as an option for humans interacting with them, rather than unconsciously "relying" on worker-generated covert agency. In the instance where robots do not have capabilities that enable human-like agency, humans interacting with them are limited, for robots in the human/machine context are not "open" and even if they were, most humans working alongside robots are typically unskilled in conventional programming and lack the tools in-context, to change their behavior. This is why Baxter is such a useful prototype adaptation for this type of interaction — it offers humans the ability to easily program and modify its behavior for improving process functionality.

### 3. CONCLUSION

Baxter and other robots that enable humans to modify their processes on-the-fly, have real potential to support an agency based solution to the problems that Applin and Fischer (2013) identify [4]. By moving some of the programming to where context happens and by enabling humans to do the programming of their robot tools, Baxter enables applied human agency and successful automation of many manufacturing processes. This helps to maintain the ethical balance in favor of humans, while still enabling corporate processes to be robust.

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