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# Processing Manufacturing Knowledge with Ontology-based Annotations and Cognitive Architectures

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# Vision



PPT\_Master\_IGD\_v2009.2.00.ppt

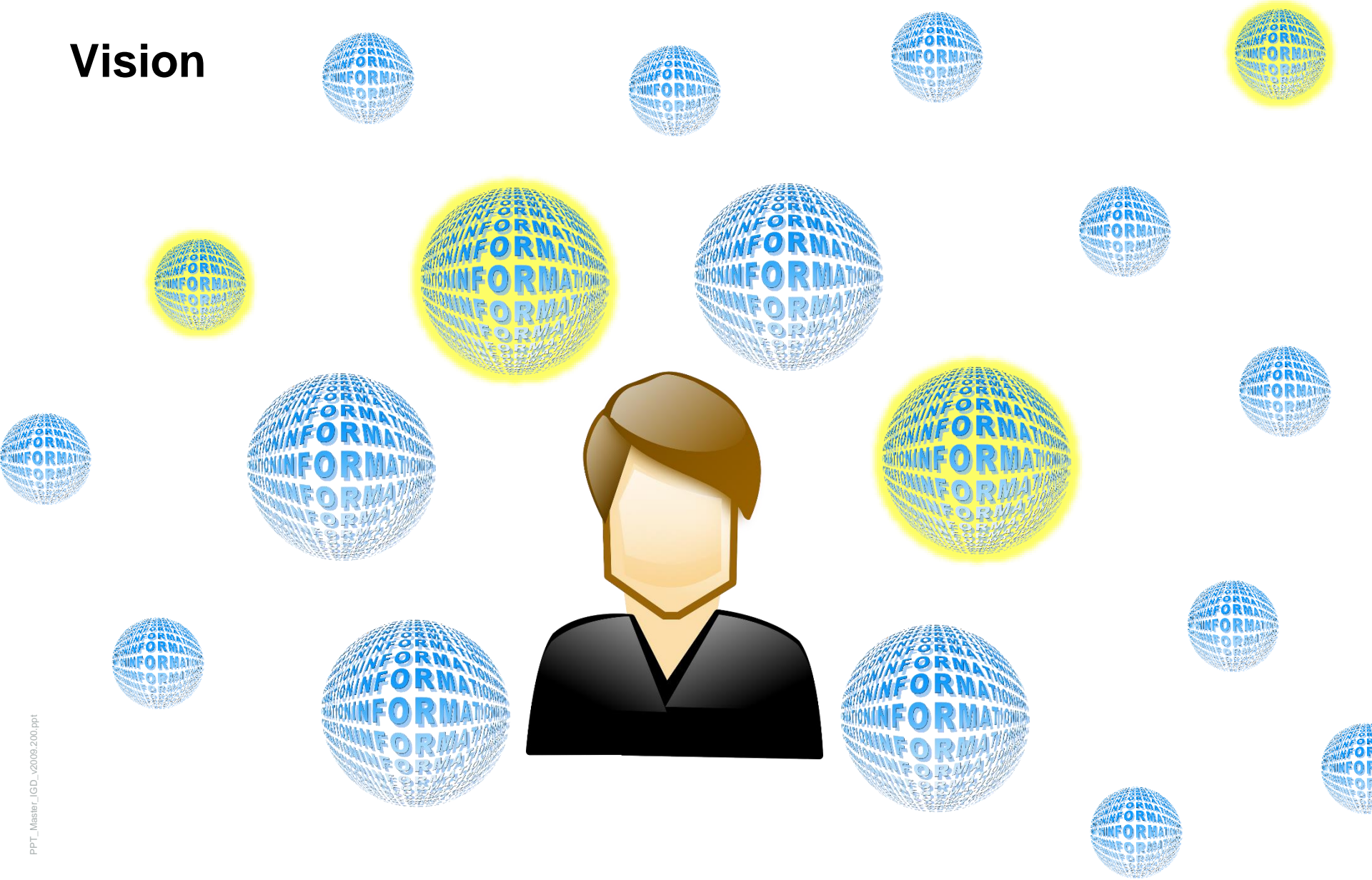
# Vision



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# Vision

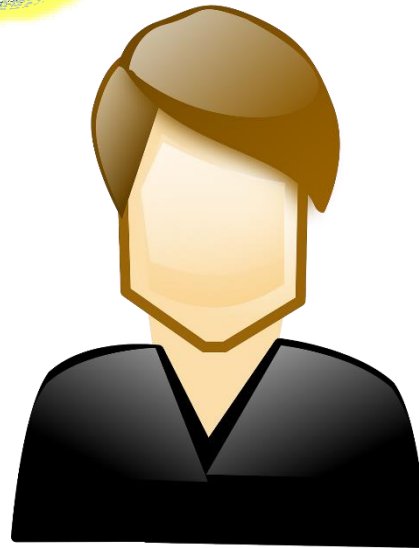
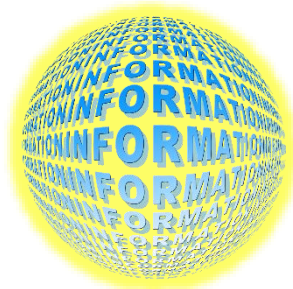


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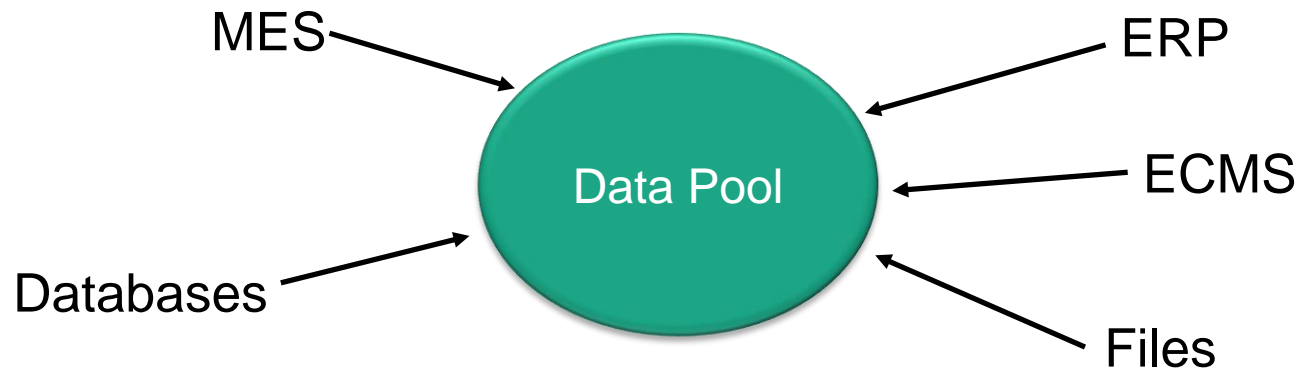


# Vision



# Assistance in manufacturing processes

- Variety of heterogeneous data sources and systems



- Cognitive efforts to summarize and combine the data
- Support by flexible and integrated presentation of the data

# Assistance in manufacturing processes



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# Assistance in manufacturing processes



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# Assistance in manufacturing processes

## Work Context A

The worker **formulates** a situation-related annotation.



## Information Assistance System

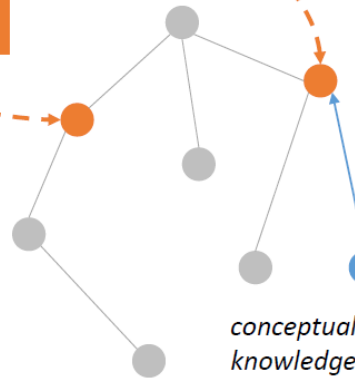
Cognitive Architecture



*procedural and meta-cognitive knowledge*

Annotation

Ontology



*conceptual knowledge*

Annotation

## Work Context B

The worker **receives** a situation-related annotation.



# Key Points

- **Supporting** the user in his current work task
- **Quick** and **easy** documentation
- **Automatic** provision of **relevant** information
  
- **Context** for better understanding

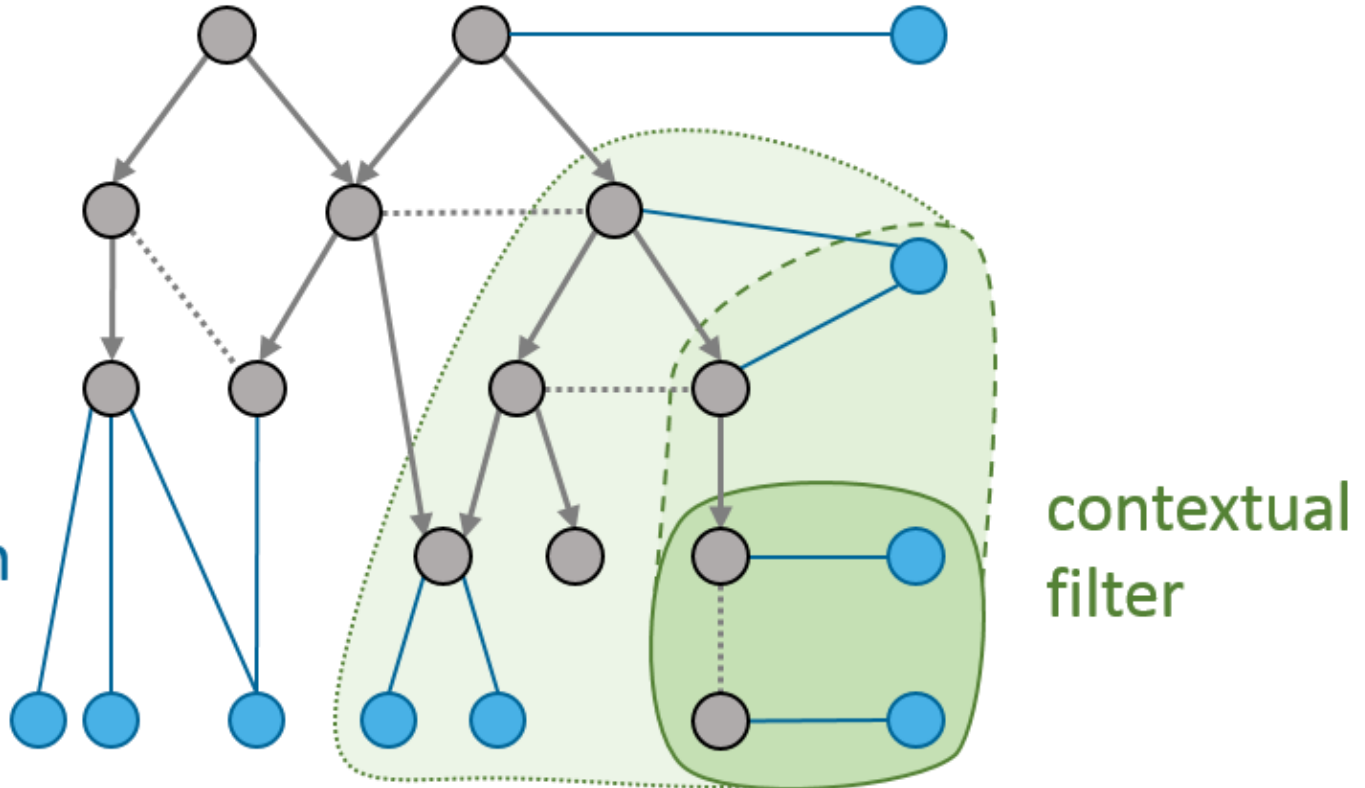
# Contextualized information by annotation

- Context for understanding information (humans)
- Context for automatically processing information (machine)
  
- Additional information attached to work task situation:  
Free text, photo, ...  
= Annotation

# Concept

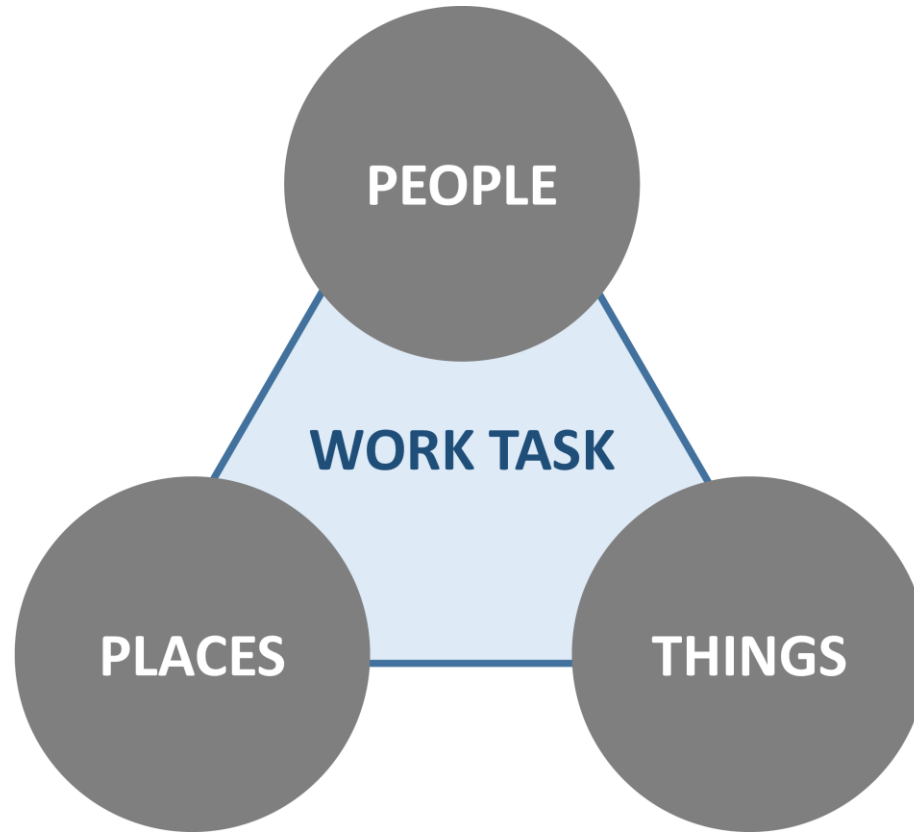
domain ontology

annotation



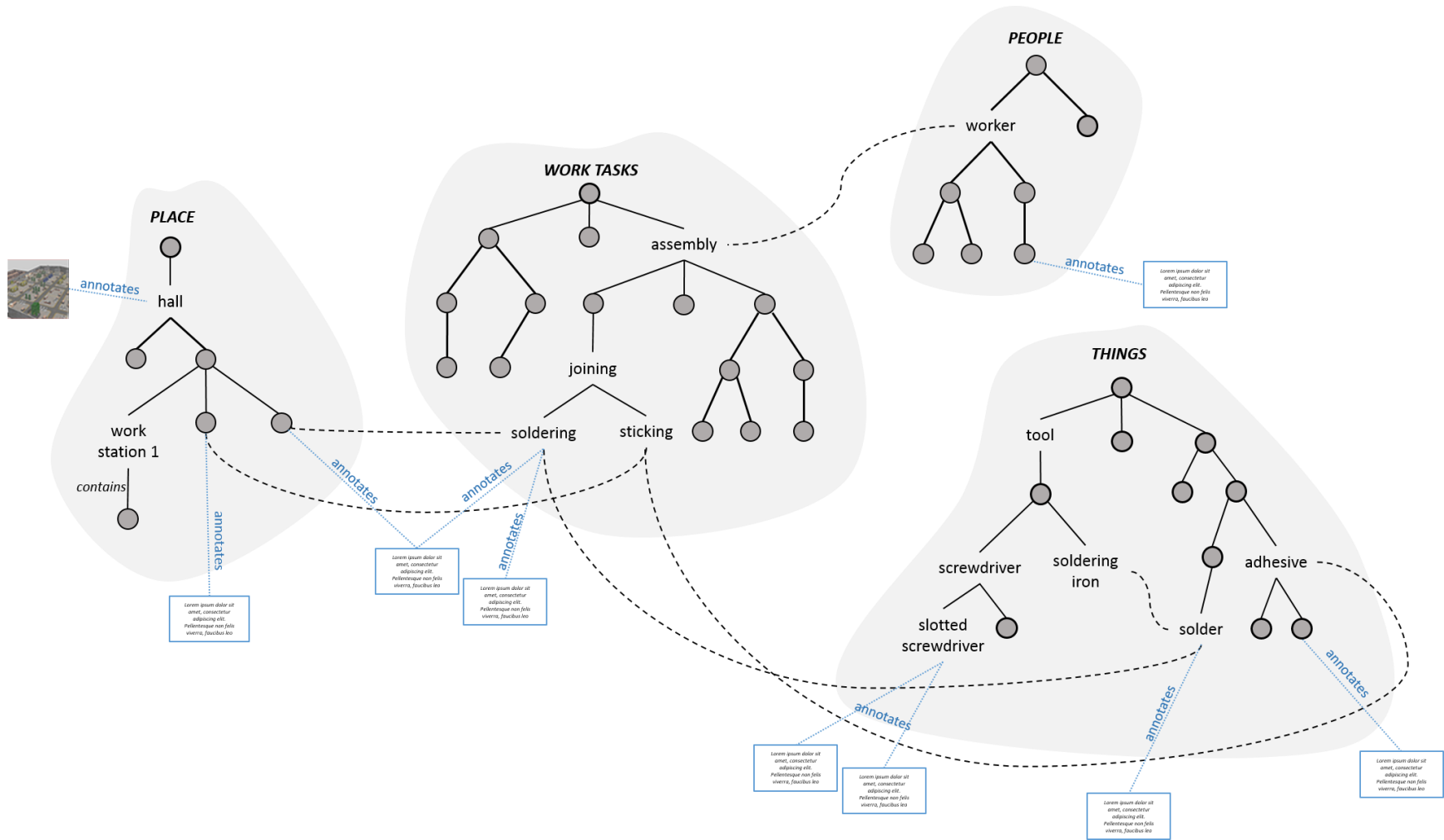


# Domain Context

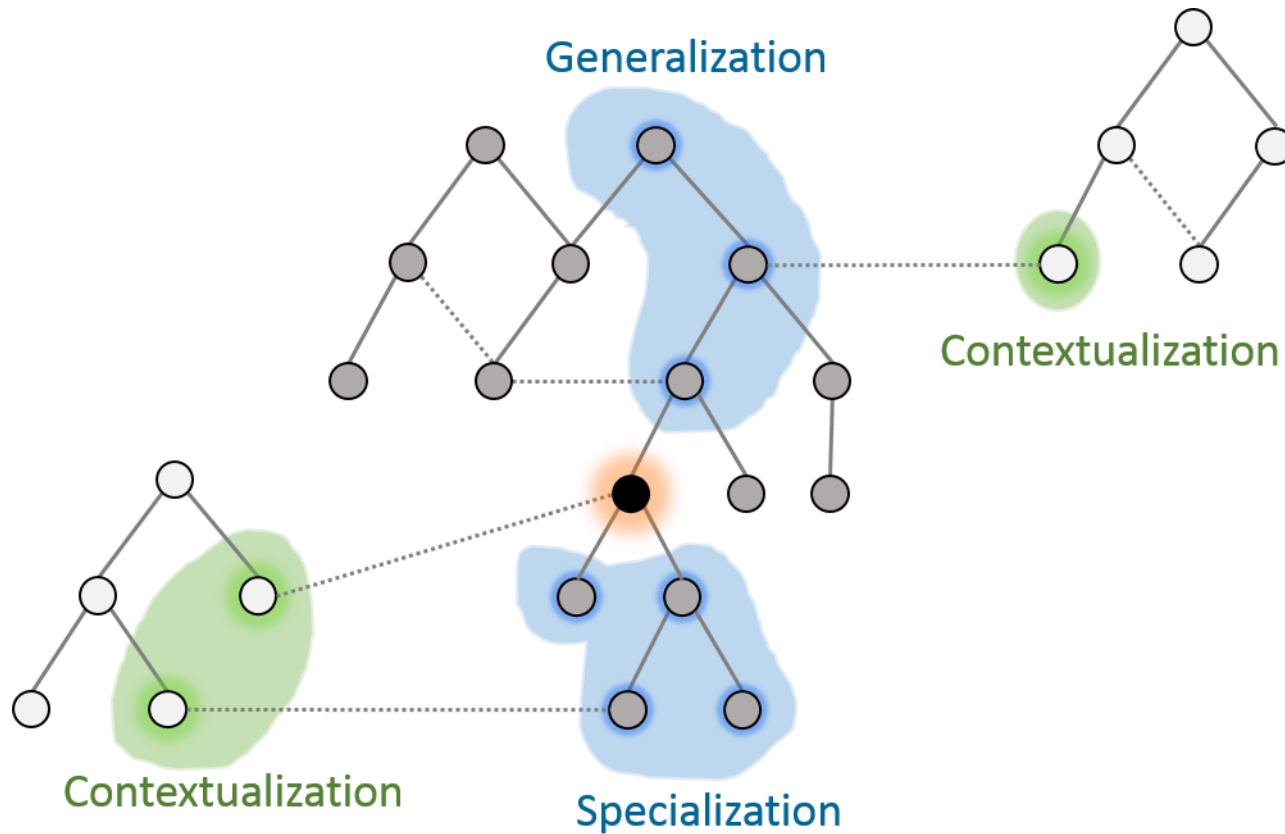


(Abowd et al.)

# Domain Ontology



# Relevance



# Cognitive Architecture

## Definition:

- Technology which mimics the mental structure of human information processing
- Decision making
- Problem solving
- Memories, learning, perception, etc.



# Cognitive Architecture

## Functions:

- Detection of most likely situation
  - Identification of physical and virtual states of the work environment
- Formalization and processing of contextual background knowledge
- Learning of new knowledge

# Cognitive Architecture

## Benefit from Ontology:

- Less (soar) modeling effort
- Operator rules on abstract layer
- Abstract concept „tool“ instead of naming each specific tool
- Interpretation at runtime

# Plant@Hand Tool – Mockup

☰
Plant@Hand 00:04:20 ⚙️

**Montageschritte**

Baugruppe 1 ▾

- 🔧 Rotorblätter montieren
- 🔧 Achse mit Rotorblättern montieren
- 🔧 Deckel auf Windradknopf schrauben
- 🔧 Solarzelle-Antrieb anschliessen
- 🔧 Solarzelle-Antrieb festschrauben

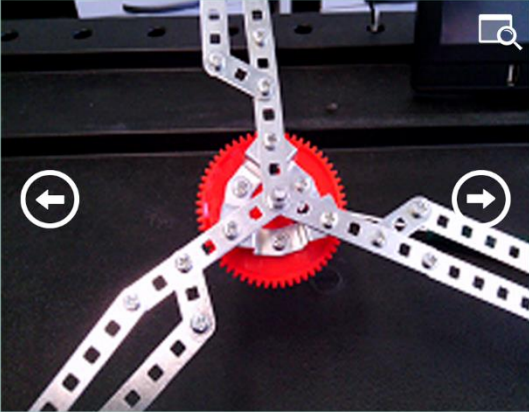
Baugruppe 2 ◀

📍 Heute | 11:00 - 13:00 Uhr
25%

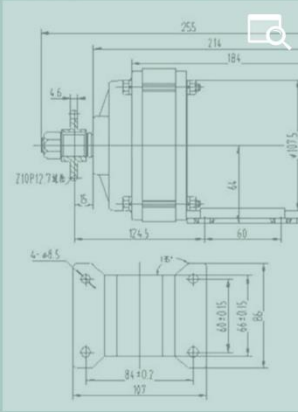
## Windrad montieren

Schritt 1 von 5 NÄCHSTER SCHRITT

Bild 1 von 2



Technische Zeichnung



Rotorblätter mit 3mm M5 Schrauben unter Zuhilfenahme von entsprechenden Muttern und Unterlegscheiben am Drehrad befestigen (siehe technische Zeichnung).

**Werkzeuge** ▾

- 🔧 Kreuzschraubendreher
- 🔧 Schlitzschraubendreher
- 🔧 Hammer
- 🔧 Flachzange

**Materialien** ▾


- 🔧 Rotorblatt
- 🔧 Schraube, 3mm M5
- 🔧 Mutter, M5
- 🔧 Unterlegscheibe
- 🔧 Achse mit Drehrad

**Notes**

Vorsicht, Flügel verbiegen und brechen leicht!

Schrauben sehr weich, nur mit geringem Widerstand montieren, um Überdrehen des Gewindes zu verhindern

Schrauben M5



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# Plant@Hand Tool

←
Plant@Hand / Windrad montieren 00:00:45 🕒 ⚙️

**Aktuelle Schritte**

Rotorblätter montieren

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**Offene Schritte**

Achse mit Rotorblättern verschrauben

Deckel auf den Windradkopf montieren

Solarzellenantrieb anschließen

Solarzellenantrieb festschrauben

Rotorblätter montieren

ROTORBLÄTTER MONTIEREN

Arbeitsschritt	Anmerkungen
Nehmen Sie: <b>Schraubenschlüssel 7mm</b>	
Setzen Sie die 3 <b>Rotorblätter</b> nacheinander auf die <b>Rotorachse</b> . Befestigen Sie dabei jedes einzelne <b>Rotorblatt</b> jeweils mit zwei 3mm Schrauben und zwei Muttern am <b>Rotorzahnrad</b> .	

**Werkzeuge**

- Kreuzschraubendreher (grün) ✕
- Schlitzschraubendreher (gelb) ✕
- Schraubenschlüssel 7mm ✕

**Materialien**

- 0 Mutter ✕
- 0 3mm Schraube ✕
- 0 5mm Schraube ✕
- 0 7mm Schraube ✕
- 0 Schlitzschraube ✕
- 0 Kabelverbinder ✕
- 0 30mm Schraube ✕

**Bauteile**

- 0 Solarzellenantrieb ✕
- 0 Deckel ✕
- 0 Rotorblatt ✕
- 0 Achse mit Drehrad ✕

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LEADER 2014-2020





# Summary

- Context-based information delivery
- **Annotations** as intuitive means for asynchronous information exchange
- **Ontology** as semantic knowledge base
- **Cognitive architectures** for ontology-based knowledge rules

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# Thank you for your attention

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