

Embracing complexity - ending 100 years of simplification Per Olof Arnäs, PhD

# So happy to be here!



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- MSc Mechanical engineering, Chalmers 1996
- PhD in logistics 2007
- Working with and in the haulage industry since 1989
  - Consultant/developer 1998-2002
  - Full time expert, developer, R&D (TRB Sverige) 2003-2010, finished PhD during
- Chalmers 2011-2020
  - Senior lecturer/researcher
  - Vice head of department (education) at Technology Management and Economics 2018-2020
- Director Logistics Strategy at Einride 2021-2023
- Independent advisor 2024-
- Secretary General of Game Changing Alliance 2024-
- Podcaster





• Given some spare time, I tend to build things that you can cook in, on, or with.

I love the 21<sup>st</sup> century





#solar #electrification #charging #ai #tech #supply chain #logistics #freight #lastmile

#coding #IT-infrastructure #4PL #SocialSustainability

gamechangingalliance.se



1896 First truck (Daimler) 1500 kg payload

**Roads were low quality** 

Very slow market uptake



1896 First truck (Daimler)

A lot of innovation

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Source: US National Archiver

Easter morning 1900: 5<sup>th</sup> Ave, New York City. Spot the automobile.



Easter morning 1913: 5<sup>th</sup> Ave, New York City. Spot the horse.



Source: George Grantham Bain Collection.





1920-30 Trucks disrupt horses









1910 Ice delivery



1923





1896

First truck 1920-30 Trucks disrupt horses Production and sourcing could be located almost anywhere

Many roads taken over by government

**Unprecedented growth** 

A lot of innovation

Trucks take over land based freight



1920-30 Trucks disrupt horses



#### **Distance less important**



1956 Containers disrupt global trade

A lot of innovation

Trucks take over land based freight

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1896

First

truck



1920-30 Trucks disrupt horses A global transportation network emerges

# Still administered using analog technology



1956 Containers disrupt global trade

A lot of innovation

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1896

**First** 

truck

Trucks take over land based freight

Globalization commences







#### 1990s Computers



1920-30 Trucks disrupt horses

1896 First truck



1956 Containers disrupt global trade

A lot of innovation

Trucks take over land based freight

Globalization commences





1920-30

Trucks



1990s Computers

TE



#### **Path of least** resistance





1920-30



#### 1990s Computers







disrupted



#### **Planning for ICE truck**

#### **Planning for BE truck**



#### **Planning for ICE fleet**

#### **Planning for BE fleet**

Maximise paid tonne-km Minimise cost

#### Scaling by Copy-Paste

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VITTIRE T

Maximise paid tonne-km Minimise cost

Sweet-spot flows a minority Each transport is unique

Charging investment

Increased complexity when scaling

#### The diesel based system is almost fully commoditized

VIMES

Competition

Commodity

Commodity

"Price" is the only competition area left

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Commodity

Commodity

#### In the electric system almost nothing is a commodity

Competition

Competition

Competition

Competition

Competition



## Superior to humans

Large data sets

Identify abstract patterns and trends

Control large systems Generating content

Recommendations and decision support

**Optimisation** 

# **Reinforcement Learning**

# When the Al learns by doing

# Some uses for Al in freight transportation and logistics

### Forecasting

# Business intelligence

# Warehouse automation

# Inventory managment

# **Digital Twin**

## Predictive capacity planning

#### Some uses for AI in freight transportation and logistics



Forecasting



Digital twin



Warehouse automation



Predictive capacity planning



Inventory management



Business intelligence

#### Some uses for AI in freight transportation and logistics



**Port logistics** 



**Robots** 



Forecasting

Predictive capacity

planning

Fraud



**Digital twin** 

Inventory

management



Warehouse automation

**Business** 

intelligence

Autonomous

vehicles



Yard management

Last mile



Drones



Cargo scanning



Predictive

**Rail logistics** 



Energy management perolofarnas.com



Routing

**Cold chain** monitoring









Carbon

reduction

Automated checkpoints.



Scheduling



**Compliance** and

documentation





Customer contact



Legal

HR

# New models all the time

Deedy 🕏 @deedydas - 3m

OpenAl o3 is 2727 on Codeforces which is equivalent to the #175 best human competitive coder on the planet.

This is an absolutely superhuman result for AI and technology at large.

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188	* sansen	157 2713

Open Al o3 - previewed Dec 24 2024 perolofarnas.com

#### DeepSeek-R1 Upsets AI Market With Low Prices

Estimated price for processing one million input/output tokens on different AI models



of is ChatGPT's latest model. List includes most comparable model per com \* Uses Meta's open-source Llama Al

Source: DocsBot

statista 🗹

DeepSeek-R1 launched Jan 10 2025

# They are getting better

#### Humanity's Last Exam (Reasoning & Knowledge)



https://artificialanalysis.ai/models#intelligence-evaluations, updated May the 4th, 2025

# New services all the time







**Open AI Deep research** 

Lovable

#### Heygen

# Prompt engineering

This is so 2024...

# How to talk to an Al

# We are all getting our very own digital assistants

#### **Prepare for the agents**

Please help me start an online business. I want to increase my net worth.

Let's start searching the internet for business ideas.

According to a recent study, the market for five fingered socks will increase greatly soon.

Looking for suppliers - found 15. Getting prices.

Building e-commerce website and connects to your Amazon account.

Arranging for dropshipping contract with supplier.



#### "Please, take control of my computer"



**Claude Computer Use** 



#### ChatGPT app use

What comes next when the AI steps outside the confines of a computer and gains control over its "universe"?

# Figure - Humanoid robots



# Figure - Humanoid robots

## We see three major business opportunities in the long term

More Structured Less Structured Less Variability More Variability Physical Labor Off-World Consumer Household 50% of global GDP is Space exploration to build human labor (\$42T) new worlds 2.3 billion households worldwide 700M aging population in need of at-home care

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need of at-home care



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# New colleagues

## **Metaphors Matter!**

METAPHORS WE LIVE BY Metaphor permeates all aspects of our lives

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"Metaphors are not merely linguistic expressions; they structure our perceptions and understanding of the world."

George Lakoff, Mark Johnsen

# **Blood Vessel Metaphor**

# "We have an infrastructure in place that we can use"

# Point-to-Point Metaphor

### "All transports are done in isolation"

# Mass Transit Metaphor

# "We provide a mobility system that can be used to move stuff"



# **Ant Hill Metaphor**

"The transportation system is an ever changing complex entity that cannot be controlled from above, only nudged from within"



### This is the system we have

#### Top down control

Consolidation driven

Designed operations

Scarcity mindset

Economies of Scale Low complexity when scaling

Centralized

structures

Can operate with 20th century tools

Few, well defined variables

### This is the system we need to have

Bottom up control

Flow driven

Decentralized structures

Abundance mindset

Real-time adaptability

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Emergent efficiencies **Complexity** increases with scale Requires AI and digital tools to work

Many, fluid

variables

### What we have

### What we need/get

Top down control Bottom up control Consolidation driven design Flow driven design Centralized structures Decentralized structures **Designed operations** Real-time adaptability **Rely on emergent efficiencies Rely on economies of scale** Ruled by a scarcity mindset Ruled by an abundance mindset Many, fluid variables Few, well defined variables Low complexity when scaling Complexity increases with scale It can operate with 20th century tools It requires AI and digital tools to work

### What we have

### What we need/get

Top down control Bottom up control Consolidation driven design Flow driven design Centralized structures Decentralized structures **Designed operations** Real-time adaptability **Rely on emergent efficiencies Rely on economies of scale** Ruled by a scarcity mindset Ruled by an abundance mindset Many, fluid variables Few, well defined variables Low complexity when scaling Complexity increases with scale It can operate with 20th century tools It requires AI and digital tools to work

**Digital First** 

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### The old system

### The new system

### Simple structure Static

Big

If you try to make this system complex, you will fail Fast Smaller parts Complex structure Dynamic

This system is built from small-scale parts that work

### Unknown unknowns

### Known unknowns

### **Elements of Al**



# But really, the best teacher is probably AI itself



I want to know more about how I can use AI in my job, please teach me

#### We will need supercomputers, maybe even quantum

This is a software game.

Thank you!



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#### SCAN ME