

Strategic IT management - 37E00200

Dark side of automation

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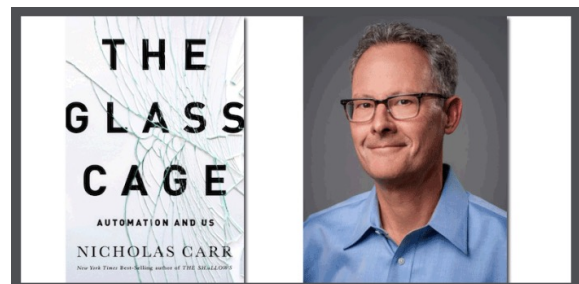
Chairman, XBRL Finland

Director, Real-Time Economy Competence Center

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Outline

- Intended vs. unintended consequences of automation
- Automation bias and automation complacency
- Technology dominance model
- Case study on erosion of skills



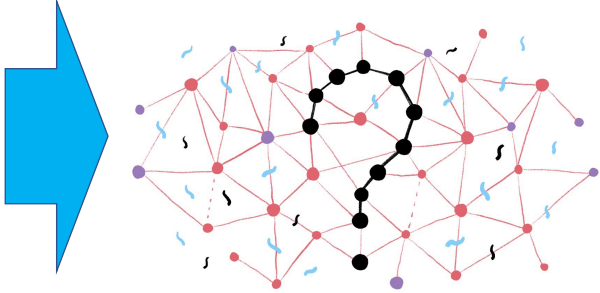


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Industrial automation



Cognitive automation



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Knowledge-work automation comes with many benefits...



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...but it has many dark sides too...

Inability to address real-world complexity results in negative effects for various stakeholders
(Drummond 2008; Rinta-Kahila et al., 2022)



Workers' disrupted role identity

(Davis and Hufnagel 2007; Mayer et al. 2020; Strich et al. 2021)



Decreased job satisfaction

(Orlikowski 1993)

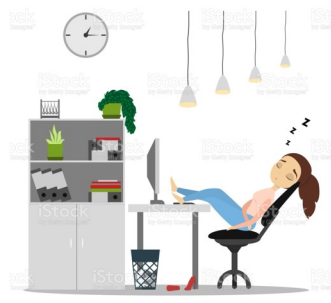


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...unintended effects that can be very insidious...

Automation bias, automation complacency, loss of situational awareness

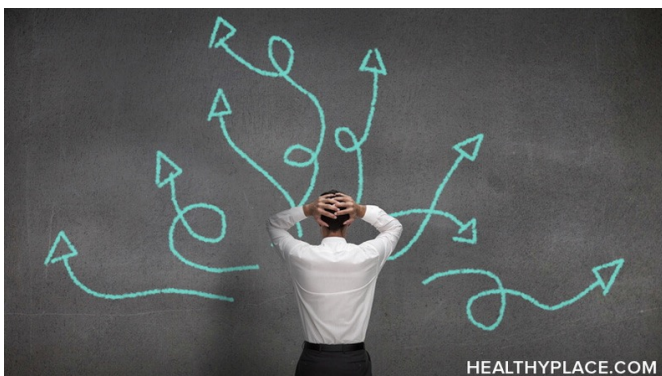
(Jussupow et al. 2021; Parasuraman & Manzey 2010)



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Over time, automation makes us forget, causing...

...unintended the erosion of humans' skills
(aka deskilling)



What is my name? What is my age? Where do I live?

Google Search I'm Feeling Lucky

“The Google Effect”
(Sparrow et al. 2011)



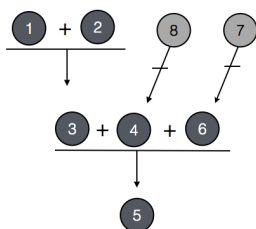
Navigation
(Carr 2015; McKinlay 2016)

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Debate between the “Pro automation argument” and the “Degeneration effect”

It is a profoundly erroneous truism, repeated by all copy-books and by eminent people when they are making speeches, that we should cultivate the habit of thinking of what we are doing. The precise opposite is the case. Civilization advances by extending the number of important operations which we can perform without thinking about them. Operations of thought are like cavalry charges in a battle — they are strictly limited in number, they require fresh horses, and must only be made at decisive moments. (Whitehead 1911, An Introduction to Mathematics, Williams & Norgate, London)

Whitehead's Pro-Automation Argument with Criticisms



- (1) Mental labour is difficult and finite: time spent thinking about trivial matters limits our ability to think about more important ones.
- (2) It is good if we have the time and ability to think the more important thoughts.
- (3) Therefore, it would be good if we could reduce the amount of mental labour expended on trivial matters and increase the amount spent on important ones.
- (4) Automation helps to reduce the amount of mental labour expended on trivial matters.
- (5) Therefore, it would be good if we could automate more mental operations.
- (6) If we reduce the amount of mental labour expended on trivial matters, we will increase the amount expended on more important ones.
- (7) In freeing us up from thinking trivial thoughts, automation may not lead to us thinking the more important ones: we may simply double-down on other trivial thoughts.
- (8) Automation may not be limited to trivial matters; it may take over the important types of thinking too.

John Danaher (2015) Is Automation Making us Stupid? The Degeneration Argument Against Automation. <http://philosophicaldisquisitions.blogspot.com/2015/04/is-automation-making-us-stupid.html>

The degeneration claim (Nicholas Carr 2014, The Glass Cage, Automation and Us, WW Norton & Co, New York) postulates that

- In order to think higher thoughts, we need to engage our minds, i.e. use attention and focus to generate information from our own cognitive resources (the generation effect)
- Automation inhibits our ability to engage our own minds (the degeneration effect), leading to automation complacency and automation bias
- Therefore, automation is bad: it reduces our ability to think higher thoughts

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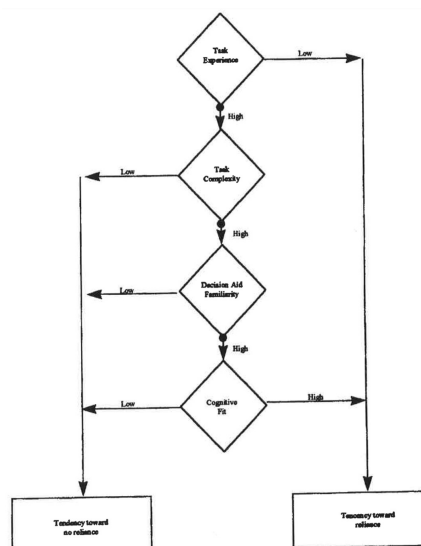
Automation complacency vs. automation bias

- Automation complacency: "false sense of security" (cruise liner falling off course)
 - Concentration and awareness can fade when we're not routinely called on to interact with our surroundings (p. 71)
- Automation bias: "overly relying on ICT" (radiologist relying on ICT instead of close hands-on inspection)
 - Our mind's focus is selective and can easily be skewed by misplaced trust in seemingly helpful prompts (p. 71)
- While automation bias involves a tendency to trust decision-support systems, automation complacency involves *insufficient attention* to and monitoring of automation output, usually because that output is viewed as reliable. (Goddard et al. 2012)

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Technology dominance model

- Technology dominance model studies the conditions under which reliance on technology might occur (Arnold & Sutton 1998)
 - Task experience
 - Task complexity
 - Decision aid familiarity
 - Cognitive fit



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Case study on erosion of skills due to automation

Rinta-Kahila et al. 2023a: The Vicious Circles of Skill Erosion – A Case Study of Cognitive Automation

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Research problem

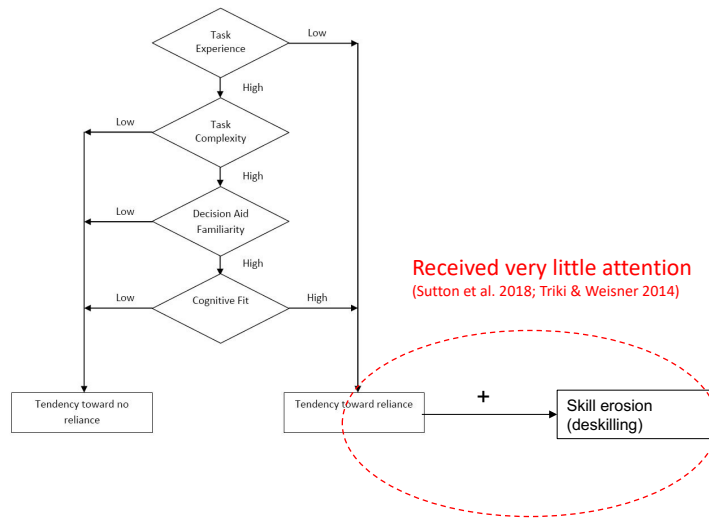
We know that automation jeopardizes knowledge workers' skills and often leads to their erosion...

...but how does this happen?

IS scholarly has acknowledged the problem but failed to investigate it

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Theory of Technology Dominance (Arnold & Sutton 1998)



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Research questions

- RQ1: how does leveraging cognitive automation contribute to the erosion of knowledge workers' skills
- RQ2: how may such skill erosion affect organizations?

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But how to study skill erosion?

- Empirical challenges
 - Cognitive skills and processes are not readily perceivable, let alone their changes over time
 - Finding an empirical context – companies may not be willing to admit skill erosion has happened
- These challenges are difficult to overcome, which may explain the lack of research on the matter
- But we got lucky...

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2. CASE

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Case study: a system to automate fixed asset management (FAM) in accounting

Current Date		Previous Date		Current Date		Previous Date	
Current	Previous	Current	Previous	Current	Previous	Current	Previous
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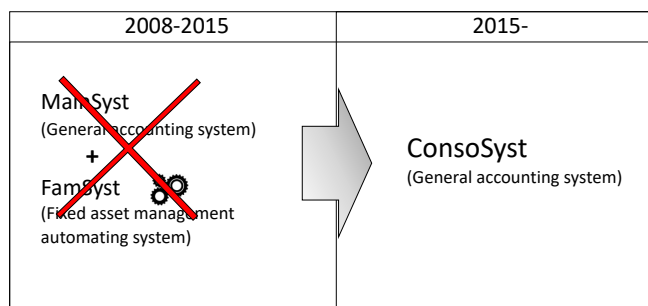
“A fixed asset is a long-term tangible piece of property that a firm owns and uses in the production of its income and is not expected to be consumed or converted into cash any sooner than at least one year’s time.” - Investopedia



Käytönaikana, jonka pituus ei ole vähemmän kuin kahdeksan vuotta	Veroarvo (alusta)	Veroarvoa vähennettävä alusta (kumulatiivisesti)			
		Veroarvo alusta	Veroarvo jäljellä maahan	Veroarvo jäljellä maahan	Veroarvo jäljellä maahan
ISTAN	2000	60000			60000
ISTAN	2000	4000			4000
ISTAN	2010				3000

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Case study: the system was decommissioned



Automation in FamSyst “had been taken so far that you used to get a tax report compiled at a single push of a button. This is not the case with ConsoSyst.” (Betty, an accountant)

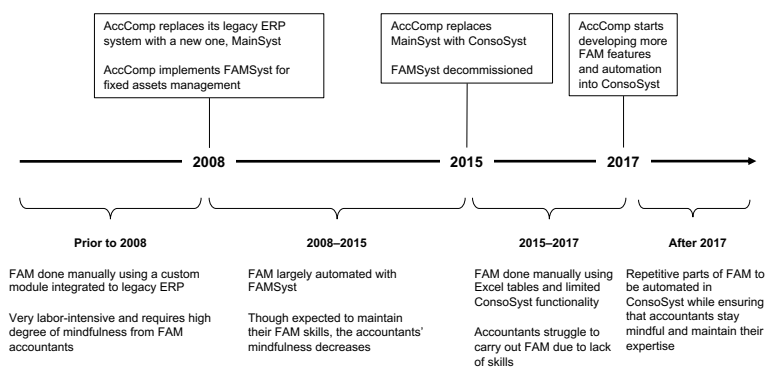
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After discontinuing FamSyst use:



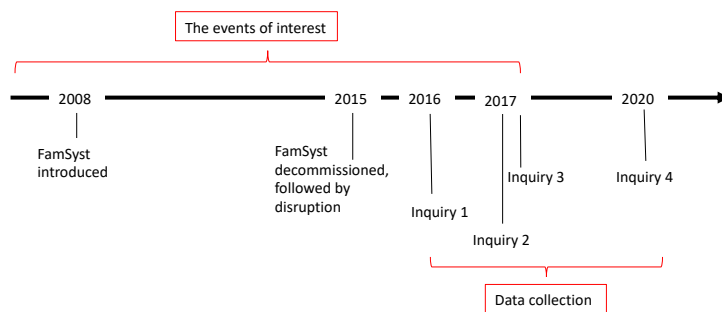
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Timeline of events



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Data collection



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Data collection: 4 inquiries

Element of Inquiry	Organization	Interviewee	Role	Interview time	Interview length
1: Identification of the research problem and general orientation to the organizational context	AccComp	Sue	Accountant	Nov. 2016	75 min.
		Amy	Accountant	Nov. 2016	87 min.
		Mary	Accountant	Nov. 2016	82 min.
		Donna	Accountant	Nov. 2016	67 min.
		Susan	Accountant	Nov. 2016	72 min.
		Betty	Accountant	Nov. 2016	75 min.
		Patricia	Accountant	Nov. 2016	62 min.
		Jennifer	Accountant	Nov. 2016	68 min.
		Linda	Accountant	Nov. 2016	69 min.
		John	Team leader	Nov. 2016	70 min.
		Carol	Head of FPS	Nov. 2016	56 min.
		Sara	Manager	Nov. 2016	85 min.
		Roger	Manager	Nov. 2016	55 min.
2: Contextual understanding of the regulatory demands (task) and automation technology (system) from the angle of skill erosion	FamComp	James	Sales manager	Mar. 2017	30 min.
	Association of Finnish Accounting Firms	Mark	CEO/owner	Mar. 2017	25 min.
		Daniel	Director of Member Services	Apr. 2020	32 min.
3: Focus on the research question: how did skill erosion occur via the interaction of the task, system, and user in their organizational context?	AccComp	Sue	Accountant	Mar. 2017	55 min.
		Amy	Accountant	Mar. 2017	51 min.
		John	Team Leader	Apr. 2017	48 min.
		Carol	Head of FPS	Jun. 2017	46 min.
4: Finer-grained understanding and validation of conclusions	AccComp	John	Accounting Manager	Apr. 2020	76 min.
		John	Accounting Manager	May 2020	61 min.
		Mary	Accountant	Aug. 2020	55 min.
		Amy	Accountant	Aug. 2020	26 min.
		Sue	Accountant	Sept. 2020	62 min.
Totals:		16 informants		25 interviews	1,490 min.

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Three facets of work-task engagement

Activity-awareness



- Calculating and allocating depreciation values
- Producing reports

Competence maintenance



- Attending internal and external training sessions
- Independently studying legislation and guidelines

Output assessment

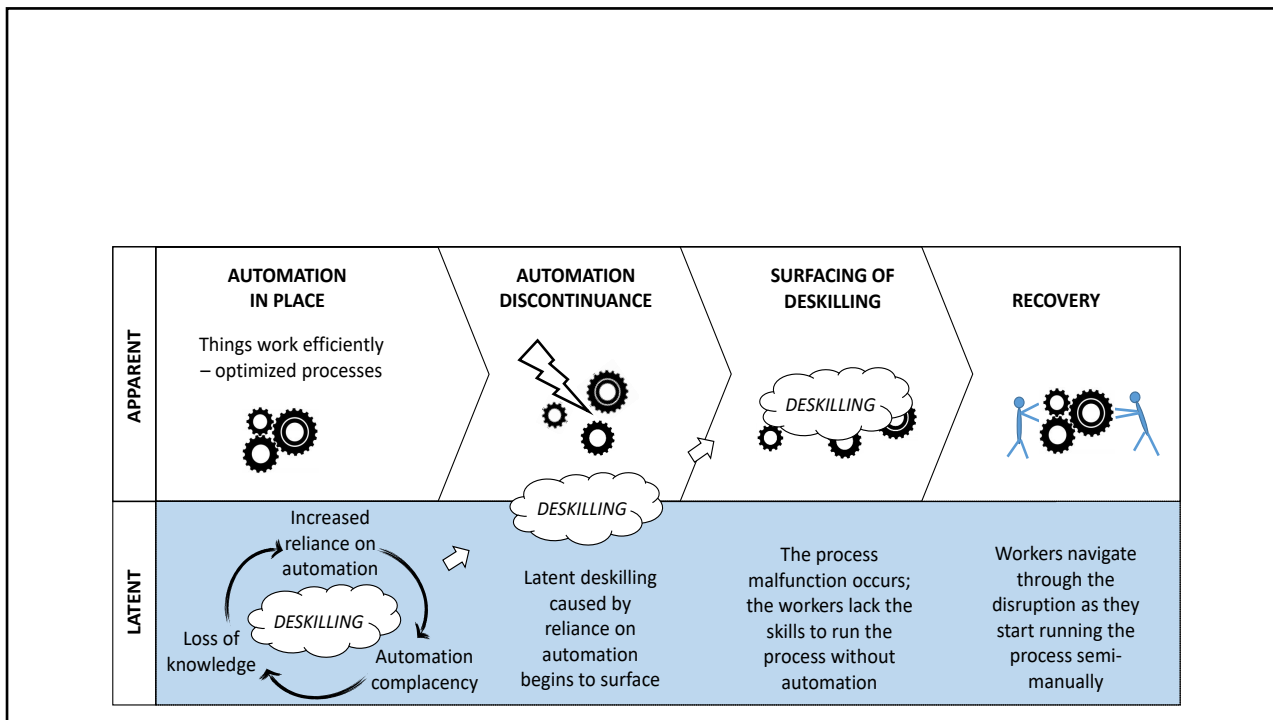


- Validating and verifying accounting and tax reports before submitting them

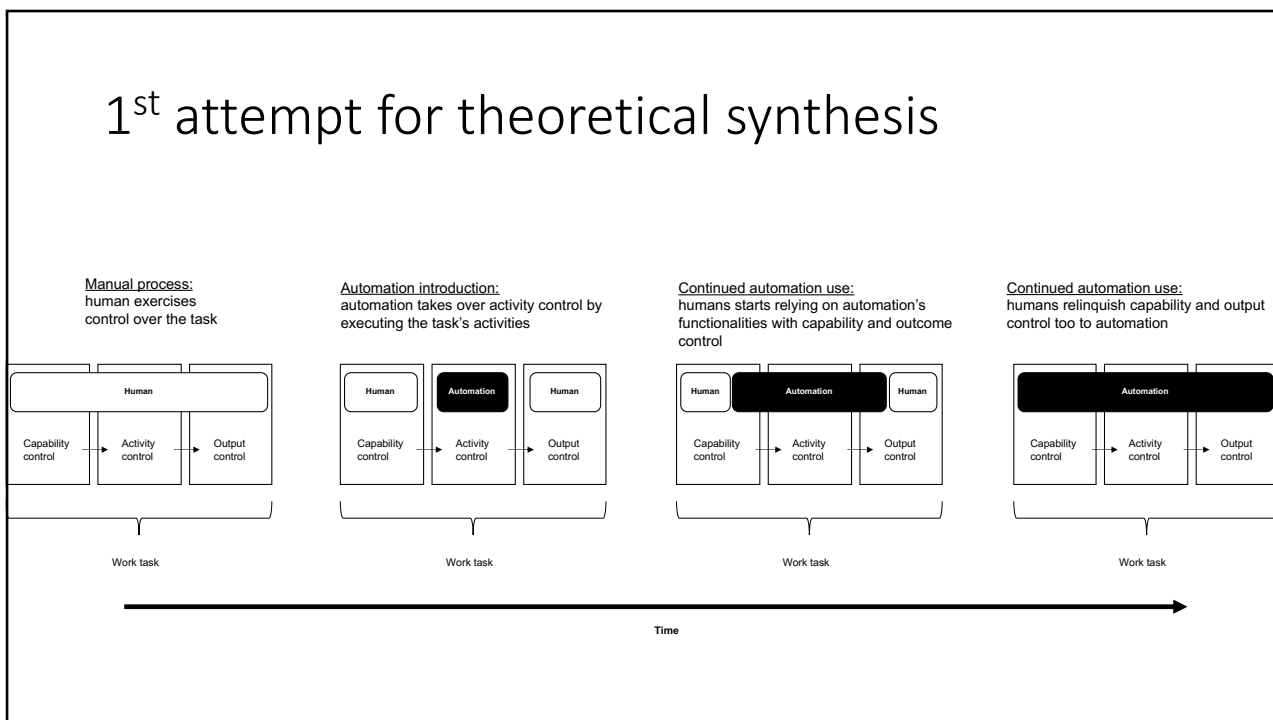
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3. THEORIZING

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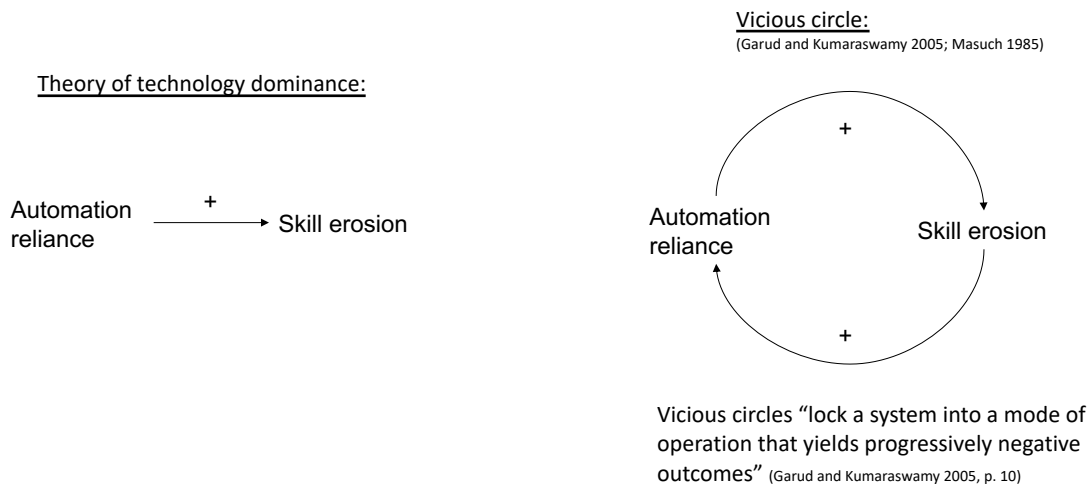


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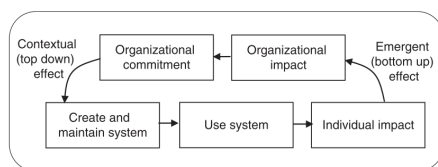
Variance view vs. systems view



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Systems theory

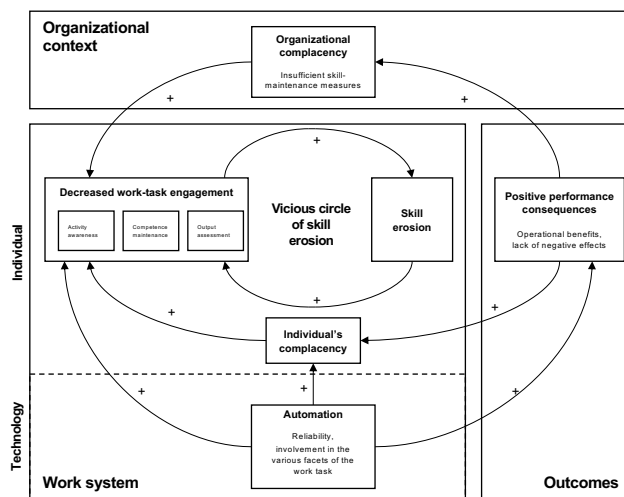
- “Knowledge is not something which exists and grows in the abstract. It is a function of human organisms and of social organization” (Boulding 1956, p. 198)
- “...the systems perspective focuses on wholes, parts, and emergent properties that arise from interactions among parts.” (Burton-Jones et al. 2015, p. 668)
- Allows the consideration of multiple analytical level and feedback loops:



(Burton-Jones et al. 2015)

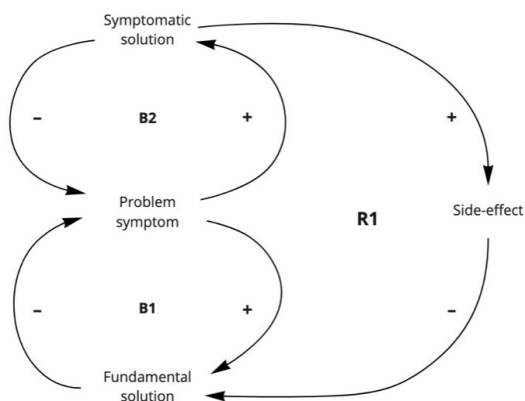
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2nd attempt for theoretical synthesis



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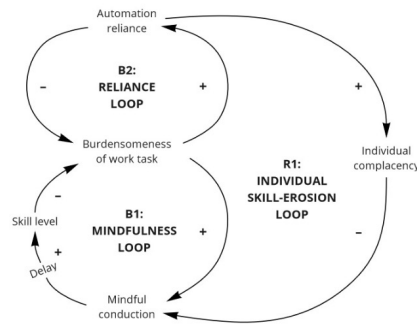
System dynamics archetype: shifting the burden (Senge 2006)



Senge, P. M. 2006. The Fifth Discipline: The Art & Practice of The Learning Organization, (2nd ed.), Crown Books.

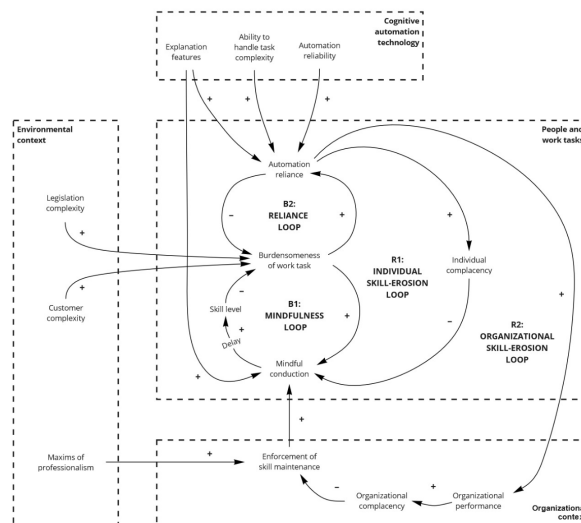
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Shifting the burden applied to the case data



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3rd attempt (final) for theoretical synthesis



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