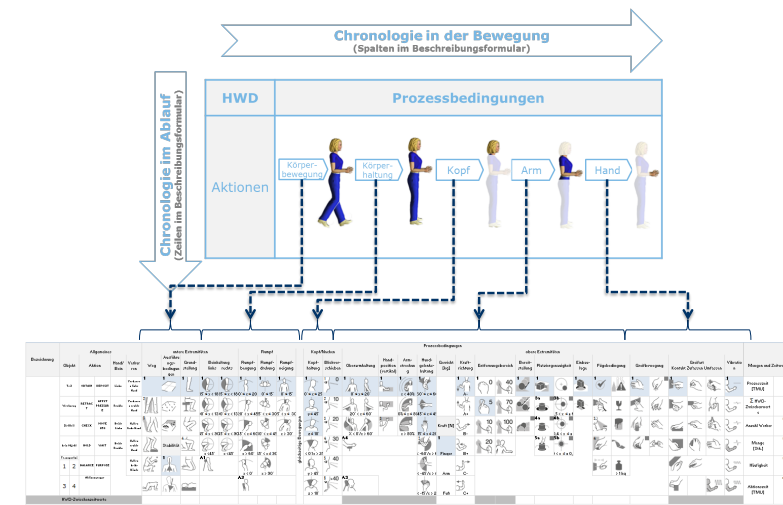
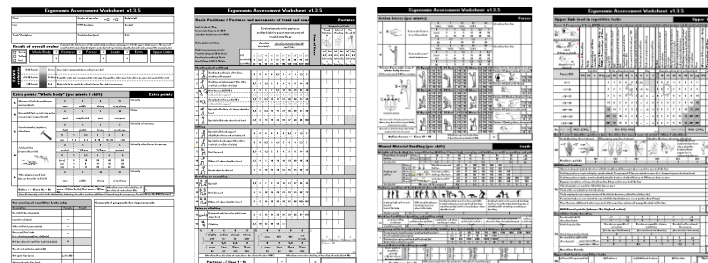




MTM – the fundamental
IE-methdodology
is developing towards
„Human Work Design“

Agenda

- Introduce MTM and the International MTM-Directorate
- New MTM approaches
 - Ergonomic Assessment Worksheet - EAWS
 - Human Work Design – MTM-HWD®
- Further research activities





Academic career / personal facts

- Head of MTM-Institute and MTM-Academy - since April 2014
- Technical Coordinator in the International MTM-Directorate
- Associate Professor for Industrial Engineering
@ Vienna University of Technology
- Lectureships at universities such as Montanuniversity Leoben
- Habilitation in the field of Industrial Engineering in June 2013
- Visiting Professor @ TU Dortmund University in 2012
- PhD in Technical Sciences @ VUT in 2000

Latest publication

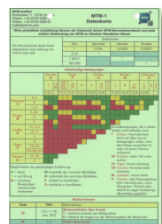
- Kuhlang, P (Hrsg.):
Modellierung menschlicher Arbeit im Industrial Engineering -
Grundlagen, Praxiserfahrungen und Perspektiven, Stuttgart,
Ergonomia, 2015. 267 S.

The two dimensions of MTM

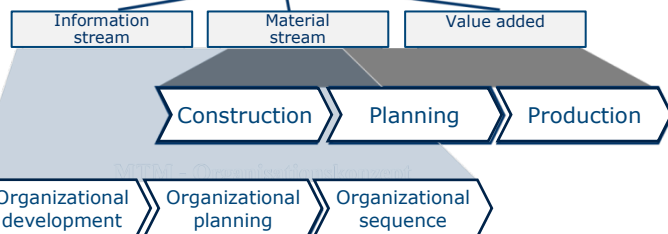
MTM

Methods-Time Measurement

instrumental: methodology



**Avoiding waste
in value stream**



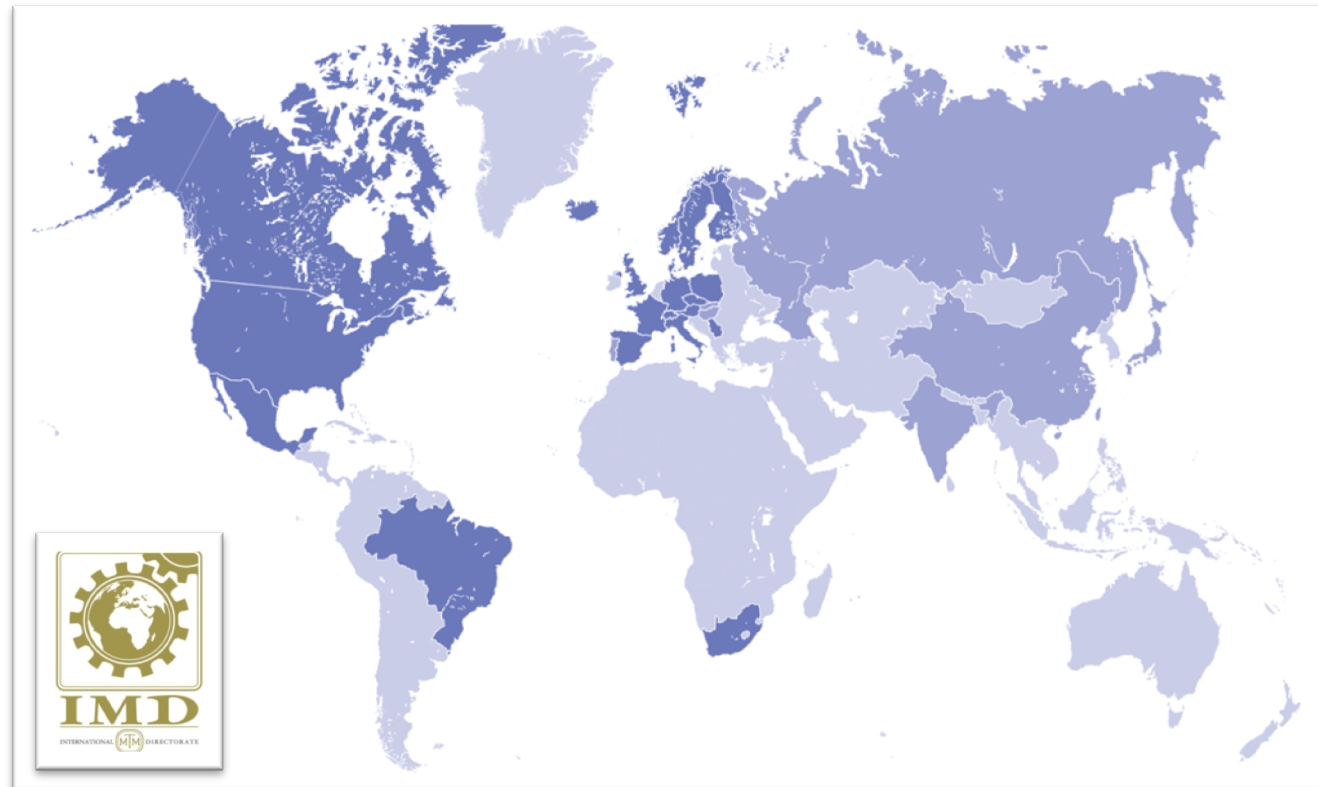
- Standard performance for human work
- International standard to design, describe and evaluate human work
- International process language

institutional: organization



- Associations (non-profit)
- Training, int. certified
- Consulting, Software

Global presence – International MTM-Directorate



Canada
USA
Brazil

Norway
Sweden
Finland
Denmark
Great Britain
Spain

Netherlands
Luxembourg
Belgium
France
Portugal
Slovakia

Germany
Switzerland
Austria
Poland
Czech Republic
Australia

Hungary
Turkey
China
Japan
South Africa
India

International standardised MTM-Systems

Technical Plattform

- Each system is under the responsibility of one NMTMA
 - Research and development
 - Maintenance of the training material

Technique	Responsibility	Field of Application
MTM-1	Germany	Work measurement
MTM-2	France	Work measurement
MTM-UAS	Germany	Work measurement
MTM-MEK	Germany	Work measurement
EAWS	Italy	Ergonomics
PROKON	Germany	Design for Assembly

- Quantitative work design and measurement systems: MTM-1, MTM-2, UAS, MEK
- Quantitative workload measurement systems: EAWS
- Qualitative product design evaluation systems: ProKon

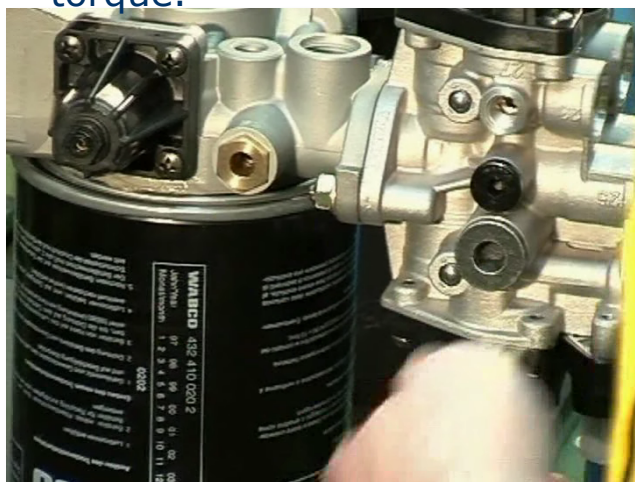
How to apply MTM?

Plan or observe operation



Start:

Assemble connection plug to compressor and tighten it to torque.



Finish:

Modeled standard operation
incl. standard time (285 TMU ≈ 10s)

Distance (cm)	$0 \leq 20$	$20 \leq 50$	$50 \leq 80$
...
Get and Place	AF1 (40 TMU)	AF2 (65 TMU)	AF3 (80 TMU)
...
Handle Aid	HB1 (40 TMU)	HB2 (60 TMU)	HB3 (75 TMU)
...

MTM-Datcard
(exc. of MTM-UAS
Basic Operations)

Choose
process blocs
and model
operation



MTM		MTM Analysis										File No. _____					
		<input type="checkbox"/> Planning Analysis <input checked="" type="checkbox"/> Production Analysis										Sheet _____					
Code		D	Z	7	0	5	.	0	5	.	.	.	5				
Description		Assemble connection plug															
No.	Description	Code	TMU	Q x F	Total TMU												
1	Plug to thread	AF2	65	1	65												
2	Turn on	ZA2	15	5	75												
3	Torque wrench	HB2	60	1	60												
4	1. Turn	ZA1	5	1	5												
5	2.-3. Turn	ZC1	30	2	60												
6	Turn to torque	ZD	20	1	20												
							Σ 285										

Modeling processes with MTM – as-is & in advance

Worker 1 – door on cardboard

No.	Description	Code	Q x F	tg
1.	Door on foldable cardboard	AL 2	1	105
2.	Follow up	PA 3	1	25
3.	Adjust	AB 1	1	25
4.	Walk	KA	5*2	25

Both workers – plug-in lug/flap

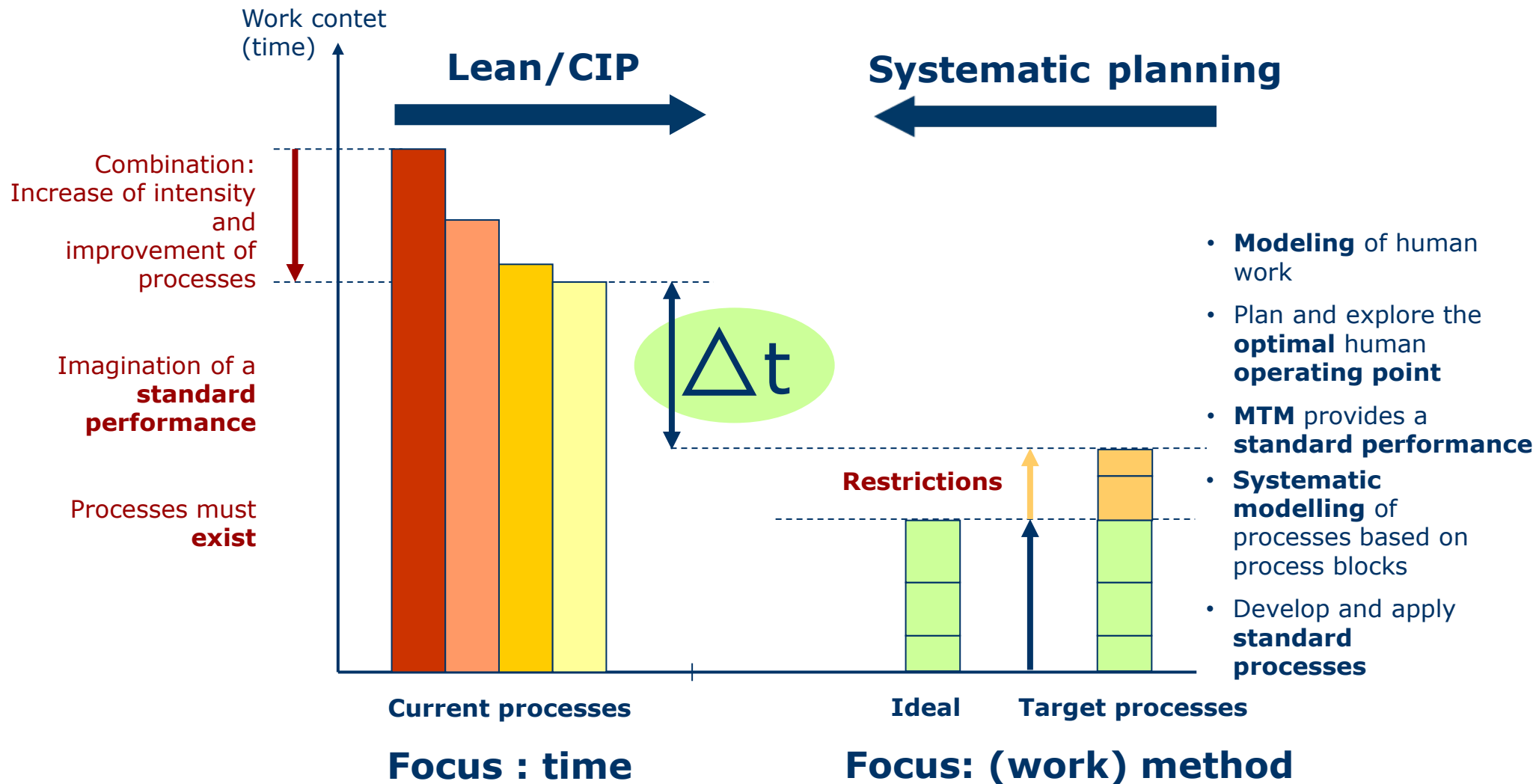
No.	Description	Code	Q x F	tg
1.	Insert lug	AB 2	2	45
2.	Press lug in	AA 1	2	20
3.		ZD	2	20
4.	Flip lug	AA 2	2	25

Extracts of the whole MTM analysis



Distance (cm)	0 ≤ 20	20 ≤ 50	50 ≤ 80
Get and Place	AF1 (40 TMU)	AF2 (65 TMU)	AF3 (80 TMU)
Handle Aid	HB1 (40 TMU)	HB2 (60 TMU)	HB3 (75 TMU)

Time vs. method focus



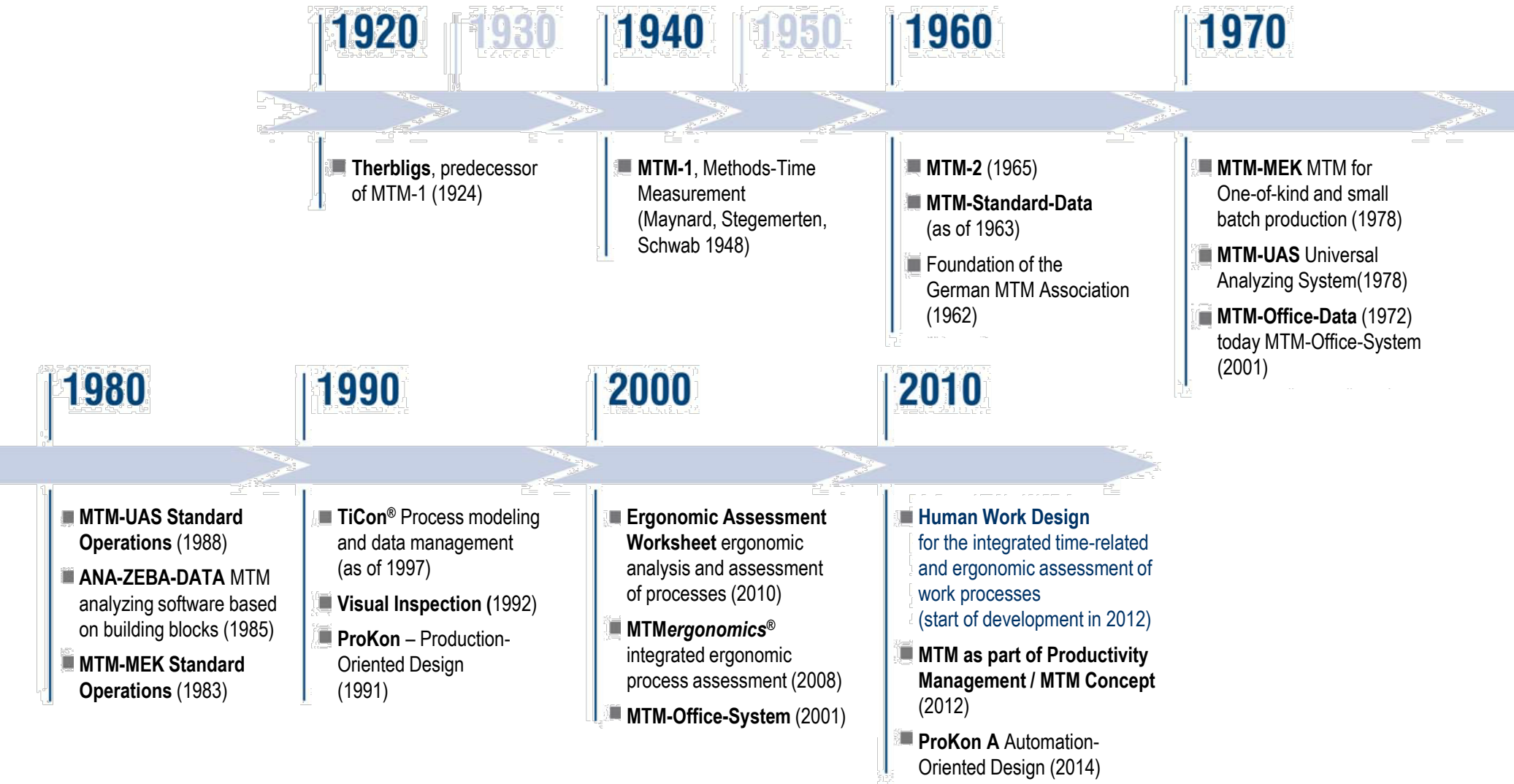
Definition: MTM standard performance

The **standard performance of 100%** is described within the LMS technique as being

*"the equivalent of the much-discussed fair day's work. It was to **represent an effort level** that could be easily maintained year in and year out by the **physically normal operator without** in any way requiring him **to draw upon his reserves of energy.**"*

Quelle: Maynard, Stegemerten, Schwab, Methods-Time Measurement, McGraw-Hill, 1948

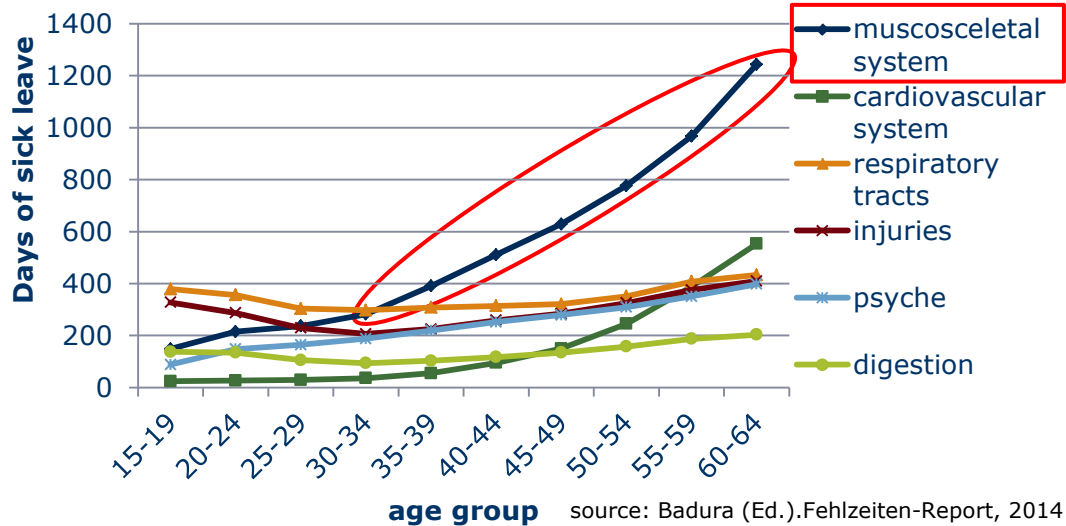
Development of MTM Building Block Systems



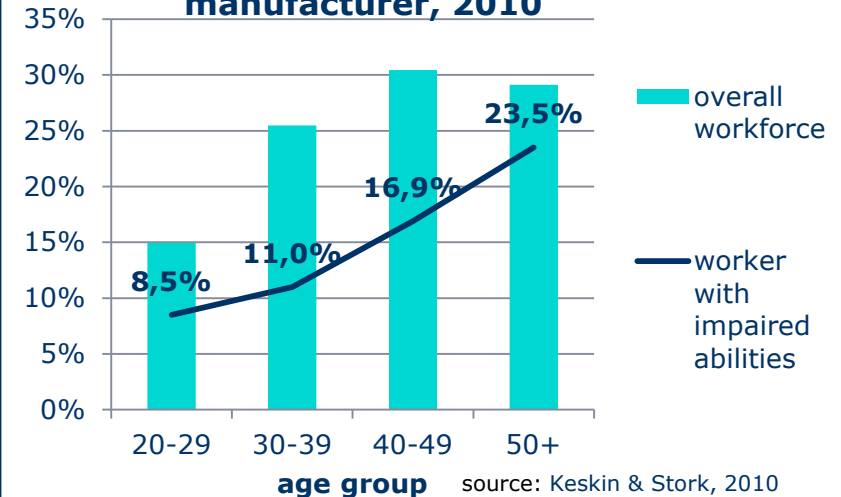
Employees with impaired abilities

Current Challenges – aging workforce

Days of sick leave, type of disease, age, 2013



Example: Employees with restrictions at an automotive manufacturer, 2010



- increasing average **age** of workforce (in Europe)
- increasing share of **work-related musculoskeletal disorders (WMSDs)** with growing age
- increasing proportion of employees with **impaired abilities** with growing age

?What measures can be taken to design/to plan work places, minimizing the physical stress in order to enable productive and ergonomic work?

EAWS – Ergonomic Assessment Worksheet

Definition

EAWS

EAWS is an ergonomic 1st level tool for **screening the risk due to biomechanical overload**, developed to provide an **overall risk evaluation** that includes every **biomechanical risk** to which an **operator** may be **exposed during a working task**.

- Up to a certain extent, EAWS can also be used as a 2nd level analysis tool, since it is quite analytical and detailed.
- EAWS gives the necessary information to **redesign the work task and to plan work systems in advance**, making the second level systems seldom necessary.

EAWS compatibility to International Standards and select Second level Tools

	Standards		Tools		
Risk Areas	CEN	ISO	Correlated single systems (Second Level)	Combined systems (First Level)	
Body Postures with low external effort	1005 - 4	11226	OWAS	AAWS	EAWS
Action Forces	1005 - 3	11228-2	RULA		
Manual Material Handling (Repositioning)	1005 - 2	11228-1	NIOSH		
Upper Limbs - high frequencies / low loads	1005 - 5	11228-3	OCRA, Strain Index, HAL-TV		

EAWS – form structure (paper&pencil, software)

Page 1 (Section 0)

Ergonomic Assessment Worksheet v1.3.5									
Plant	Gender of operator	<input type="checkbox"/> Male <input type="checkbox"/> Female	Body height						
Size	MTM Analysis								
Task/Workshop	Task duration [min]	Date							
Result of overall analysis <small>Calculate the total scores of the whole body evaluation and compare it to the upper limb scores. The overall result is determined by the higher value but take special notice that the value into account the overall result.</small>									
<input type="checkbox"/> Green <input type="checkbox"/> Yellow <input type="checkbox"/> Red	Whole Body	Postures	Forces	Loads	Extra	Upper Limbs			
EAWS 0-25 Points Green Low risk 26-50 Points Yellow Medium risk 51-75 Points Red High risk	Low risk: no measures or only minor measures are needed. Medium risk: measures should be taken to reduce the risk. High risk: measures should be taken to reduce the risk to an acceptable level.								
Extra points "Whole body" (per minute / shift)									
1. Absence of static posture	0	5	10	15	20	25	30	35	40
2. Absence of static posture	0	5	10	15	20	25	30	35	40
3. Absence of static posture	0	5	10	15	20	25	30	35	40
4. Absence of static posture	0	5	10	15	20	25	30	35	40
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8. Absence of static posture	0	5	10	15	20	25	30	35	40
9. Absence of static posture	0	5	10	15	20	25	30	35	40
10. Absence of static posture	0	5	10	15	20	25	30	35	40
11. Absence of static posture	0	5	10	15	20	25	30	35	40
12. Absence of static posture	0	5	10	15	20	25	30	35	40
13. Absence of static posture	0	5	10	15	20	25	30	35	40
14. Absence of static posture	0	5	10	15	20	25	30	35	40
15. Absence of static posture	0	5	10	15	20	25	30	35	40
16. Absence of static posture	0	5	10	15	20	25	30	35	40
17. Absence of static posture	0	5	10	15	20	25	30	35	40
18. Absence of static posture	0	5	10	15	20	25	30	35	40
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25. Absence of static posture	0	5	10	15	20	25	30	35	40
26. Absence of static posture	0	5	10	15	20	25	30	35	40
27. Absence of static posture	0	5	10	15	20	25	30	35	40
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29. Absence of static posture	0	5	10	15	20	25	30	35	40
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32. Absence of static posture	0	5	10	15	20	25	30	35	40
33. Absence of static posture	0	5	10	15	20	25	30	35	40
34. Absence of static posture	0	5	10	15	20	25	30	35	40
35. Absence of static posture	0	5	10	15	20	25	30	35	40
36. Absence of static posture	0	5	10	15	20	25	30	35	40
37. Absence of static posture	0	5	10	15	20	25	30	35	40
38. Absence of static posture	0	5	10	15	20	25	30	35	40
39. Absence of static posture	0	5	10	15	20	25	30	35	40
40. Absence of static posture	0	5	10	15	20	25	30	35	40
41. Absence of static posture	0	5	10	15	20	25	30	35	40
42. Absence of static posture	0	5	10	15	20	25	30	35	40
43. Absence of static posture	0	5	10	15	20	25	30	35	40
44. Absence of static posture	0	5	10	15	20	25	30	35	40
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57. Absence of static posture	0	5	10	15	20	25	30	35	40
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66. Absence of static posture	0	5	10	15	20	25	30	35	40
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72. Absence of static posture	0	5	10	15	20	25	30	35	40
73. Absence of static posture	0	5	10	15	20	25	30	35	40
74. Absence of static posture	0	5	10	15	20	25	30	35	40
75. Absence of static posture	0	5	10	15	20	25	30	35	40
76. Absence of static posture	0	5	10	15	20	25	30	35	40
77. Absence of static posture	0	5	10	15	20	25	30	35	40
78. Absence of static posture	0	5	10	15	20	25	30	35	40
79. Absence of static posture	0	5	10	15	20	25	30	35	40
80. Absence of static posture	0	5	10	15	20	25	30	35	40
81. Absence of static posture	0	5	10	15	20	25	30	35	40
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87. Absence of static posture	0	5	10	15	20	25	30	35	40
88. Absence of static posture	0	5	10	15	20	25	30	35	40
89. Absence of static posture	0	5	10	15	20	25	30	35	40
90. Absence of static posture	0	5	10	15	20	25	30	35	40
91. Absence of static posture	0	5	10	15	20	25	30	35	40
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93. Absence of static posture	0	5	10	15	20	25	30	35	40
94. Absence of static posture	0	5	10	15	20	25	30	35	40
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97. Absence of static posture	0	5	10	15	20	25	30	35	40
98. Absence of static posture	0	5	10	15	20	25	30	35	40
99. Absence of static posture	0	5	10	15	20	25	30	35	40
100. Absence of static posture	0	5	10	15	20	25	30	35	40

Page 2 (Section 1)





Ergonomic Assessment Worksheet v1.3.5									
Basic Positions / Postures and movements of trunk and arms									
Postures									
Evolution of static posture on the high frequency movements of trunk and arms on the low frequency movements of trunk and arms on the very low frequency movements of trunk and arms									
Static posture									
High frequency movements									
Trunk									
Arms									
Head									
Neck									
Shoulder									
Elbow									
Wrist									
Hand									
Finger									
Thumb									
Other									
Extra points "Whole body" (per minute / shift)									
Extra points									
1. Absence of static posture									
2. Absence of static posture									
3. Absence of static posture									
4. Absence of static posture									
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61. Absence of static posture									

Evaluation of overall risk

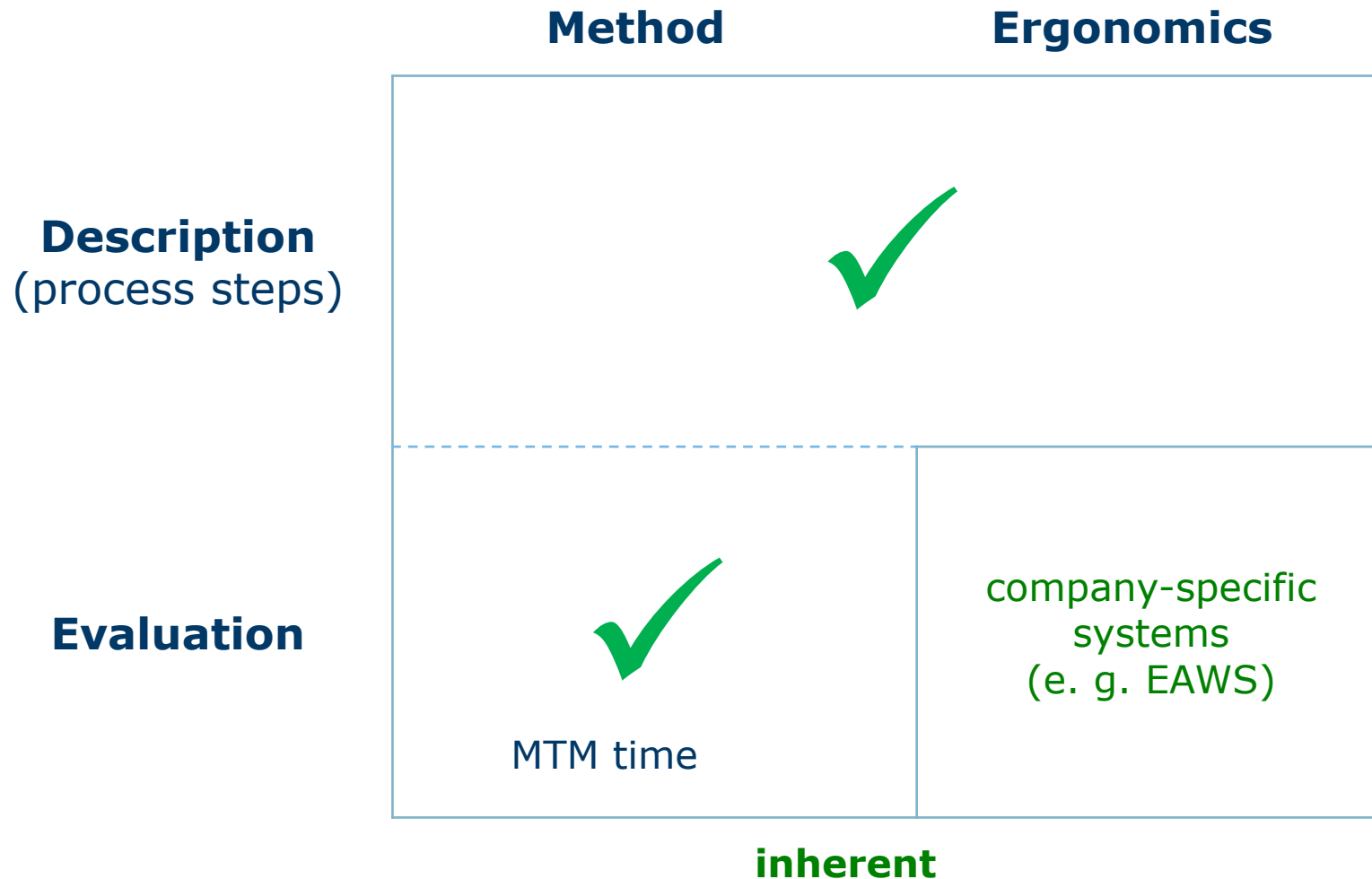
The EAWS sheet provides one score for each Macro-Section which is shown in a traffic light scheme (green, yellow, red) according to the Machinery Directive 2006/42/EC (EN 614).

0-25 Points	Green	Low risk	recommended; no action is needed
>25-50 Points	Yellow	Possible risk	not recommended; redesign if possible, otherwise take other measures to control the risk
>50 Points	Red	High risk	to be avoided; action to lower the risk is necessary

Process description & ergo. assessment – **upto today**

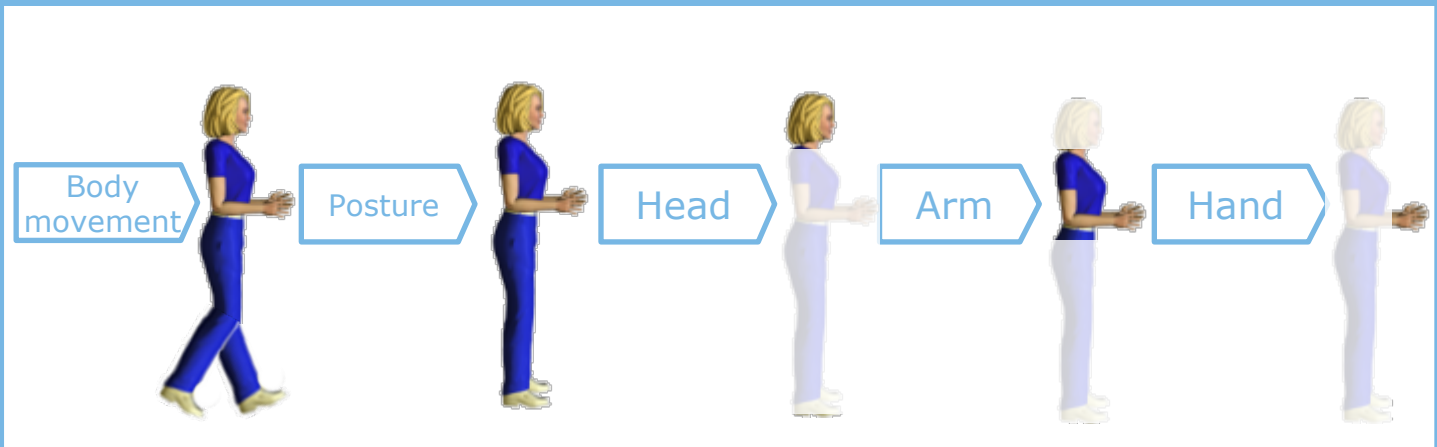







	Method	Ergonomics
Description (process steps)	 MTM-1, MTM-2, MTM-UAS, MTM-MEK	 observed activity
Evaluation	 MTM time	 ergonomic assessment method

Process description & ergo. assessment – **from today**



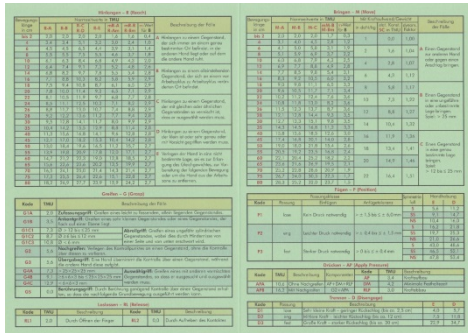





Basic Pattern “Chronology” – „Modern Therbligs”



HWD	Process Conditions						
Actions							
							



Development of the Process Language MTM

	MTM-1	MTM-UAS	MTM-HWD®
Process element/bl ocs	Basic Motions <ul style="list-style-type: none"> Reach, Grasp, Move, Position, Release, Apply Pressure, Walk, Side Step,... Process time 	Basic Operations <ul style="list-style-type: none"> Get and Place, Place, Handle Aid, Operate, ... Process Time 	Actions <ul style="list-style-type: none"> Obtain, Deposit, Retract, Check, Apply Pressure, Move Leg Wait, Hold, Balance Purpose
Datacard			
Formulas			

Thank you for your kind attention!



Contact:

ao. Univ.-Prof. Dr.
Peter Kuhlmann

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