Automation: Friend or Foe?

ACADEMIC CONTEXT (Psychology):

PERCEPTIONS OF ADVANCED FLIGHT DECK AUTOMATION

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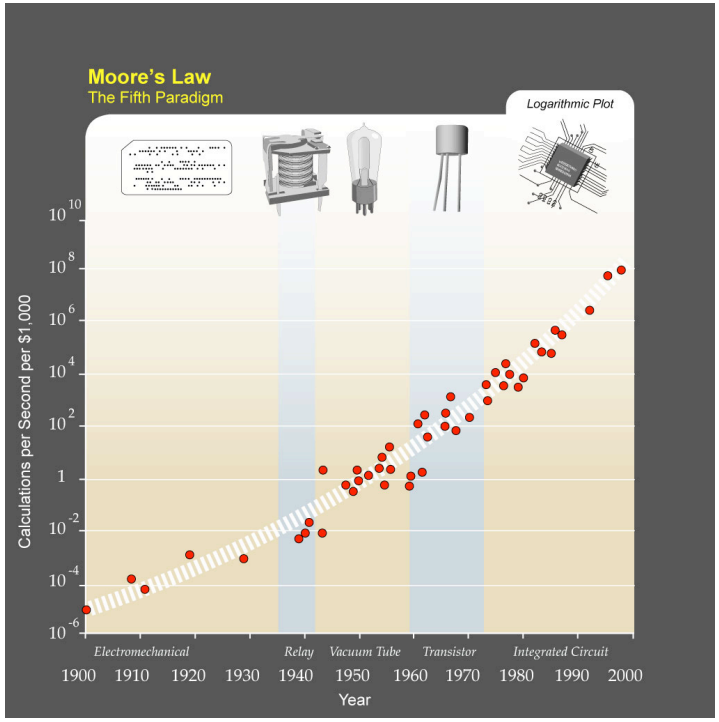
INTRODUCTION

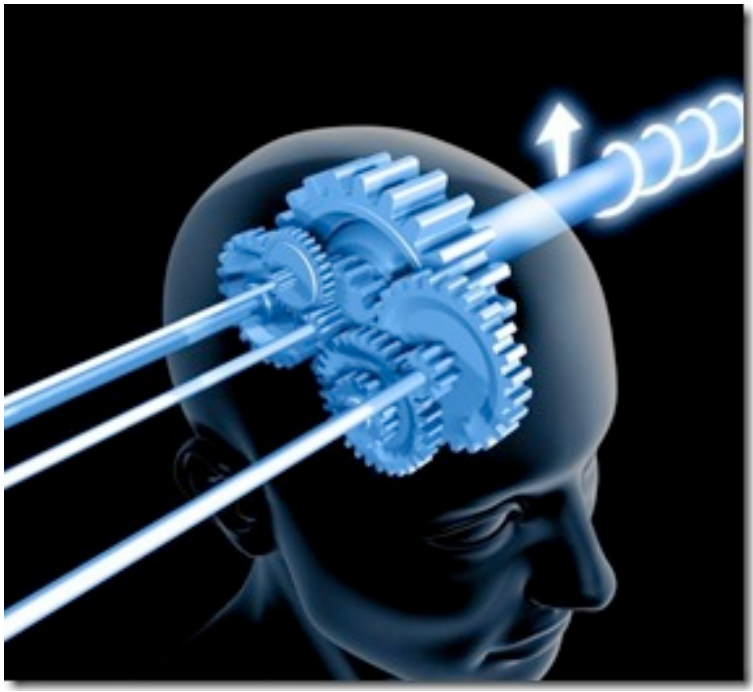
Present research

- **Examine previous theory from the literature**
- **Design and implement the research plan based on the hypotheses**
- **Collect empirical (quantitative, positivist) data**
- **Identify the significant phenomena**

AUTOMATION (What is it?)

Automation…generally means replacing human functioning with machine functioning

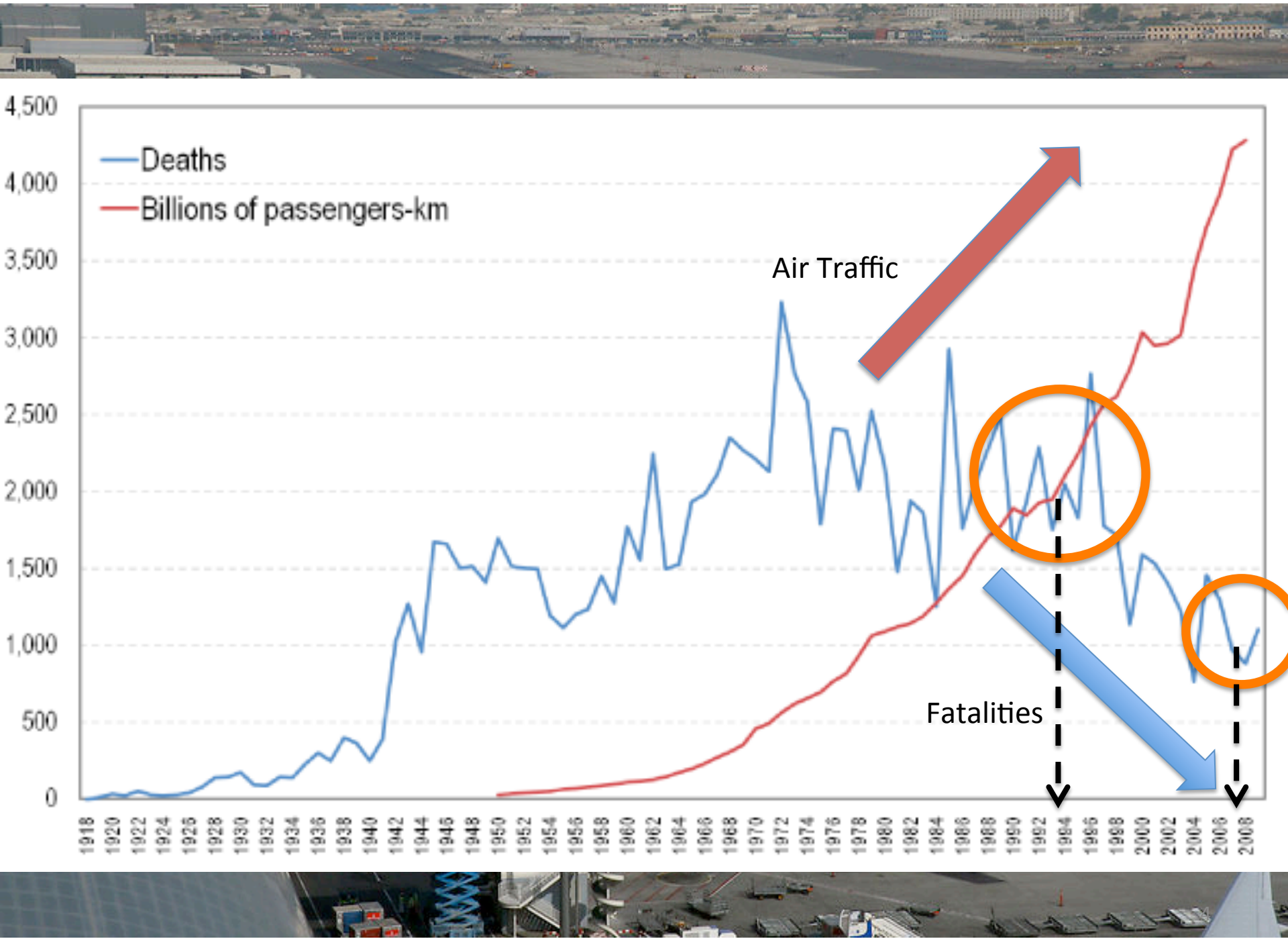




FLIGHT DECK AUTOMATION:

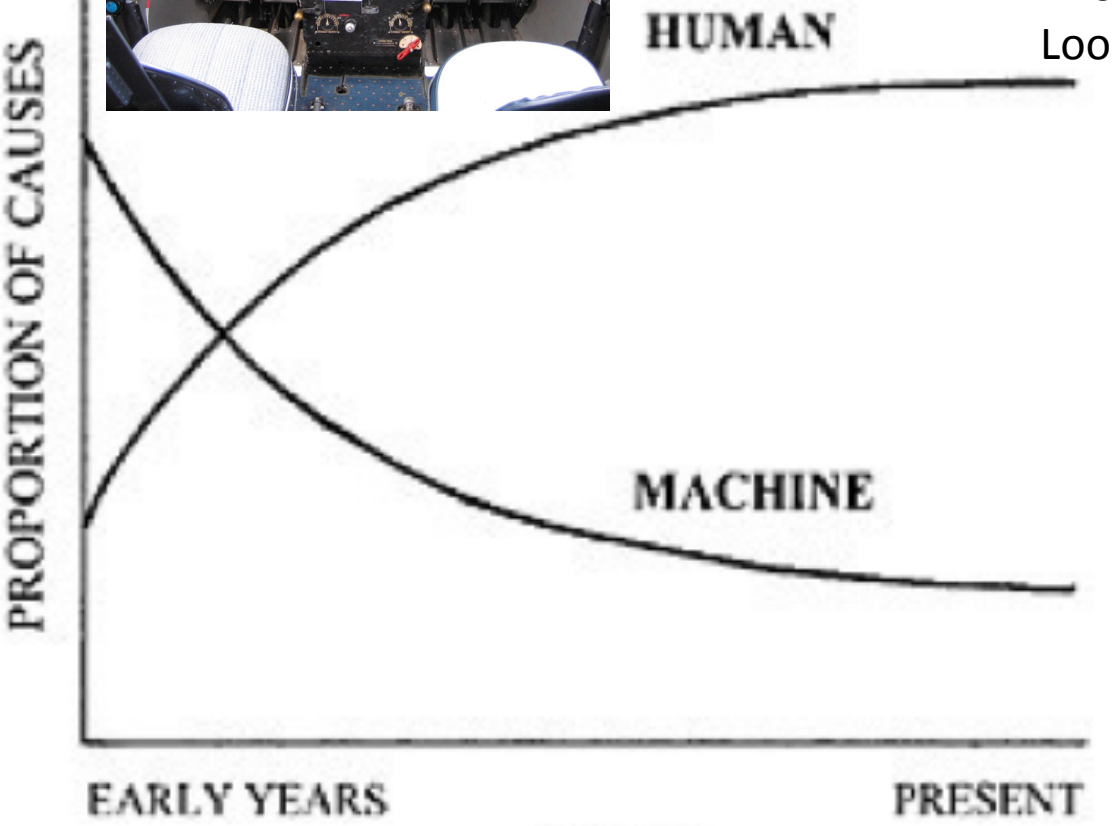
"…some tasks or portions of tasks performed by the human crew can be assigned, **by the choice of the crew**, to machinery"

Automation is the use of machines, control systems and **technology** to optimise aircraft efficiency


Deaths
Billions of passengers-km
Air Traffic
Fatalities
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1918 1920 1922 1924 1925 1928 1930 1932 1934 1936 1938 1940 1942 1944 1945 1948 1950 1952 1954 1956 1958 1960 1962 1964 1966 1968 1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008

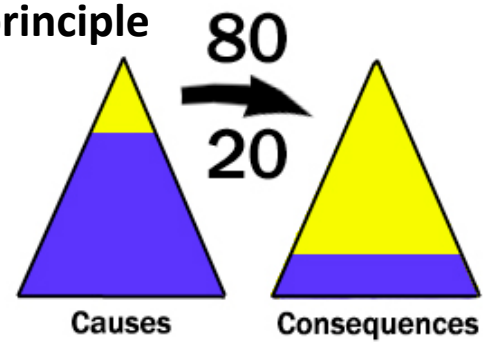
Machine failure vs human failure

risk or hazards must be addressed in an economical order



Deficient Knowledge Loops

Pareto principle



Advanced Technology

Assuming 20% of the hazards will account for 80% of the injuries

Koonce (2003)

The Problem

“To err is human and to blame it on a computer is even more so”

total distrust in the system or complete complacency.
(Robert Orben)

Computers make excellent and efficient servants, but I have no wish to serve under them. *-Spock in Star Trek- ”The Ultimate Computer”*

Automated aircraft flight deck systems					
Year	**Location**	**Aircraft type**	**Operator**	**Description of incident or accident**	**System(s) involved**
1972	Miami	L-1011	Eastern Airlines	Loss of situational awareness after an inadvertent autopilot disconnection.	ALTITUDE HOLD
1973	Boston	DC-9-31	Delta Airlines	Pilots' preoccupation with questionable flight director led to a loss of situational awareness.	FLIGHT DIRECTOR
1988	Gatwick	A320	Air France	Vertical mode confusion.	FLIGHT CONTROL UNIT
1989	Boston	B767	Unknown	Vertical mode confusion.	FLIGHT CONTROL UNIT and FLIGHT DIRECTOR
1990	Bangalore	A320	Indian Airlines	Vertical mode confusion.	FLIGHT CONTROL UNIT
1991	Moscow	A310	Interflug	Inadvertent autopilot disconnection leading to confusion and loss of control.	ELECTRONIC FLIGHT INSTRUMENT SYSTEM
1992	Strasbourg	A320	Interair	Vertical mode confusion.	FLIGHT CONTROL UNIT
1993	Tahiti	B744	Air France	Inadvertent autopilot disconnection and vertical mode confusion.	NAVIGATION MODE
1994	Toulouse	A330	Airbus	Unexpected altitude capturing during a simulated engine failure.	NAVIGATION MODE
1995	Connecticut	MD80	American Airlines	Inadvertently descended below minimum altitude.	NAVIGATION MODE
1995	Cali	B757	American Airlines	Incorrect input into the flight management computer resulting in aircraft impacting terrain.	NAVIGATION MODE
1996	Puerto Plata	B757	Birgen Air	Loss of control.	ELECTRONIC FLIGHT INFORMATION SYSTEM

Automated aircraft mechanical subsystems

Year	Location	Aircraft type	Operator	Description of incident or accident	System(s) involved
1984	New York	DC10	Scandinavian Airlines	Overran runway.	POWER PLANT
1985	San Francisco	B747	China Airlines	Inappropriate control of engine failure using the autopilot system.	POWER PLANT and ELECTRONIC ENGINE CONTROL
1988	Habsheim, France	A320	Air France	Loss of situational awareness in flight envelope.	FLY-BY-WIRE CONTROL SYSTEM
1989	Helsinki	A300	Kar Air	Inadvertent activation of Go-Around mode.	ELECTRONIC ENGINE CONTROL
1999	Warsaw	A320	Lufthansa	Overran runway.	POWER PLANT mode logic
1994	Hong Kong	A320	Dragon Air	Incorrect flap setting.	FLAPS MANAGEMENT SYSTEM
1994	Nagoya	A300	China Airlines	Aircraft inadvertently stalled on final approach.	ELECTRONIC ENGINE CONTROL
1994	Manchester	B757	Britannia	Inadvertent stall situation, recovered.	POWER PLANT and ELECTRONIC ENGINE CONTROL
1994	Paris	A310	Tarom	Aircraft inadvertently stalled then recovered.	POWER PLANT and ELECTRONIC ENGINE CONTROL
1994	Indiana	ATR72	American Eagle	Lack of knowledge in flight surface de-icing system led to inadvertent stall.	DE-ICING SYSTEM
1995	Bucharest	A310	Tarom	Aircraft entered a spiral dive situation.	ELECTRONIC ENGINE CONTROL
2008	Sao Paulo	A320	Tam	Overran runway after confusion with auto thrust.	ELECTRONIC ENGINE CONTROL
2009	Schiphol, Netherlands.	B738	Turkish Airlines	Inadvertent aircraft stall on final approach after thrust auto reduced to flight idle.	ELECTRONIC ENGINE CONTROL and AUTO THRUST
2009	Atlantic ocean	A330	Air France	Aircraft stalled after loss of flight information and autopilot.	FLIGHT CONTROL COMPUTER

Report on an academic study:

SOUTH AFRICAN AIRLINE PILOTS' PERCEPTIONS OF ADVANCED FLIGHT DECK AUTOMATION

Objective: instrument construction, test psychometric properties

Research approach: quantitative, 262 airline pilots surveyed, statistical analyses

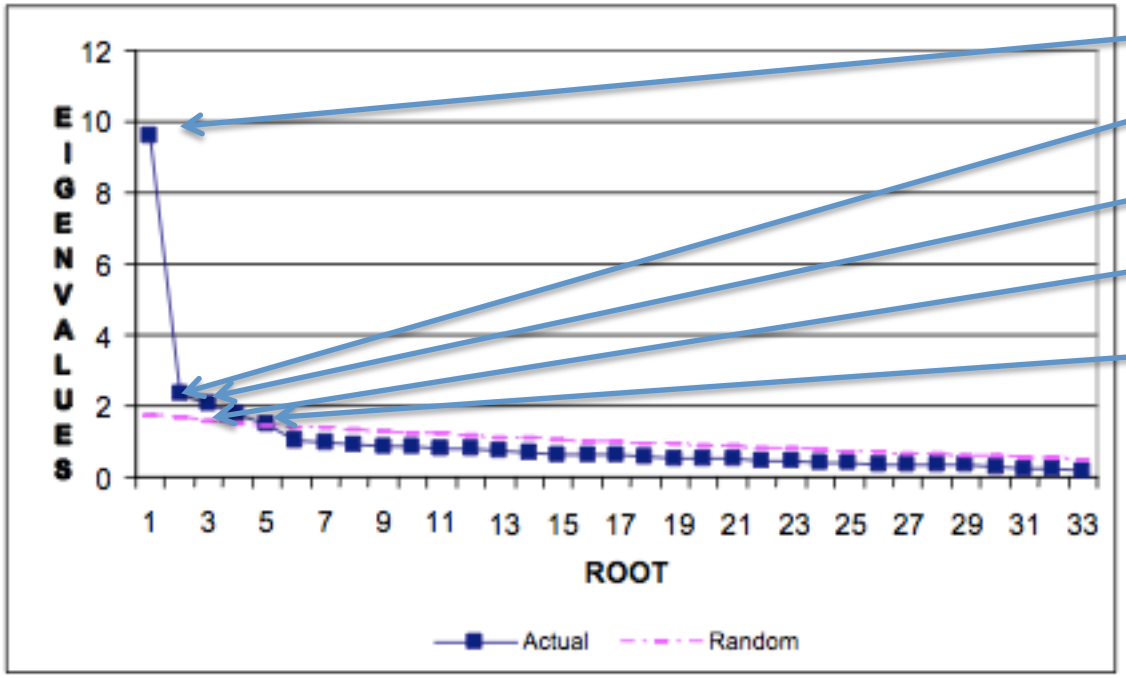
Presently on Airbus types	63.4%
Presently on Boeing types	35.5%
Mean flying hours	12231 hours (SD 5636)
Mean digital flight hours	4691 hours (SD 2530)

METHOD AND RESULTS:

Measurement Instrument (Automation Attitude Questionnaire):
training, skills, workload, ergonomics, performance

Statistical analysis: Exploratory Factor Analysis (EFA),
principle axis factoring,
promax rotation, Kaiser's normalisation

Solution: 5 factors explained 52% of the variance

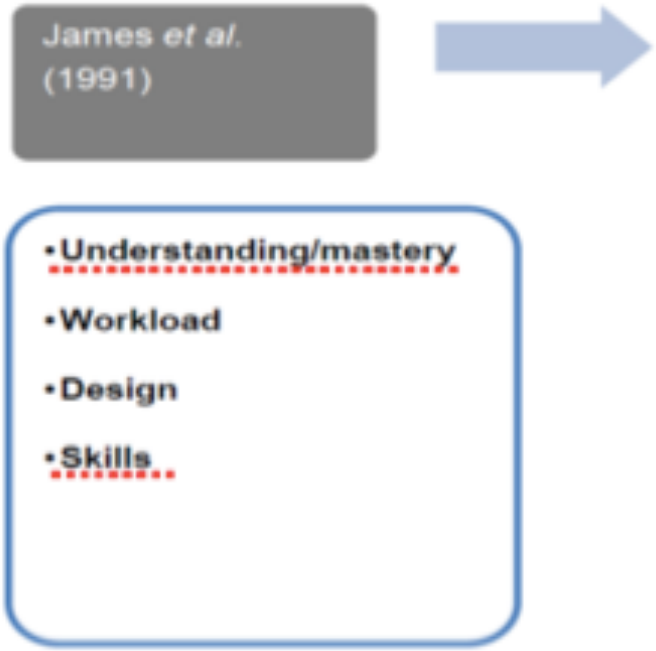


1. Understanding
2. Training
3. Trust
4. Workload
5. Design

factors

Figure 2: Scree plot of the actual and the random data of 33 factors.

trend in the data



AUTOMATION (based on new technology)

Friend or foe ?

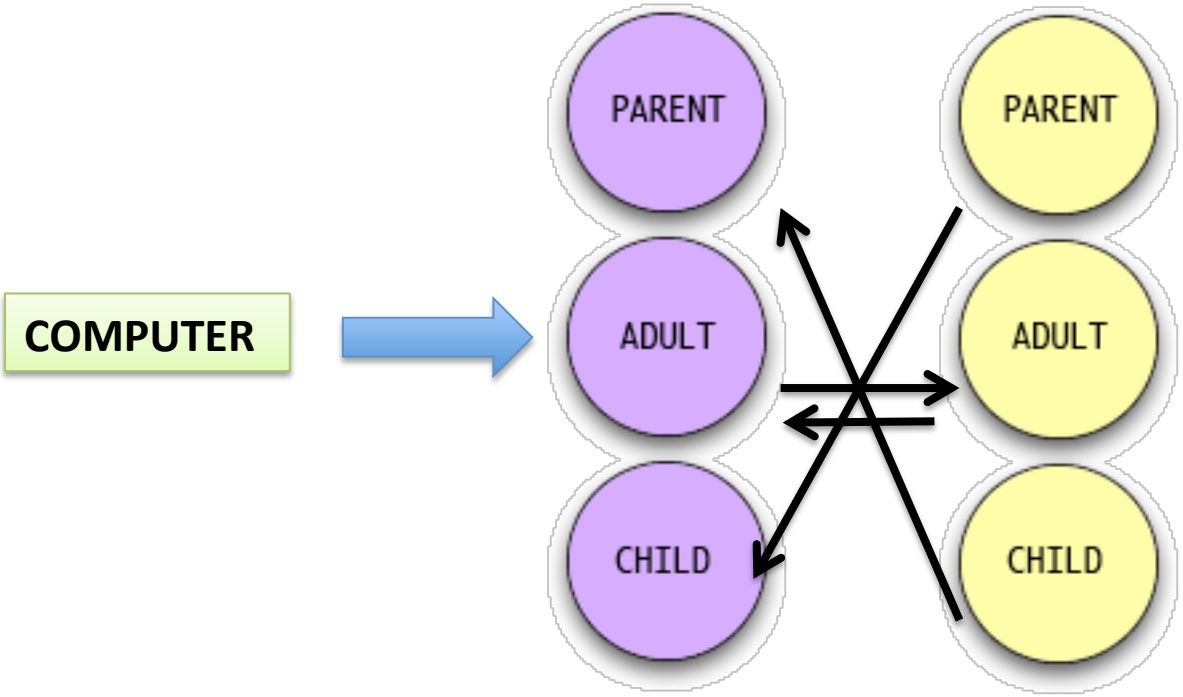
…it depends

AUTOMATION (based on new technology)

Transactional Analysis

Friend or foe ?

…it depends



The industry must **define the relationship** between humans and technology and not let the technology define the human being

The elements of **discipline**, **skill** and **proficiency** remain unchallenged as the foundation of **professional airmanship**

In conclusion…….

Realism and comprehensiveness of displays must be supported by AN active and positive attitude of crew and in case of doubt, by reference to airmanship and common sense

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Thank you for your time ☺