

Ironies of Automation

A Comedy in Three Parts

@101010Lund

Irony

Combination of circumstances, the result of which is the direct opposite of what might be expected

Paradox

Seemingly absurd though perhaps really well-founded statement

Brief Paper

Sources

(Bainbridge 1983)

<http://www.bainbrdg.demon.co.uk/Papers/Ironies.html>

Ironies of Automation*

LISANNE BAINBRIDGE†

Key Words—Control engineering computer applications; man–machine systems; on-line operation; process control; system failure and recovery.

Abstract—This paper discusses the ways in which automation of industrial processes may expand rather than eliminate problems with the human operator. Some comments will be made on methods of alleviating these problems within the 'classic' approach of leaving the operator with responsibility for abnormal conditions, and on the potential for continued use of the human operator for on-line decision-making within human–computer collaboration.

Irony: combination of circumstances, the result of which is the direct opposite of what might be expected.

Paradox: seemingly absurd though perhaps really well-founded statement.

THE classic aim of automation is to replace human manual control, planning and problem solving by automatic devices and computers. However, as Bibby and colleagues (1975) point out: "even highly automated systems, such as electric power networks, need human beings for supervision, adjustment, maintenance, expansion and improvement. Therefore one can draw the paradoxical conclusion that automated systems still are

designer errors can be a major source of operating problems. Unfortunately people who have collected data on this are reluctant to publish them, as the actual figures are difficult to interpret. (Some types of error may be reported more readily than others, and there may be disagreement about their origin.) The second irony is that the designer who tries to eliminate the operator still leaves the operator to do the tasks which the designer cannot think how to automate. It is this approach which causes the problems to be discussed here, as it means that the operator can be left with an arbitrary collection of tasks, and little thought may have been given to providing support for them.

1.1. *Tasks after automation*. There are two general categories of task left for an operator in an automated system. He may be expected to monitor that the automatic system is operating correctly, and if it is not he may be expected to call a more experienced operator or to take-over himself. We will discuss the ironies of manual take-over first, as the points made also have implications for monitoring. To take over and stabilize the process requires manual control skills, to diagnose the fault as a basis for shut down or recovery requires cognitive skills.

@101010Lund

The ironies of automation ... still going strong at 30?

Sources

(Bainbridge 1983)

<http://www.bainbrdg.demon.co.uk/Papers/Ironies.htm>

(Baxter et al. 2012)

http://johnrooksby.org/papers/ECCE2012_baxter_ironies.pdf

Gordon Baxter, John Rooksby, Yuanzhi Wang and Ali Khajeh-Hosseini

School of Computer Science

University of St Andrews

St Andrews

UK

{Gordon.Baxter, jrnr Derek.Wang, ak562}@st-andrews.ac.uk

ABSTRACT

Motivation – Bainbridge highlighted some of the ironies of automation 30 years ago and identified possible solutions. Society is now highly dependent on complex technological systems, so we assess our performance in addressing the ironies in these systems.

Research approach – A critical reflection on the original ironies of automation, followed by a review of three domains where technology plays a critical role using case studies to identify where ironies persist.

Findings/Design – The reliability and speed of technology have improved, but the ironies are still there. New ironies have developed too, in cloud computing where the cheaper cost of computing resources can lead to systems that are less dependable when developers bypass company procedures.

Research limitations/Implications – The work relies on published or reported cases. This makes it difficult to precisely determine how widespread the issues are.

Originality/Value – The research re-iterates the importance of the need to regularly consider the ironies of automation in systems development so that we can mitigate against any potential adverse consequences.

recent technological developments may have some new ironies in store for us.

We begin by providing a recap of the ironies of automation that Bainbridge originally highlighted. We then consider the way that technology has developed over the past 30 years, and what effect this has had on the ironies of automation. We focus our discussions on three domains that are the subject of ongoing interest because of the central role occupied by technology: aviation; financial trading; and cloud computing. For each domain we illustrate our discussions with an analysis of a case study of a situation where things went wrong. We highlight some of the ironies in each case study, and discuss the ironies more broadly for each domain, highlighting where some new ironies are starting to emerge. We finish with a general discussion of the persistence of the ironies of automation and what we can do to mitigate against them.

2 THE IRONIES OF AUTOMATION (1982)

In her original paper, Bainbridge focused mainly on issues associated with monitoring and control activities in the process industries (chemical production, steel manufacturing and so

Act 1

The Sorcerer's Apprentice

@101010Lund



 **Matt Sullivan** @mattpsullivan · May 23
Replying to @101010Lund

@101010Lund

Tasks After Automation



Monitor

@101010Lund



I HAS BOREDOM.

Boredom. I has it.

@101010Lund

who monitors the
monitors?



@101010Lund

Are you sure you
can intervene?



Skills



@101010Lund

Manual Control Skills

@101010Lund

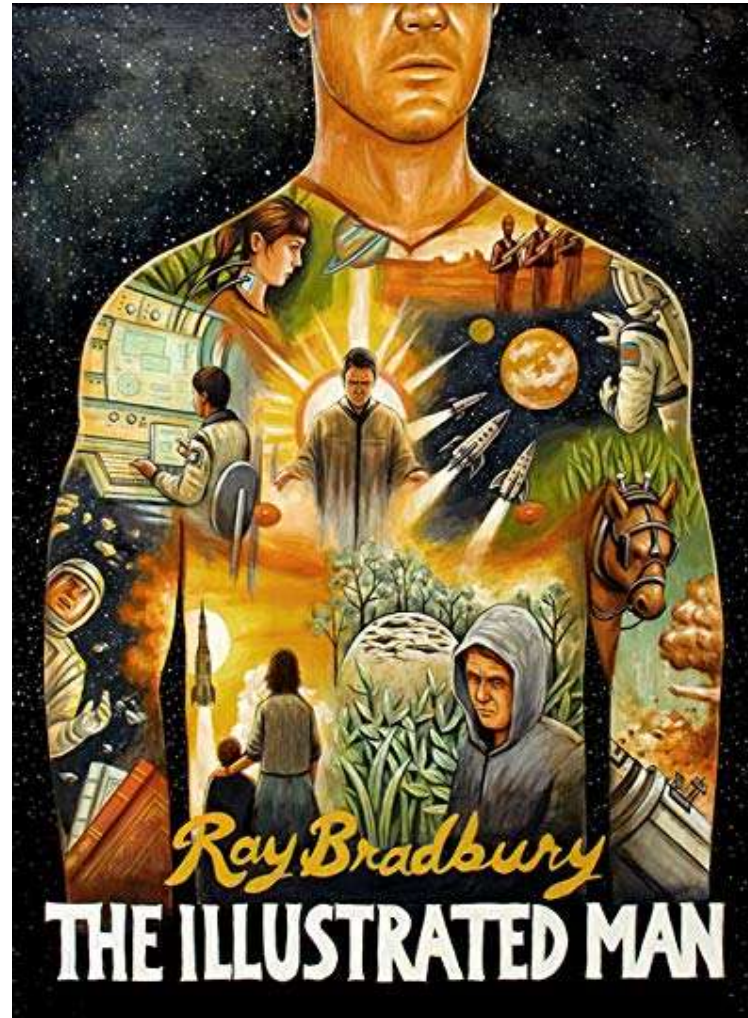
Long-Term Knowledge

Use it or lose it

Act. 2

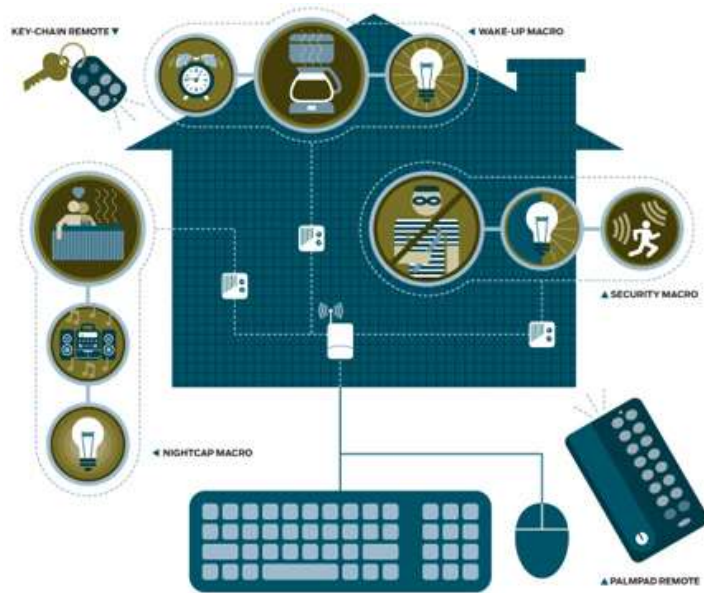
The veldt

@101010Lund



@101010Lund

The veldt



@101010Lund

Working Storage

- Knowledge of current state
- What's going on here?



Monitoring

- Can monitoring be done by an unskilled operator (or program)?
- If automation can perform the task better than you, how do you know what you need to monitor?

Interlude

Some potential mitigations
(they're all situation dependent)

Degradation & Shutdown

Can you afford to shut down?

If so, how fast?

If not, what can you do instead?

Keeping Skills Sharp

Occasional manual operation
Training (simulators?)

Training

General strategies only. How do you train someone how to deal with the unknown?

Training =
1 / Alerts

Study historical outage data

Postmortem docs should not be write-only

Rediscover your system

It probably doesn't behave quite the way you
think it does

Act. 3

Choose Your Own Adventure

what have you
experienced?

ML enables new
automation

Second Order Effects

Ironies. Paradoxes. Systems thinking.

Contact

- Tanner Lund
 - Azure PRSE
- @101010Lund
- /in/tannerlund
- tlund2@outlook.com

