

Hauptseminar Sommersemester 2015:

Cognitive Computing

Dr. Frank J. Furrer

Please enter your full name and e-mail address
into the participants list

Hauptseminar Sommersemester 2015:

Cognitive Computing

Dr. Frank J. Furrer

Language: English

Today: Kick-Off Meeting 17-April-2015



3 ECTS Credits are awarded:

- Full participation in all 3 seminar days
- Delivery of a satisfactory paper
- Delivery of a good presentation

Content:

Part 1: Cognitive Computing

1. Introduction
2. Material for Q1: Cognitive SW architectures
3. Material for Q2: Future Cognitive Applications
4. Material for Q3: Impact of Cognitive Computing

Part 2: Authoring and Presenting

1. Principles of a good paper
2. Principles of a good presentation

Part 3: Seminar Organization

1. Objectives
2. Work Plan
3. Timing
4. ECTS Credits

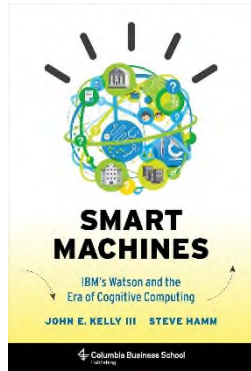
**... some
hidden
slides**



Introduction

HS 2015: Cognitive Computing

Mandatory Reading



John E. Kelly III, Steve Hamm:

**Smart Machines –
*IBM's Watson and the Era
of Cognitive Computing.***

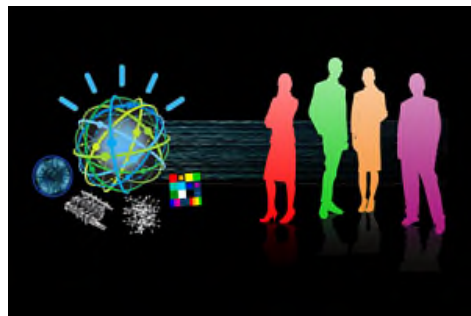
Columbia University Press, N.Y., USA,
2013. ISBN 978-0-231-16856-4



Erik Brynjolfsson, Andrew McAfee:

**The Second Machine Age – *Work, Progress, and
Prosperity in a Time of Brilliant Technologies.***

W.W. Norton & Company, Inc., N.Y., USA, 2014. ISBN 978-
0-393-23935-5



Eric W. Brown:

Cognitive Computing Ushers in New Era of IT.

IBM Research Brief, 2014.

Downloadable from:

<http://www.forbes.com/sites/ibm/2014/02/03/cognitive-computing-ushers-in-new-era-of-it> [last accessed: 8.9.2014]

Definition:

«Cognitive technologies are products of the field of artificial intelligence.

They are able to perform tasks that only humans used to be able to»

David Schatsky, Craig Muraskin, Ragu Gurumurthy:

Demystifying artificial intelligence – What business leaders need to know about cognitive technologies

Deloitte University Press, November 2014.

Downloadable from: <http://dupress.com/articles/what-is-cognitive-technology/> [last accessed: 31.12.2014]



Fixed **Algorithmic** Computing

- Execution of a pre-defined set of instructions
- Inputs & outputs (data/information)
- Decision points
- Optimization schemes (can be adaptive)

Cognitive Computing

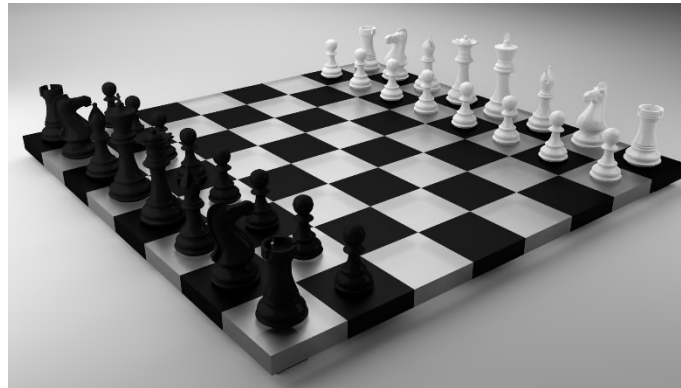
- Context-aware
- Dealing with uncertainty
- Process unstructured data (e.g. language)
- Learning (Domain expertise) & adaptive behaviour
- Goal-directed



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Famous **(Fixed) Algorithmic** Computing Garry Kasparov – IBM Deep Blue Chess Match 1997

http://en.wikipedia.org/wiki/Deep_Blue_versus_Garry_Kasparov



3,5 : 2,5

Deep Blue = Chess World Champion
[200 millionen positions/sec]

... some examples of **cognitive** computing:

<http://www.automobilesreview.com>



Audi driverless car
racing on Hockenheimring



<http://snapbuzz.net/tag/table-tennis>



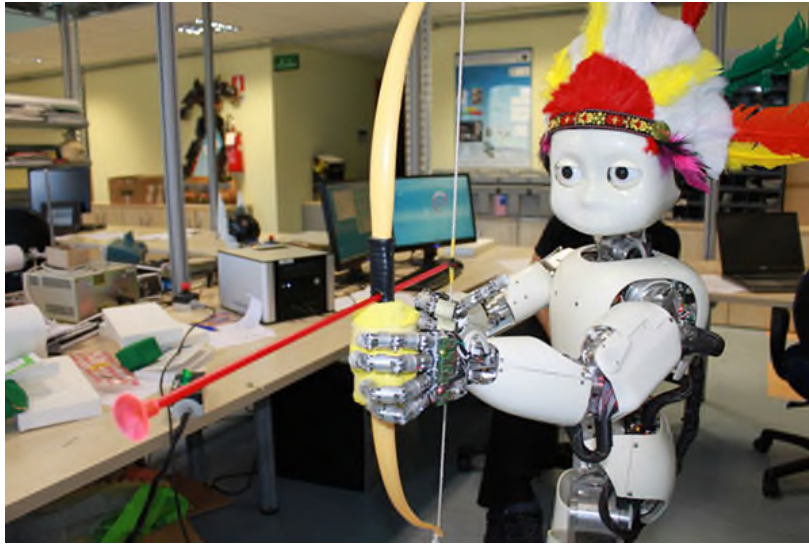
KUKA industrial robot
in table-tennis
championship



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... more examples of **cognitive** computing:

<http://vremechnko.org>



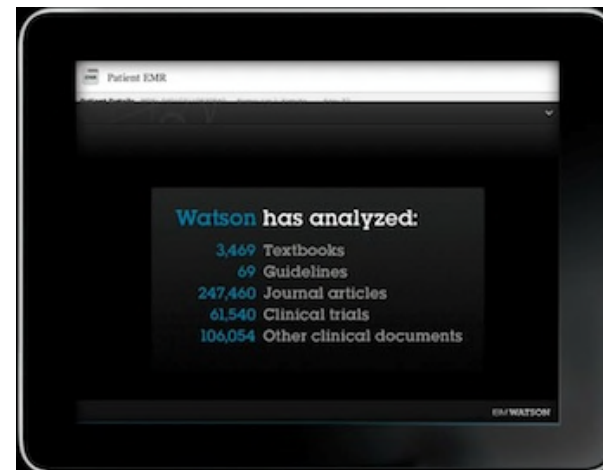
Humanoid robot **iCub**
learning archery



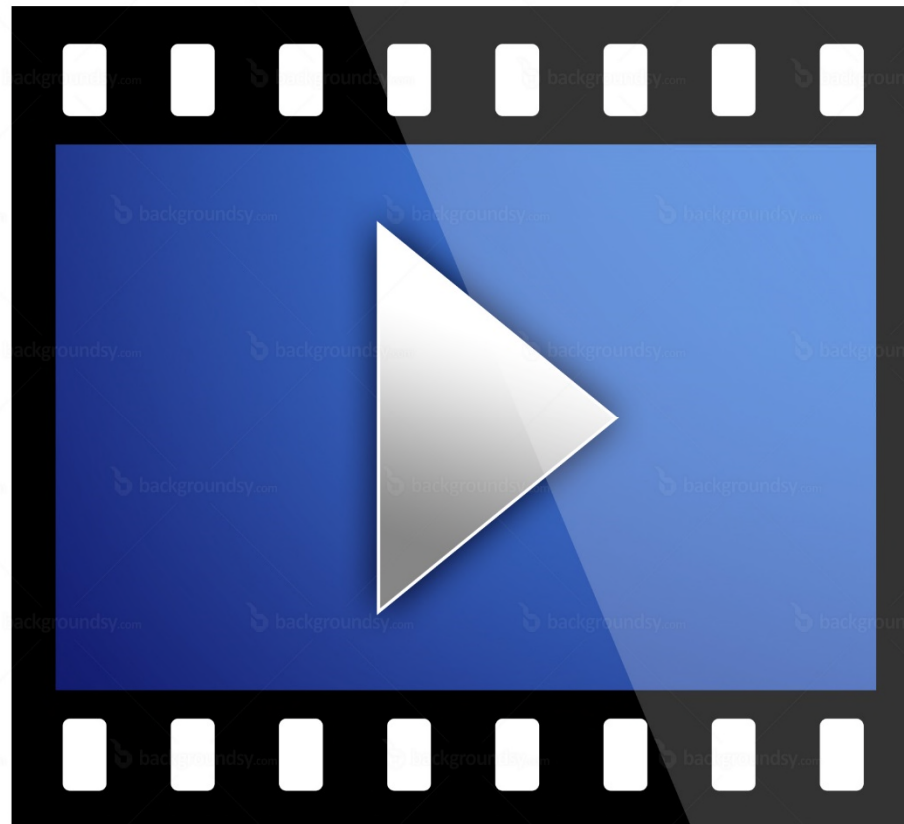
<http://www.darkdaily.com>



IBM Watson cognitive computer
assisting cancer diagnosis



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This seminar will work on answers to the central question: **Which are the situation, the challenges, and the impact of cognitive computing in the year 2025?**

Each participant chooses one of the 3 topics:

Q1: Which are the promising *software architectures* for cognitive computing ?

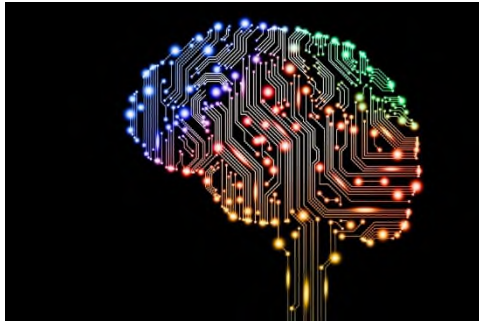
Q2: How does cognitive computing enable *future applications* ?

Q3: What is the *impact* of cognitive computing on people, work and society ?

Q1:

Which are the promising
software architectures
for cognitive computing ?

<http://www.digitaltrends.com>

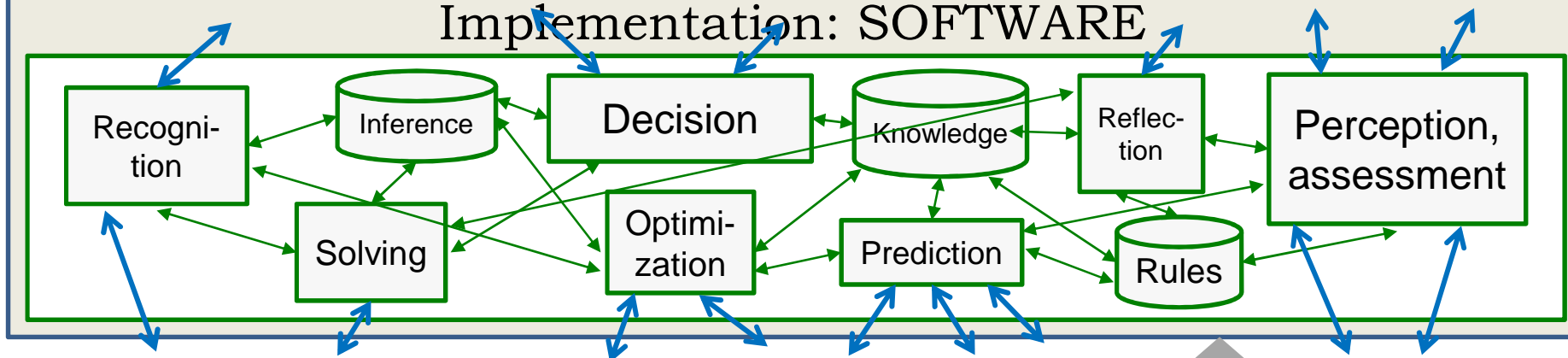


Basic Technologies

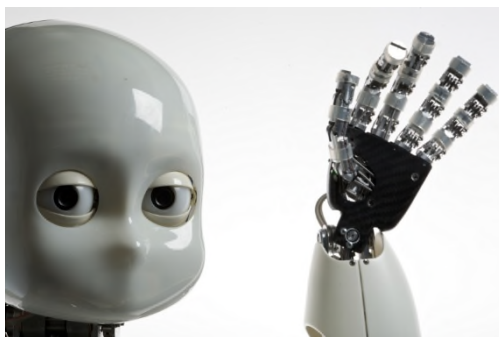
- Artificial Intelligence (AI)
 - Robotics
- Cognitive Science, ...

Cognitive Cyber-Physical Computing System

Implementation: SOFTWARE



<http://robotics.idisia.ch/robots/>



Mechatronics

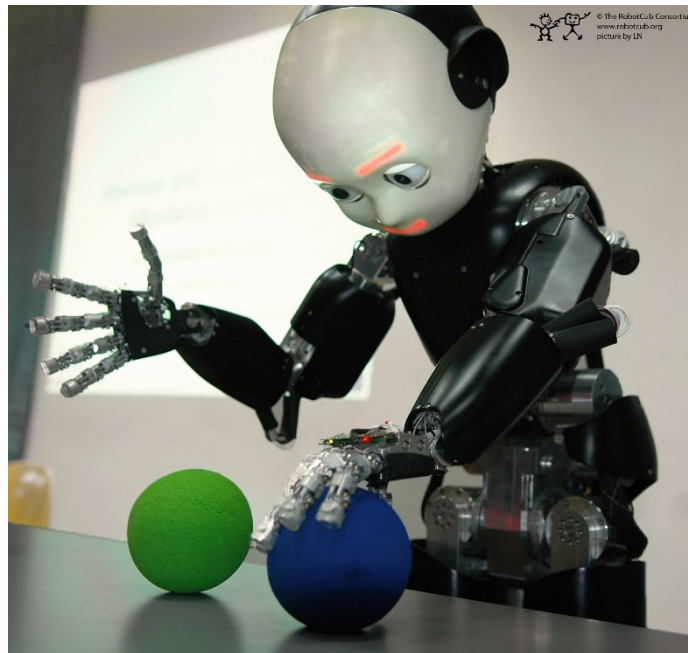
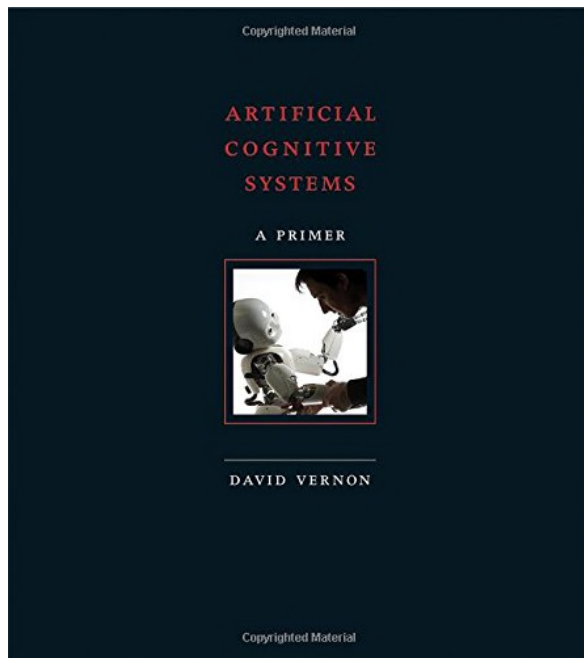
- Sensors
- Actuators
- Local controllers, ...

HS 2015: Cognitive Computing

David Vernon: **Artificial Cognitive Systems – A Primer**. MIT Press, Cambridge MA, USA, 2014. ISBN 978-0-262-02838-7

John E. Laird: **The SOAR Cognitive Architecture**. MIT Press, Cambridge MA, USA, 2012. ISBN 978-0-262-12296-2

iCub-Wiki: *iCub Cognitive Architecture*, 20 June 2013. Downloadable from:
http://wiki.icub.org/wiki/ICub_Cognitive_Architecture and
http://wiki.icub.org/wiki/Main_Page [last accessed: 9.2.2015]

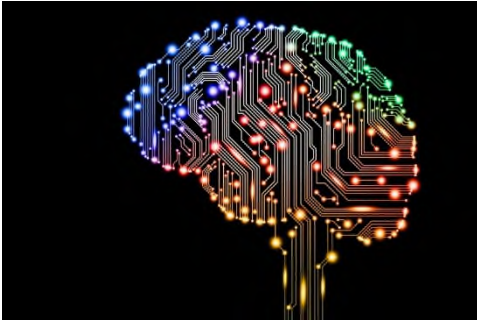


Q2:

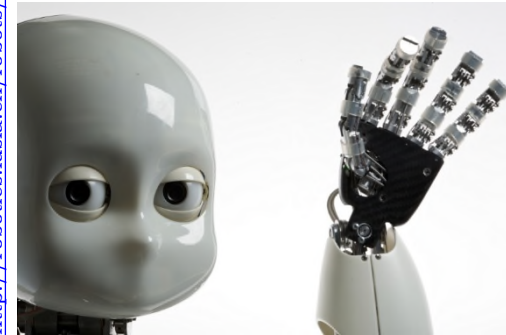
How does
cognitive computing enable
future applications ?

HS 2015: Cognitive Computing

<http://www.digitaltrends.com>



<http://robotics.idisia.ch/robots/>

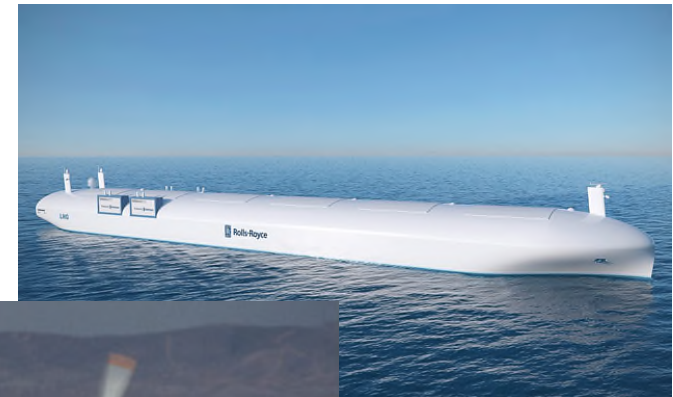


Basic Technologies

- Artificial Intelligence (AI)
 - Robotics
- Cognitive Science, ...

Cyber-Physical Systems

- Robots,
 - Autonomous systems
 - Swarms, ...



D / © Dr. Fra

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David Schatsky, Craig Muraskin, Ragu Gurumurthy:

Demystifying artificial intelligence – What business leaders need to know about cognitive technologies

Deloitte University Press, November 2014. Downloadable from:

<http://dupress.com/articles/what-is-cognitive-technology/> [last accessed: 31.12.2014]

Peter Fingar:

Cognitive Computing – A Brief Guide for Game Changers.

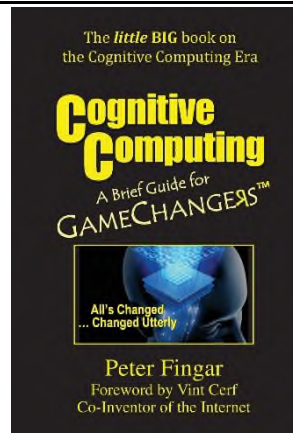
Meghan-Kiffer Press, Tampa, Florida, USA, 2005. ISBN 978-0-9296-5251-1

Tim Estes:

Who will own cognitive computing? – The race for our century.

Digital Reasoning, April 2014

<http://www.digitalreasoning.com/buzz/who-will-own-cognitive-computing-the-race-for-our-century.802766>



Q3:

What is the

impact

of cognitive computing

on people, work and society ?

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Impact ?

New (congitive) application

New (congitive) application

New (congitive) application



Work



People



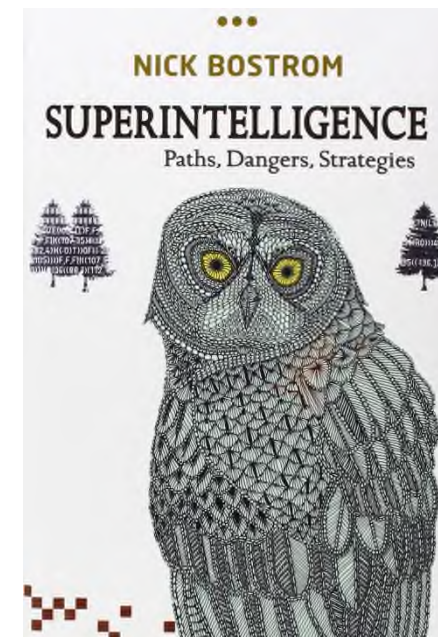
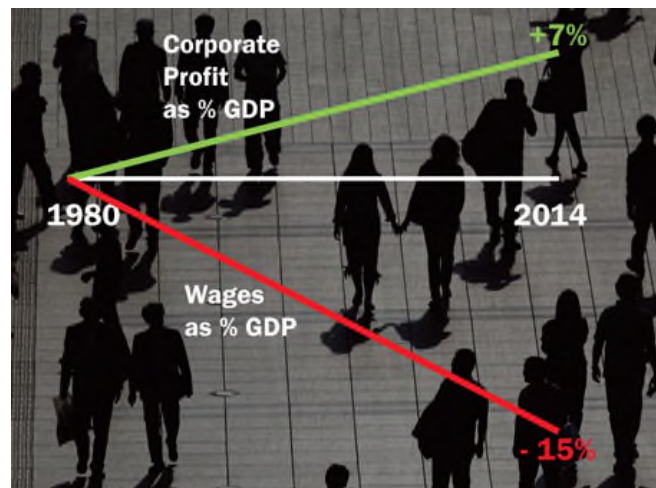
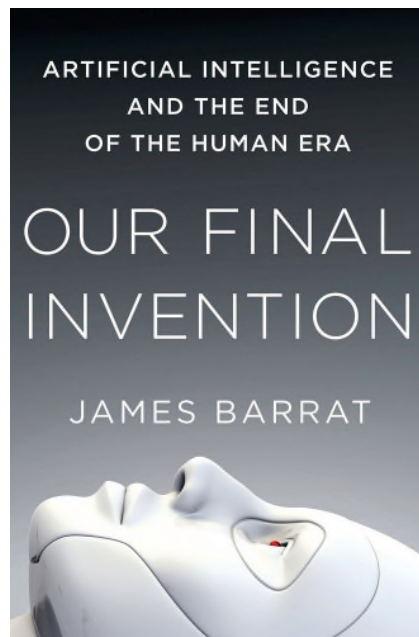
Society

HS 2015: Cognitive Computing

James Barrat: **Our Final Invention – Artificial Intelligence and the End of the Human Era**. St. Martin's Press, New York, N.Y., USA, 2013. ISBN 978-0-312-62237-4

Nick Bostrom: **Superintelligence – Paths, Dangers, Strategies**. Oxford University Press, Oxford, UK, 2014. ISBN 978-0-19-967811-2

Harry Rudin: **Will the IT Revolution Cost Our Children Their Jobs?** ERCIM News, Number 99, October 2014, pp. 9-10. Downloadable from: <http://ercim-news.ercim.eu/en99/challenges-for-icst/will-the-it-revolution-cost-our-children-their-jobs> [last accessed: 7.10.2014] and: http://www.oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf [last accessed: 7.10.2014]



<http://de.123rf.com>



Principles of a good paper

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Principles of a good paper:

Key element = An interesting, consistent and complete **storyline**

Storyline:

Context

Vision

Mission

Focus

Material/body

Message

<http://change4change.blogspot.ch>



Structure:

Title

Abstract/summary

Introduction

Existing work, state-of-the-art

Chapters

Conclusions/recommendations

References

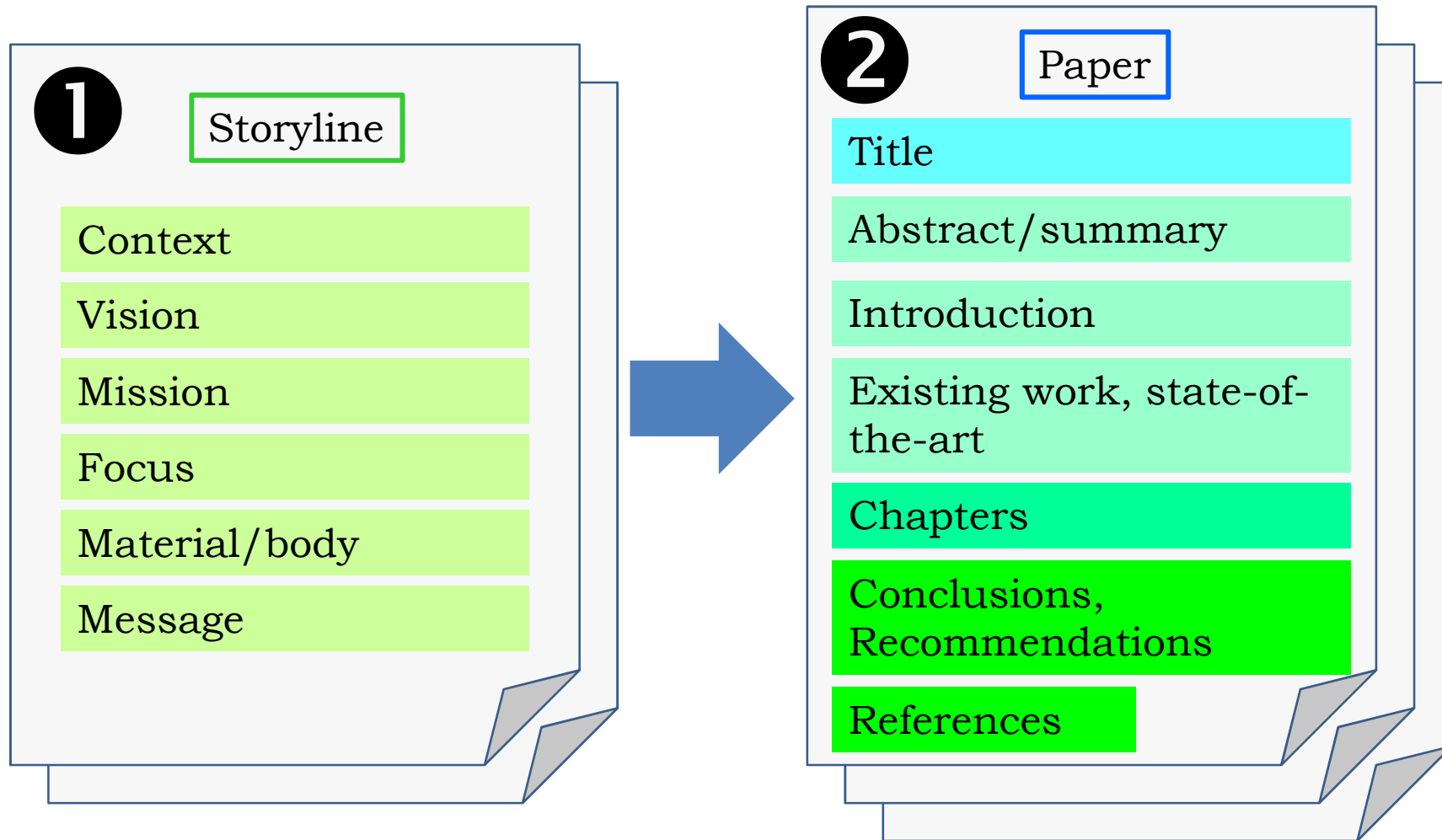


<http://performancing.com>

HS 2015: Cognitive Computing

Principles of a good paper:

Key element = An interesting, consistent and complete **storyline**



HS 2015: Cognitive Computing

Principles of a good paper:

Storyline:

Context

Vision

Mission

Focus

Material/body

Message



<http://en.wikipedia.org/wiki/Traffic>

CONTEXT

Individual traffic using trucks and private cars forms an important element of our economy and of our individual life-style.

In the last decades the amount of traffic has increased considerably.

The results are daily congestions and higher accident rates.

They cause significant damage to the economy and to our individual mobility.

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Principles of a good paper:

Storyline:

Context

Vision

Mission

Focus

Material/body

Message

What we want to achieve

„... how do we see an improved world“
(State [Utopia])

What we want to do

„... how do we improve the world“
(Action [Way to ...])

Example:

Modern individual traffic



<http://en.wikipedia.org/wiki/Traffic>

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Principles of a good paper:

Storyline:

Context

Vision

Mission

Focus

Material/body

Message



<http://en.wikipedia.org/wiki/Traffic>

VISION

The vision is to keep traffic fluid, efficient and with low rates of accidents.

One promising approach is to support - or even replace - the drivers by electronic driving assistance systems.

Clear and comprehensive statement
of the long-term goal
⇒ **Vision Statement**

Principles of a good paper:

Storyline:

Context

Vision

Mission

Focus

Material/body

Message



<http://en.wikipedia.org/wiki/Traffic>

MISSION

This paper demonstrates the feasibility and implementation of one important electronic driving assistance system.

We present and discuss the sensor-based collision-avoidance systems.

Many such systems are under development - some of them can even be found in modern production cars.

Our target audience are graduate students in mechanical, electronics and computer science

Precise statement of the work
⇒ **Mission Statement**

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Principles of a good paper:

Storyline:

Context

Vision

Mission

Focus

Material/body

Message

FOCUS

Sensor-based collision-avoidance systems is a wide field of research.

It encompasses sensor-, software-, image processing- and safety engineering.

We focus on one specific system: The system developed by Mercedes-Benz which can be found in most of their current production cars.

We explain its architecture, functionality, features and limitations.



<http://en.wikipedia.org/wiki/Traffic>

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Principles of a good paper:

Storyline:

Context

Vision

Mission

Focus

Material/body

Message

Restrict, restrict, restrict!

Organize, organize, organize!

Avoid all unnecessary concepts.

Establish a clear state-of-the-art, of prior work and of relevant references

<http://en.wikipedia.org/wiki/Traffic>



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Principles of a good paper:

Conceptual Storyline:

Context

Vision

Mission

Focus

Material/body

Message

This paper has demonstrated the great value of collision-avoidance systems.

Such systems could greatly be improved by using real-time environmental information.

Therefore, research should continue into car-to-car and car-to-infrastructure communications

<http://en.wikipedia.org/wiki/Traffic>



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Storyline:

Context

Vision

Mission

Focus

Material/body

Message

Paper:

Title

Abstract/summary

Introduction

Existing work, state-of-the-art

Chapters

Conclusions/recommendations

References

... your deliverables (2 separate documents)

⇒ Style

Style

The **content** of your paper is:

• correct

• precise

• clear

• brief

• ethical

Your material must be free from error and in accordance with facts

If it is vague, it is not scientific writing

If it is unclear or ambiguous, it is not scientific writing either

If it is long-winded and unnecessarily discursive, it is poor scientific writing

Fair, truthful, respectful, references, copyrights, ...

- precise
- clear



Importance of definition of terms

Many terms are highly ambiguous, context-dependent, author-dependent, time-dependent etc.

System, element, module, component, domain, ...

Term „Human“ [Definition]:

We are bilaterally, symmetrical, sexually differentiated bipeds located on one of the outer spirals of the Milky Way, capable of recognising the prime numbers ...

[NASA Deep Space Probe]

- brief

Clear is more important than brief

Acronyms and abbreviations are poison for the reader

⇒ Avoid them (whenever possible)

If necessary, introduce them (1x or 2x) at the beginning:

„This paper introduces the concept of System-of-Systems (SoS)“.

An SoS ...

The vehicle can be seen as an SoS, with many CS, such as ABS, ESC, BA and possibly a CAS.



Principles of a good presentation

Principle 1: **Understand** your audience

Background ?

Prior Knowledge ?

Expectations ?

Reason for attendance ?



<http://www.englishhandculture.com>

Tailor your presentation
to the background and needs
of your audience

Principle 2: **Key Message**

What is your message ?

Why is it important ?

What does it mean to
your audience ?

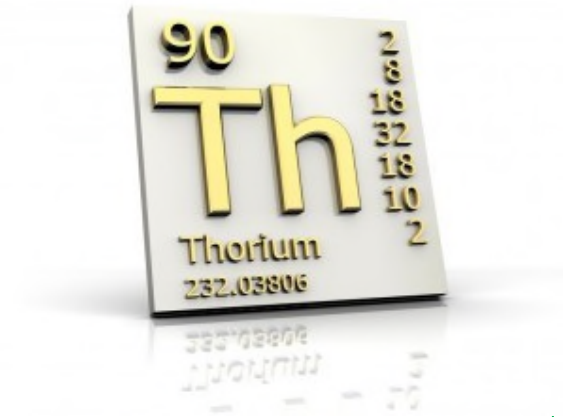
What do you want them
to remember ?



<http://www.mediafane.com>

The key message is the
continuous focus of your
presentation

Example: Thorium Nuclear Energy



Audience: YOU!

- *Background:* mathematical-physical-engineering education
- *Prior knowledge:* basic nuclear physics
- *Expectations:* Possible solution to world's energy problem?
- *Reason for attendance:* critical assessment, gain of knowledge

Key message:

«THORIUM – The Green Energy Source of the Future»

Richard Martin: **Superfuel – Thorium, the green energy source of the future.**

Palgrave MacMillan Publishers, New York, USA, 2012. ISBN 978-0-230-11647-4

Principles of a good presentation

Storyline:

Context

Vision

Mission

Focus

Material/body

Message

Focus =
Audience

Additional power:

Illustrations/pictures

Animations

Personal style

«Delivery»

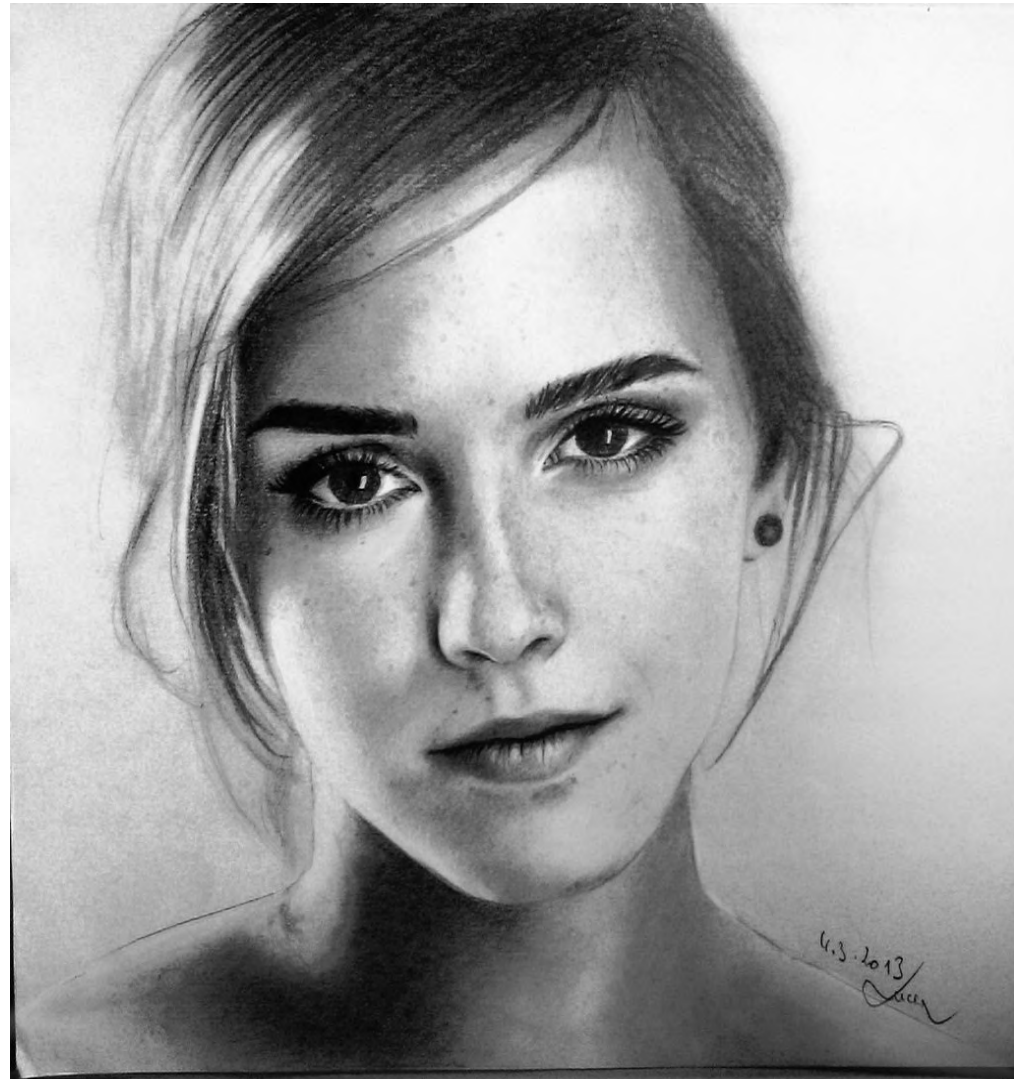
Principles of a good presentation

Illustrations/pictures

Animations

Personal style

- emotion
- feeling
- provocation



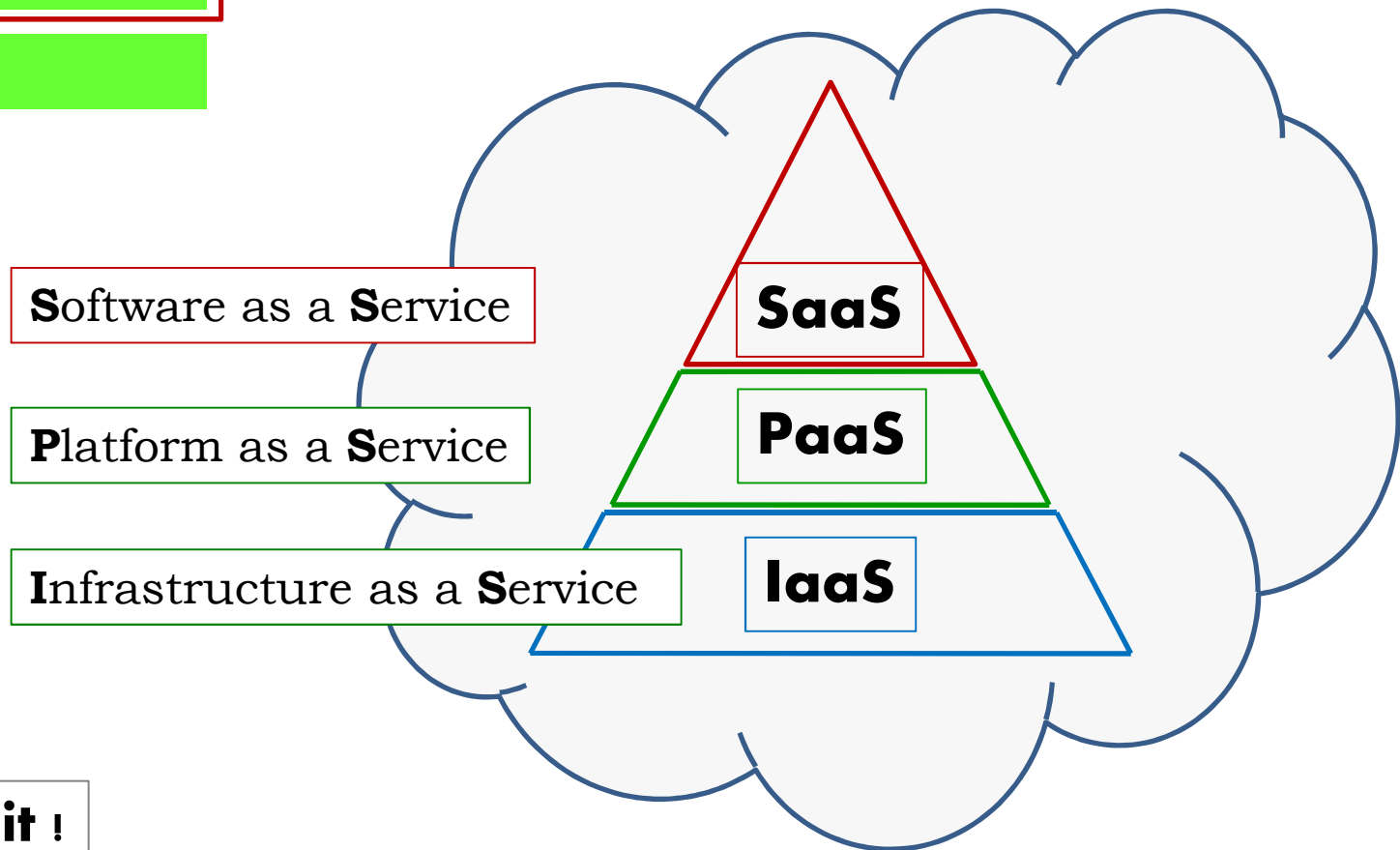
Principles of a good presentation

Illustrations/pictures

Animations

Personal style

Cloud Definitions:



Don't overdo it !

Principles of a good presentation

Illustrations/pictures

Animations

Personal style

- relate to your audience
- be highly present
- be strongly engaged



<http://dailygrail.com>

Elements of a bad presentation:

- Small (< 22 pt) or unreadable fonts
- Too dense slides
- Few illustrations, pictures
- Excessive animations
- (Extensive) use of bullet point lists
- Unclear message, bad storyline
- Introduction of superfluous concepts
- ... and some more

Garr Reynolds: **Presentation ZEN** – *Simple Ideas on Presentation Design and Delivery*.

New Riders Publishing, Berkeley CA, USA, 2008. ISBN 978-0-321-52565-9

Elements of a bad presentation:

- Small
- Too
- Few
- Exce
- (Ext
- Unc
- Intr
- ... an



<http://img.galerie.chip.de>

Garr Reynolds

New Riders Publishing, Berkeley CA, USA, 2008. ISBN 978-0-321-52565-9

What is the sure death of a good presentation ?

<http://info.everywoman.com>



Time overrun !

<http://www.wfs.org>



Presentation time-
schedule follows
(~ 10 ... 15 min)

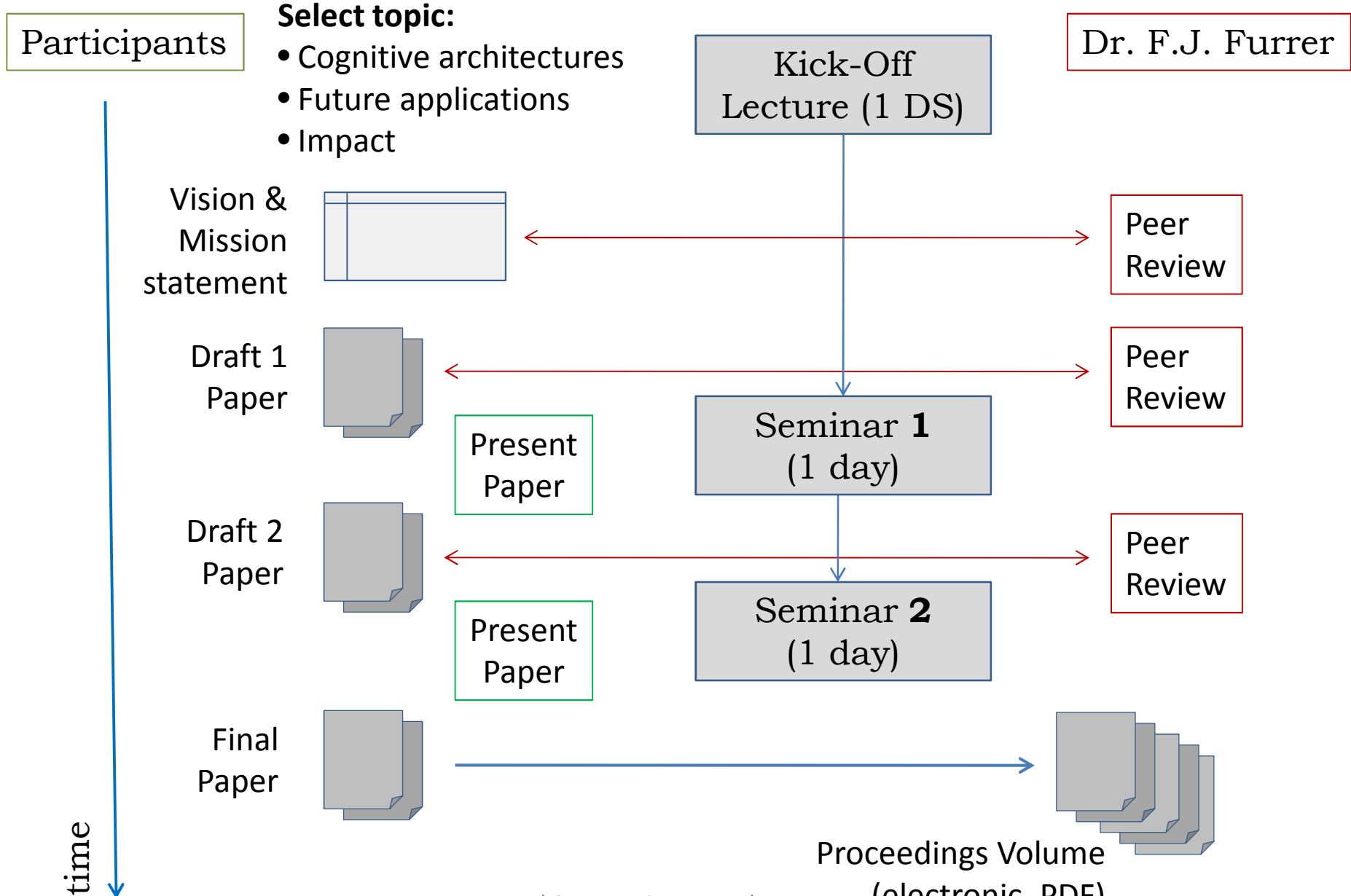


Seminar Organization

What the Participants will learn:

1. Do focused research in a specific area
2. Author a **good** paper
3. Learn (or perfect) the use of TeX[®]
4. Experience the peer-review process
5. Hold a **convincing** presentation
6. Broaden your perspective in this field

HS 2015: Cognitive Computing





TECHNISCHE BERICHTE
TECHNICAL REPORTS
ISSN 1430-211X

TUD-FI14-04-August 2014

Dr. Frank J. Furrer, Jan Reimann (Eds.)
Institut für Software- und Multimediatechnik

Impact and Challenges of Software in 2025



Hauptseminar SS 2014:

Impact and Challenges of Software in 2025

Collected Papers

<http://nbn-resolving.de/urn:nbn:de:bsz:14-qucosa-152785>

Formats:

Paper: LaTeX

Presentation: Powerpoint

Please use the **Template:**

“Springer LNCS” for your paper.

Downloadable from:

<ftp://ftp.springer.de/pub/tex/latex/llncls/latex2e/llncls2e.zip>

[last accessed: 05.03.2015]

HS 2015: Cognitive Computing

| | |
|--|--|
| Hauptseminar Kick-Off Meeting | Friday, April 17, 2015: 14:50 – 16:20 Room INF 2101 |
| 1st Seminar Day | Friday, June 5, 2015: 09:00 – 13:00 Room INF 2101 |
| 2nd Seminar Day | Friday, July 10, 2015: 09:00 – 13:00 Room INF 2101 |

More information at (TUD HS Website):
http://bit.do/HS2015_CognitiveComputing

Hauptseminar limited to **8** participants

HS 2015: Cognitive Computing

| | | |
|--|--|---|
| Hauptseminar Kick-Off Meeting | Friday, April 17, 2015: 14:50 – 16:20 Room INF 2101 | Introductory Lecture by Dr. Frank J. Furrer |
| Select 2 peer reviewers (from the participants and Georg Püschel is also available) 1 Note: All papers will also be reviewed by Dr. F.J. Furrer (as 3 rd peer reviewer) | Friday, April 24, 2015 | e-mail your choice to: <ul style="list-style-type: none"> • All participants • frank.j.furrer@bluewin.ch • Georg.Pueschel1@mailbox.tu-dresden.de |
| Deliver your choice of topic (i.e. Question 1, 2 or 3) and a short vision/mission statement to the 2 peer reviewers and to F.J. Furrer 2 Note: Content and structure of the “vision/mission statement” will be explained in the Kick-Off Meeting | Wednesday, April 29, 2015 | e-mail your choice to: <ul style="list-style-type: none"> • All participants • frank.j.furrer@bluewin.ch • Georg.Pueschel1@mailbox.tu-dresden.de |
| Feedback from Reviewers 3 | Friday, May 8, 2015 | By e-mail from: <ul style="list-style-type: none"> • The peer reviewers • frank.j.furrer@bluewin.ch • Georg.Pueschel1@mailbox.tu-dresden.de |
| Deliver 1 st draft of both your storyline and your paper to your peer reviewers 4 Note: Content and structure of the “storyline” and “paper” will be explained in the Kick-Off Meeting | Friday, May 22, 2015 | e-mail your storyline and paper: <ul style="list-style-type: none"> • Peer reviewers • frank.j.furrer@bluewin.ch • Georg.Pueschel1@mailbox.tu-dresden.de |
| Feedback from Reviewers 5 | Friday, May 29, 2015 | By e-mail from: <ul style="list-style-type: none"> • The peer reviewers • frank.j.furrer@bluewin.ch • Georg.Pueschel1@mailbox.tu-dresden.de |

2 documents

HS 2015: Cognitive Computing

| | | |
|--|---|--|
| 1st Seminar Day 6 | Friday, June 5, 2015: 09:00 – 13:00 Room INF 2101 | <ul style="list-style-type: none"> • Participants presentations • Peer discussions, Feedback on style & content |
| Deliver 2 nd , improved draft of your paper to your peer reviewers 7 | Friday, June 19, 2015 | e-mail your paper: <ul style="list-style-type: none"> • Peer reviewers • frank.j.furrer@bluewin.ch • Georg.Pueschel1@mailbox.tu-dresden.de |
| Feedback from Reviewers 8 | Friday, July 3, 2015 | By e-mail from: <ul style="list-style-type: none"> • The peer reviewers • frank.j.furrer@bluewin.ch • Georg.Pueschel1@mailbox.tu-dresden.de |
| 2nd Seminar Day 9 | Friday, July 10, 2015: 09:00 – 13:00 Room INF 2101 | <ul style="list-style-type: none"> • 2nd participants presentation • Peer discussions, Feedback on style and content |
| Deliver final version of your paper 10 | Latest: Friday August 7, 2015 | e-mail your paper to: <ul style="list-style-type: none"> • All participants • frank.j.furrer@bluewin.ch • Georg.Pueschel1@mailbox.tu-dresden.de |
| pdf-volume of collected papers ready | Friday, August 28, 2015 | Downloadable from the seminar website |

HS 2015: Cognitive Computing

The next 2 steps:

| | | |
|---|--|--|
| A list of all participants will be e-mailed nex week | Georg is also available as 2 nd peer-reviewer | F.J. Furrer will review all papers as 3 rd reviewer |
| <p>Select 2 peer reviewers (from the participants and Georg Püschel is also available)</p> <p><u>Note:</u> All papers will also be reviewed by Dr. F.J. Furrer (as 3rd peer reviewer)</p> | | Friday, April 24, 2015 |
| <p>Deliver your choice of topic (i.e. Question 1, 2 or 3) and a short vision/mission statement to the 2 peer reviewers and to F.J. Furrer</p> <p><u>Note:</u> Content and structure of the “vision/mission statement” will be explained in the Kick-Off Meeting</p> | | Wednesday, April 29, 2015 |

HS 2015: Cognitive Computing



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Schweiz

Hauptseminar Website:

http://bit.do/HS2015_CognitiveComputing

Back-Up Slides

What is the sure death of a good presentation ?

<http://info.everywoman.com>



Time overrun !



<http://www.wfs.org>

Time Management (1/2):

Keep your time – never overrun your assigned slot!

Bad solutions:

- Talking faster
- Skipping slides at the end

1. Planning: Maximum 1 Slide/Minute

2. Dry run: Do a realistic presentation

3. Planning: Have planned (!) buffer-slides



<http://www.youtube.com/watch?v=jdj-9PmX8B8>

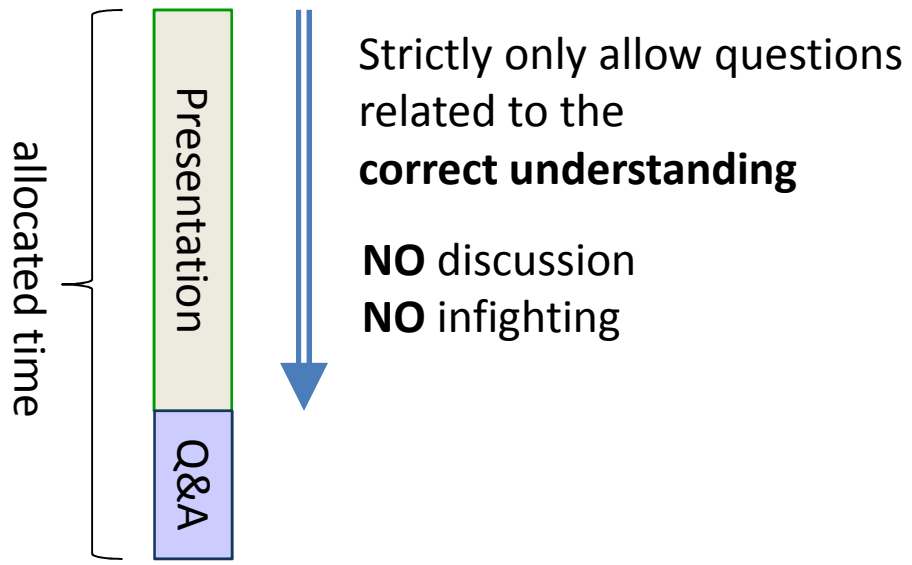
Time Management (2/2):

Keep your time – never overrun your assigned slot!

CAUTION:

- You may be delayed by questions!

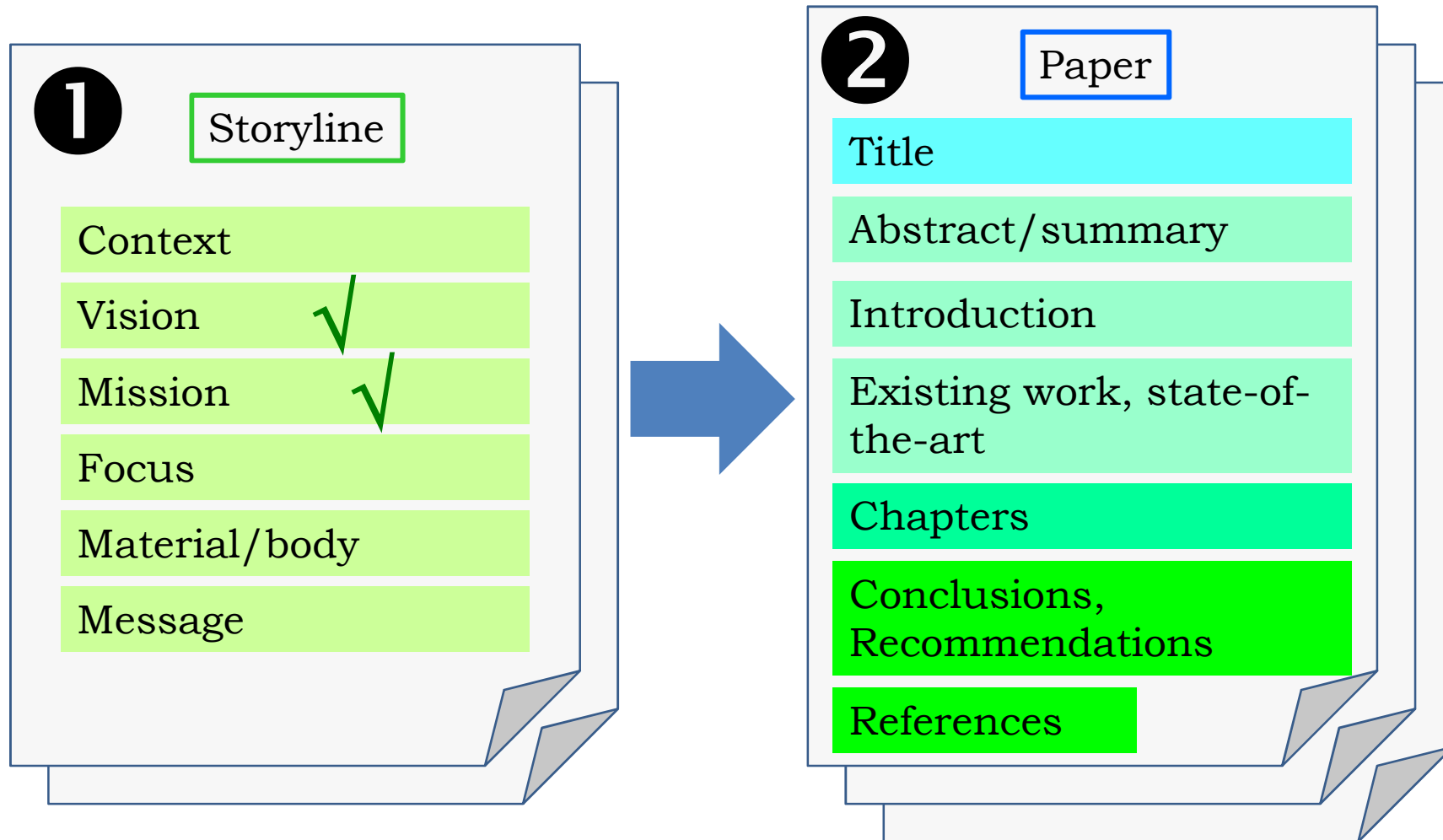
4. Buffer-slides:
≈ 10% of total talk time



HS 2015: Cognitive Computing

Principles of a good paper:

Key element = An interesting, consistent and complete **storyline**



HS 2015: Cognitive Computing

Principles of a good paper:

Storyline:

Context

Vision

Mission

Focus

Material/body

Message

FOCUS

Sensor-based collision-avoidance systems is a wide field of research.

It encompasses sensor-, software-, image processing- and safety engineering.

We focus on one specific system: The system developed by Mercedes-Benz which can be found in most of their current production cars.

We explain its architecture, functionality, features and limitations.



<http://en.wikipedia.org/wiki/Traffic>

HS 2015: Cognitive Computing

Principles of a good paper:

Storyline:

Context

Vision

Mission

Focus

Material/body

Message

Restrict, restrict, restrict!

Organize, organize, organize!

Avoid all unnecessary concepts.

Establish a clear state-of-the-art, of prior work and of relevant references

<http://en.wikipedia.org/wiki/Traffic>



HS 2015: Cognitive Computing

Principles of a good paper:

Conceptual Storyline:

Context

Vision

Mission

Focus

Material/body

Message

This paper has demonstrated the great value of collision-avoidance systems.

Such systems could greatly be improved by using real-time environmental information.

Therefore, research should continue into car-to-car and car-to-infrastructure communications

<http://en.wikipedia.org/wiki/Traffic>



HS 2015: Cognitive Computing

Storyline:

Context

Vision

Mission

Focus

Material/body

Message

Paper:

Title

Abstract/summary

Introduction

Existing work, state-of-the-art

Chapters

Conclusions/recommendations

References

... your deliverables (2 separate documents)

⇒ Style

Style

The **content** of your paper is:

• correct

• precise

• clear

• brief

• ethical

Your material must be free from error and in accordance with facts

If it is vague, it is not scientific writing

If it is unclear or ambiguous, it is not scientific writing either

If it is long-winded and unnecessarily discursive, it is poor scientific writing

Fair, truthful, respectful, references, copyrights, ...

- precise
- clear



Importance of definition of terms

Many terms are highly ambiguous, context-dependent, author-dependent, time-dependent etc.

System, element, module, component, domain, ...

Term „Human“ [Definition]:

We are bilaterally, symmetrical, sexually differentiated bipeds located on one of the outer spirals of the Milky Way, capable of recognising the prime numbers ...

[NASA Deep Space Probe]

- brief

Clear is more important than brief

Acronyms and abbreviations are poison for the reader

⇒ Avoid them (whenever possible)

If necessary, introduce them (1x or 2x) at the beginning:

„This paper introduces the concept of System-of-Systems (SoS)“.

An SoS ...

The vehicle can be seen as an SoS, with many CS, such as ABS, ESC, BA and possibly a CAS.