УДК 681.51

С.О. Медведєва
І.С. Бевз

Overreliance on Automation

Вінницький національний технічний університет

Анотація

У статті розкриваються проблеми, викликані надмірним використанням автоматизації та розглядаються деякі способи для запобігання або зменшення його можливих негативних наслідків.

Ключові слова: Автоматизація, GPS, надійність, дотримання, переоцінювання.

Abstract

The article reveals the problems caused by the overreliance on automation and gives the overview of some ways for avoiding or diminishing its possible negative effects.

Keywords: Automation, GPS, reliable, compliance, overrealiance.

The dictionary defines automation as “the technique of making an apparatus, a process, or a system operate automatically.”

We can define automation as “the creation and application of technology to monitor and control the production and delivery of products and services.”

Automated systems typically are highly reliable – with the exception of some automated alerting systems, which can have high false alarm rates. This, together with their opacity and complexity, can lead operators to rely unquestioningly on automation. Many people suggested that the bias is reflected in the operator’s following the advice of automated systems even when the automation commits both errors of omission (misses) and errors of commission (false alarms).

However, reliance on automation can be distinguished from compliance. Meyer showed that when automation reliability is such that malfunctions are almost always correctly indicated, the automation makes few misses, so operators have high reliance on the automation. This is an effective strategy but can result in a problem when the automation does fail to indicate a hazard (a miss), because in this case the operator may not monitor the automation—the so-called complacency effect. On the other hand, if automation reliability is such that few false alarms are made, then the operator usually has high compliance: If an automated alarm sounds, the operator tends to comply immediately with the alarm and attend to the situation. Reliance on automated aids permits the operator to attend to tasks other than the automated task until the alert is triggered, thus improving multitask performance and not just the performance on the automated task.

There have been some examples in the history that can serve as an illustration for the overreliance on automation

An example from the maritime industry is particularly revealing of the effects of user overreliance on automated systems. The cruise ship *Royal Majesty* ran aground off Nantucket after veering several miles off course into shallow waters. The automated systems in this ship included an autopilot and an Automatic Radar Plotting Aid that was tied to signals received by a Global Positioning System (GPS). Under normal operating conditions, the autopilot used GPS signals to keep the ship on its intended course.

This accident represents a classic case of automation complacency related to inappropriately high trust in the automation [1]. This accident also demonstrates the importance of salient feedback about automation states and actions, as mentioned earlier. The text annunciators that distinguished between the dead reckoning and satellite modes were not salient enough to draw the crew’s attention to the problem.

A general aviation accident further exemplifies the danger of overreliance on automated systems such as GPS. In 1997, a single-engine airplane with a non-instrumentrated pilot took off under instrument meteorological conditions [2]. About two hours later, following a meandering course that included course reversals and turns of more than 360°, the aircraft crashed into trees at the top of a ridge. No mechanical problems with the airplane’s controls, engine, or flight instruments were identified. Many factors

undoubtedly played a role in this accident, but the apparent reliance on GPS technology, perhaps to compensate for insufficient training and lack of ratings, stands out as a compelling factor.

There is some consensus for the existence of overreliance on automation (called complacency) for now-entrenched historical reasons related to the development of NASA's Aviation Safety Reporting System [3]. However, Moray and Inagaki disagreed with the interpretation of Parasuraman et al. that their findings reflected complacency. Though accepting that people have often failed to notice when automation fails, they argued that none of the reported literature has shown what the optimal level of trust would actually be.

Consistent with the information-theoretic model of sampling, Moray and Inagaki proposed that automation should be monitored (or sampled) by the human at a rate set by the objective failure rate of the automation: The more reliable the automation, the less the operator should monitor it. Moray and Inagaki stated that complacency (overtrust) should be inferred only if the operator sampled less frequently than this rate; if they sampled more frequently, they should be characterized as "skeptical" (undertrusting).

This is an elegant theory that has some support. Moray et al. found that in an adaptive automation experiment with varying levels of automation, participants converged on the optimal level of trust—in the sense that subjective trust matched the objective reliability of the automation—relative to higher or lower trust. Moray and Inagaki's theory depends for its validation on one's being able to specify precisely what the optimal sampling rate of automation should be. This is easy when the failure rate of the automation is known. But monitoring automation is rarely the only task for the operator, and therefore the sampling rate also depends on the operator's being able to specify the required sampling frequency of all the other tasks in which he or she is engaged. In general, identifying an optimal automation sampling rate may be difficult to do in complex systems with multifunction forms of automation and simultaneous manual tasks. Moreover, the theory cannot explain why operators apparently sample less frequently when the automation failure rate remains constant than when it varies at about the same mean rate.

The overall failure rate was the same in both conditions, but operators noticed more automation failures in the variable-reliability condition than in the constantreliability condition, perhaps because they were more skeptical. One explanation for undermonitoring of automation that complements the trust theory is based on attention. Common sense tells us that there is nothing to be gained by attending to very reliable automation with low downside risk—for example, our home heating systems—until after failure is evident. Attending to imperfect automation is also diminished when the operator is engaged in other tasks that require focal attention. Evidence in support of this view comes from studies of eye movements. Metzger and Parasuraman (2001), for example, asked experienced air traffic controllers to monitor a radar display for separation conflicts while simultaneously accepting and handing off aircraft to and from their sector, managing electronic flight strips, and using data linking to communicate with pilots. They were assisted by a "conflict probe" aid that predicted the future (up to 8 minutes) courses of pairs of aircraft in the sector.

The automation was highly reliable and reduced the time that controllers took to call out the conflict. In one scenario, however, the automation did not point out the conflict because it did not have access to the pilot's intent to change course. Controllers were either considerably delayed or missed the conflict entirely. Eye movement analysis showed that those controllers who did not detect the conflict in this case had fewer fixations of the radar display compared with when they had been given the same conflict scenario without the conflict probe aid. This finding is consistent with the view that overreliance on automation is associated with reduced attention allocation, compared with manual conditions [2].

Look around you. So many of the things that machines do for us today, were either impossible to do before the advent of those machines, or used to be done by people. People these machines replaced have found an other, often more productive, work to do.

Automation makes life easy for human beings, which is the goal of all technological progress. Once mankind makes one task easy through automation, the challenge of making it *easier* automatically presents itself. Also, other tasks take birth as a result of technological progress, and the people who would have been doing the original task, will now perform these new tasks.

In spite of high level of automation we can't rely on it completely.

СПИСОК ВИКОРИСТАНОЇ ЛІТЕРАТУРИ / REFERENCES

1. Lee J. Journal Citation Reports. Trust in Automation: Designing for Appropriate Reliance / J.D. Lee, K. A. See // University of Iowa. – 2004. – p.806-810
2. National Transportation Safety Board [http://www.ntsb.gov/_layouts/ntsb.aviation/index.aspx]. – Aviation Accident Database & Synopses

3. Parasuraman R. The international journal of aviation psychology. Lawrence Erlbaum Associates, Performance Consequences of Automation-Induced “Complacency” / R. Parasuraman, R. Malloy, L.Singh // Cognitive Science Laboratory. The Catholic University of America. – 1993. – p.24

Ірина Сергіївна Бевз – студентка групи 2АВ-12б, факультет комп’ютерних систем та автоматики, Вінницький національний технічний університет, Вінниця, e-mail: Bewz1006@gmail.com.

Науковий керівник: Світлана Олександрівна Медведєва – викладач англійської мови, Вінницький національний технічний університет, Вінниця

***I.Bevz* — Department of Computer Systems, Vinnytsia National Technical University, Vinnytsia, e-mail: Bewz1006@gmail.com.**

Supervisor: *Medvedieva Svitlana O.* — Teacher of Foreign Languages Department, Vinnytsia National Technical University, Vinnytsia National Technical University, Vinnytsia.