

**Agents**



**Hype**

**and**

**e-Business**



**Reality**

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# Overview

1. Developments in e-Business
2. The role of electronic institutions
3. What are software agents?
4. Where can/are agents used?
5. Agents and electronic institutions
6. Barriers and opportunities
7. Conclusions

# First development in Business

From



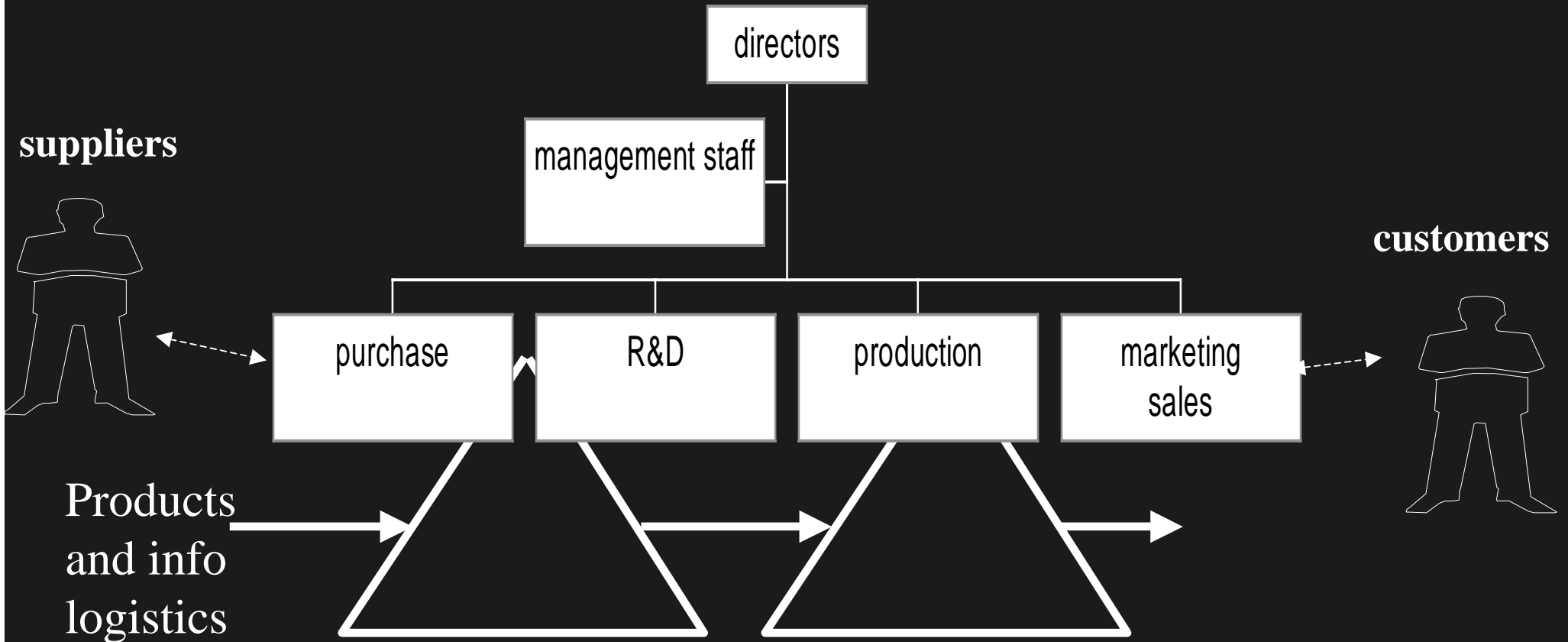
operational excellence

To

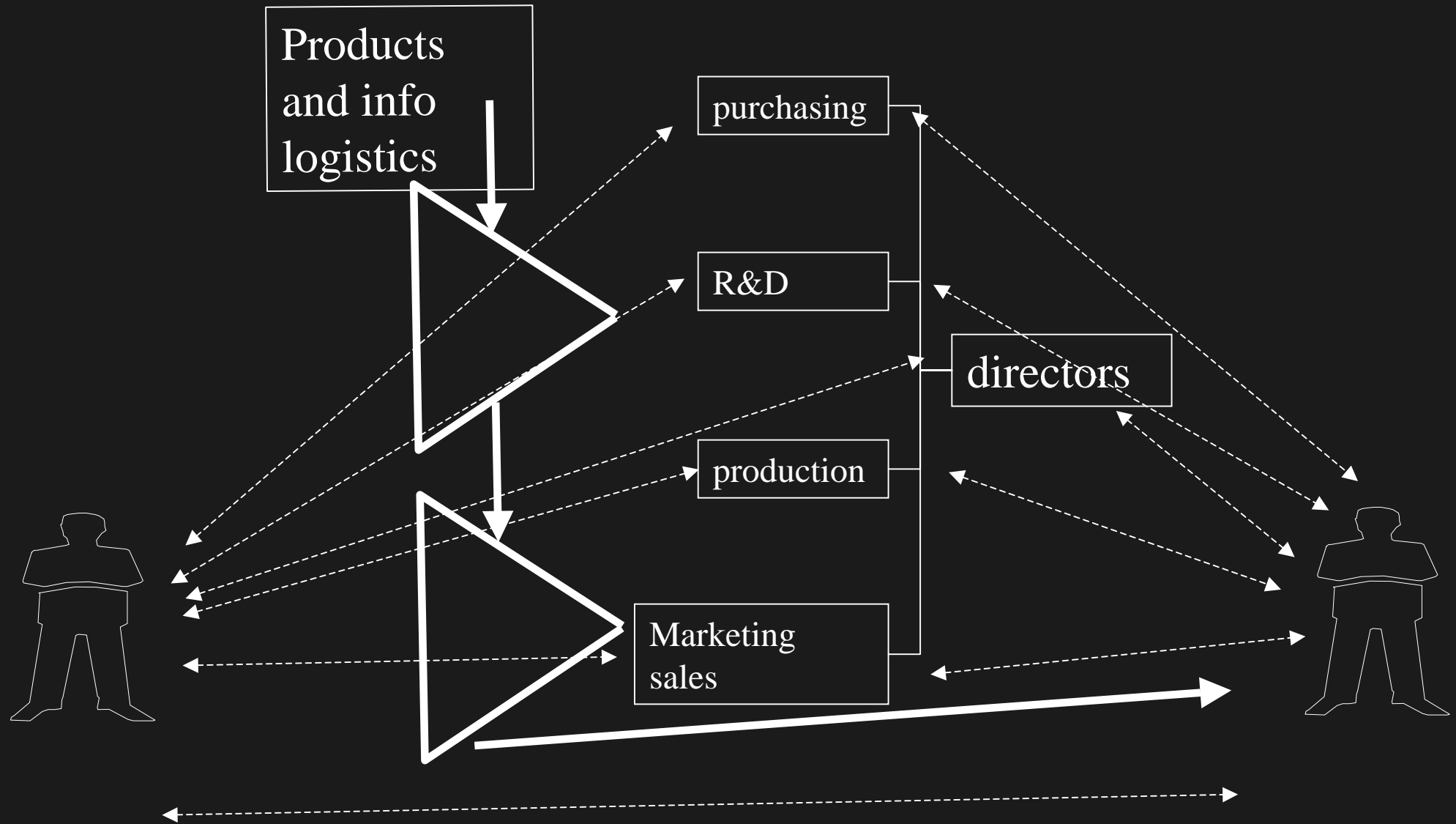


relational excellence

# operational excellence

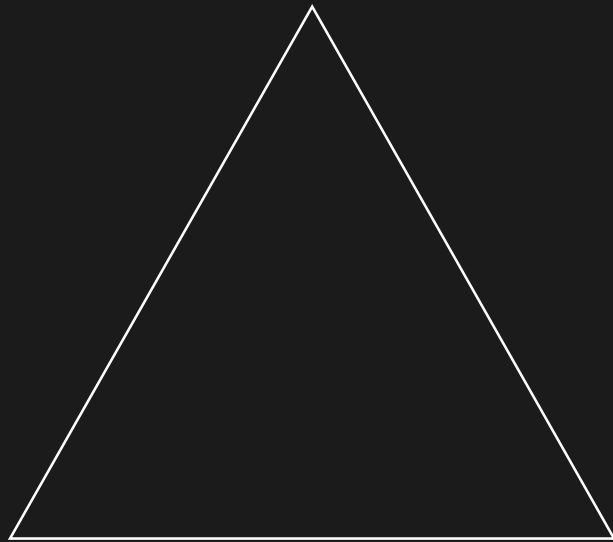


# Relational oriented



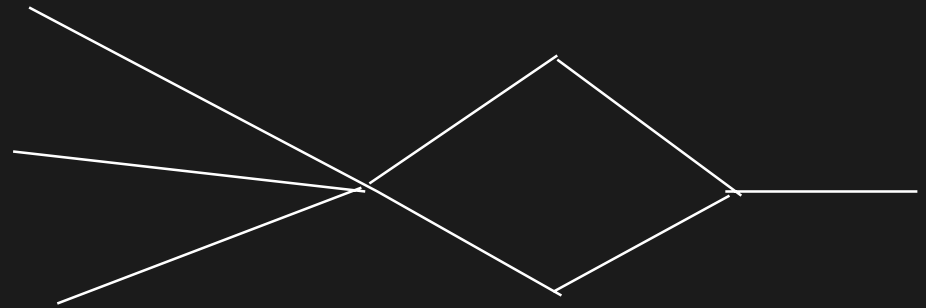
# Second development in Business

From



hierarchy

To



Market  
Network  
Peer-to-peer

# Characteristics

- Transactions through market
  - no longstanding relations
  - supply and demand determine price
- Transactions through hierarchy
  - tight relation between supplier and customer
  - price is management decision

# Market vs. hierarchy

	Production costs	Coordination costs
markets	low	high
hierarchy	high	low

# Electronic interconnections

- Lower communication costs
- Lower coordination costs
  - market efficiency
    - information gathering
    - price comparison
    - global competition
  - hierarchy integration
    - use of EDI in supply chains

# Developments in e-Business

1. First development leads to tighter relation with customers and suppliers
2. Second development leads to changing relations

## Practice (at this moment)

Development of “closed” markets related to business area.

E.g. covisint (automotive industry)

# Role of electronic institutions

- Provide TRUST to parties in the transaction by:
  1. Provide explicit rules and norms of conduct
  2. Provide mechanisms to enforce those norms
- Standardising interactions by:
  1. Describe exchange mechanisms
  2. Specify coordination structure
  3. Determine interaction and communication forms within the institution

# Software Developments in e-Business

- Systems have an ever shorter time-to-market period
- Systems get more and more complex, due to the integration of different aspects of EC
- The environments for EC are getting more “open”
- Contacts between systems are more “peer-to-peer” than “hierarchical”.
- Applications get more distributed (outsourcing of tasks becomes common)
- Systems have to be personalized, thus adaptive

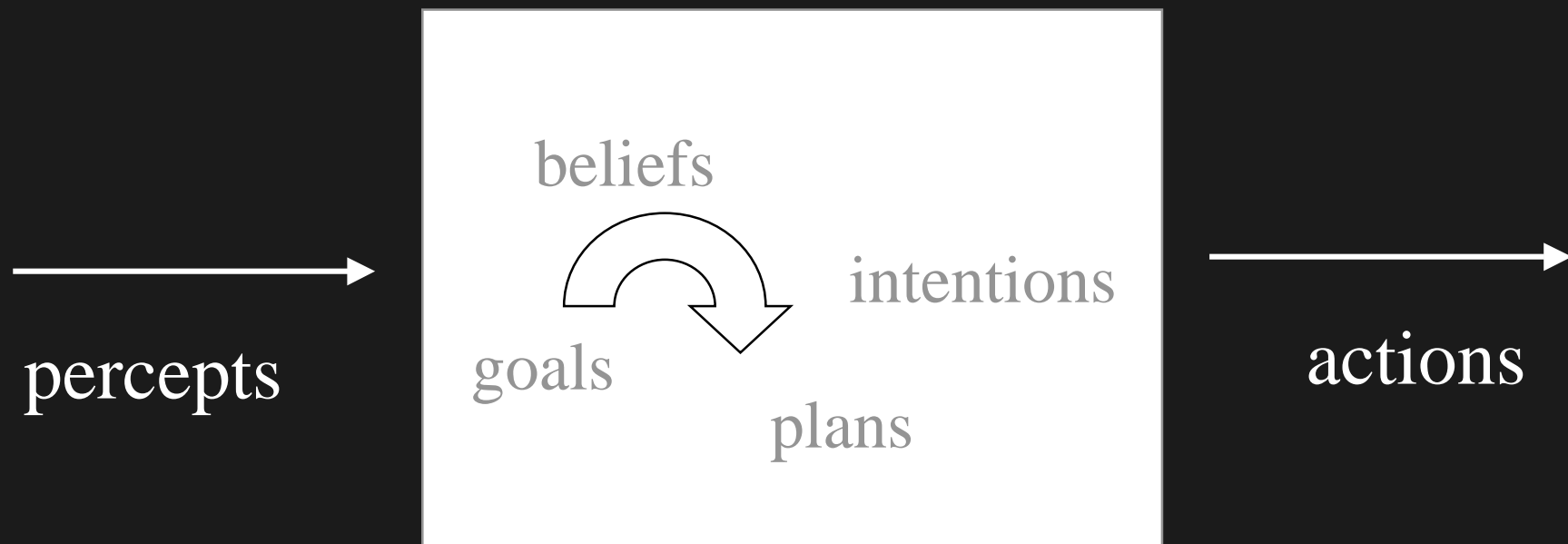
# Software Agents

- **Autonomous**
  - **Pro-active**
  - **Reactive**
  - **Social able**
- 
- *Intelligent*
  - *Mobile*
  - *Adaptable*

# BDI Agents

- Agents can be coherently seen as having mental states such as Beliefs, Desires and Intentions.
- BDI theories provide a conceptual model of the knowledge, goals and plans of the agent.
- BDI agents have some representation of the mental attitudes (possibly very simple with a database).

# BDI deliberation cycle



# When are agents most useful?

- For large scale, complex systems
- For distributed systems
- For heterogeneous systems
- In open environment
- Adaptable systems

# Agents for EC?

- Electronic commerce is about connecting complex, dynamic systems in a changing, uncertain and/or unknown environment.
- Agents are tools that are developed to take into account exactly (some of) the above conditions in their working environment.

# Benefits of agents for EC

- Autonomous → can perform long-term transactions without user attention
- Multi-Agent Systems →
  - modularize complexity in a natural way
  - Inherently distributed nature
- Reactive → can adapt to changing/open environment
- Learning → can adapt to the user/organization
- Social ability → can communicate “peer-to-peer”

# Where can agents be used?

- User assistance
- Need identification
- Vendor and product brokering
- Negotiation
- Purchase and delivery
- Service and feedback

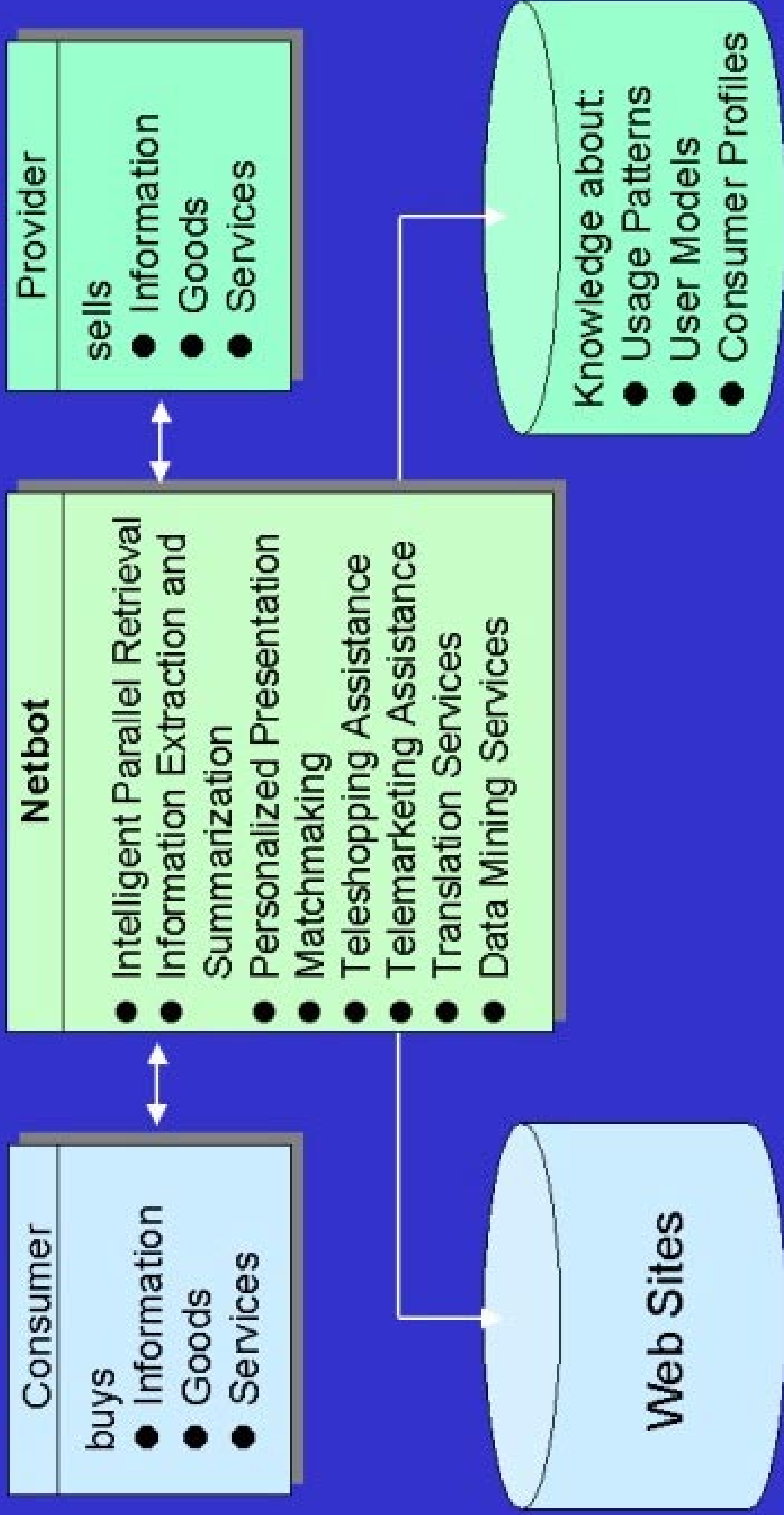
# User assistance

- Intelligent support for gathering information
- Monitoring and supporting the transaction process
- Learning the user preferences in order to perform standard portions of the transaction

# Examples

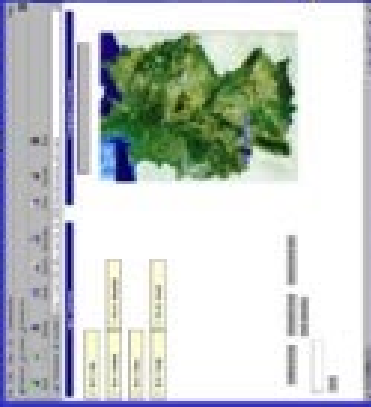
- Human like assistants
  - Virtual robots (verbots:  
<http://www.vperson.com/>)
  - Agent based user interfaces (dfki)
- Auction monitors
  - E-bay

# Intelligent Web Services



# AiA: Information Integration for Virtual Webpages

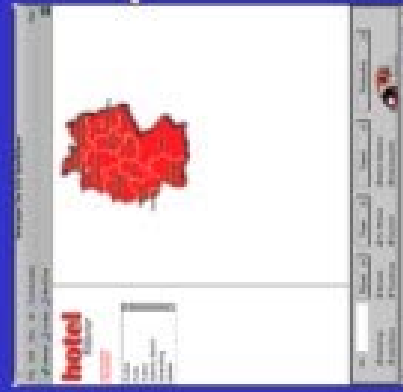
PAN Travel Agent Andi



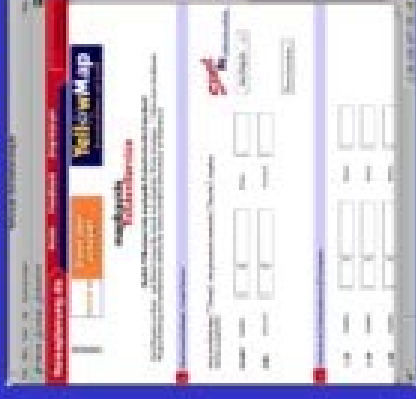
Yahoo  
Weather  
Server



Hotel  
Guide



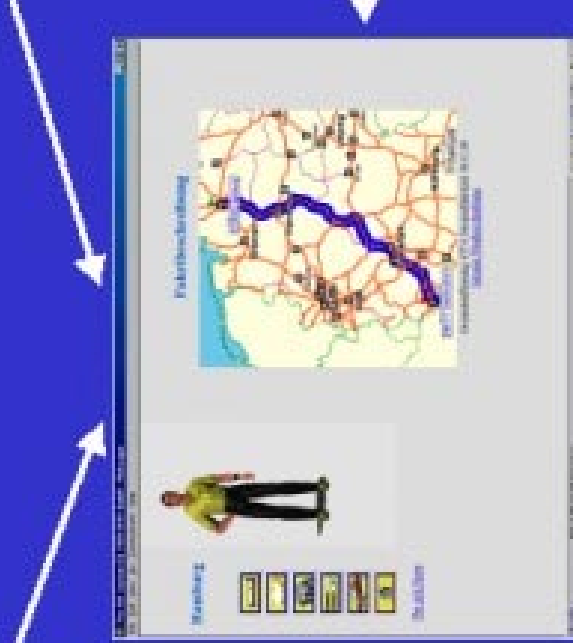
Car Route Planner



Yahoo  
News  
Server



Gault Millau  
Restaurant  
Guide

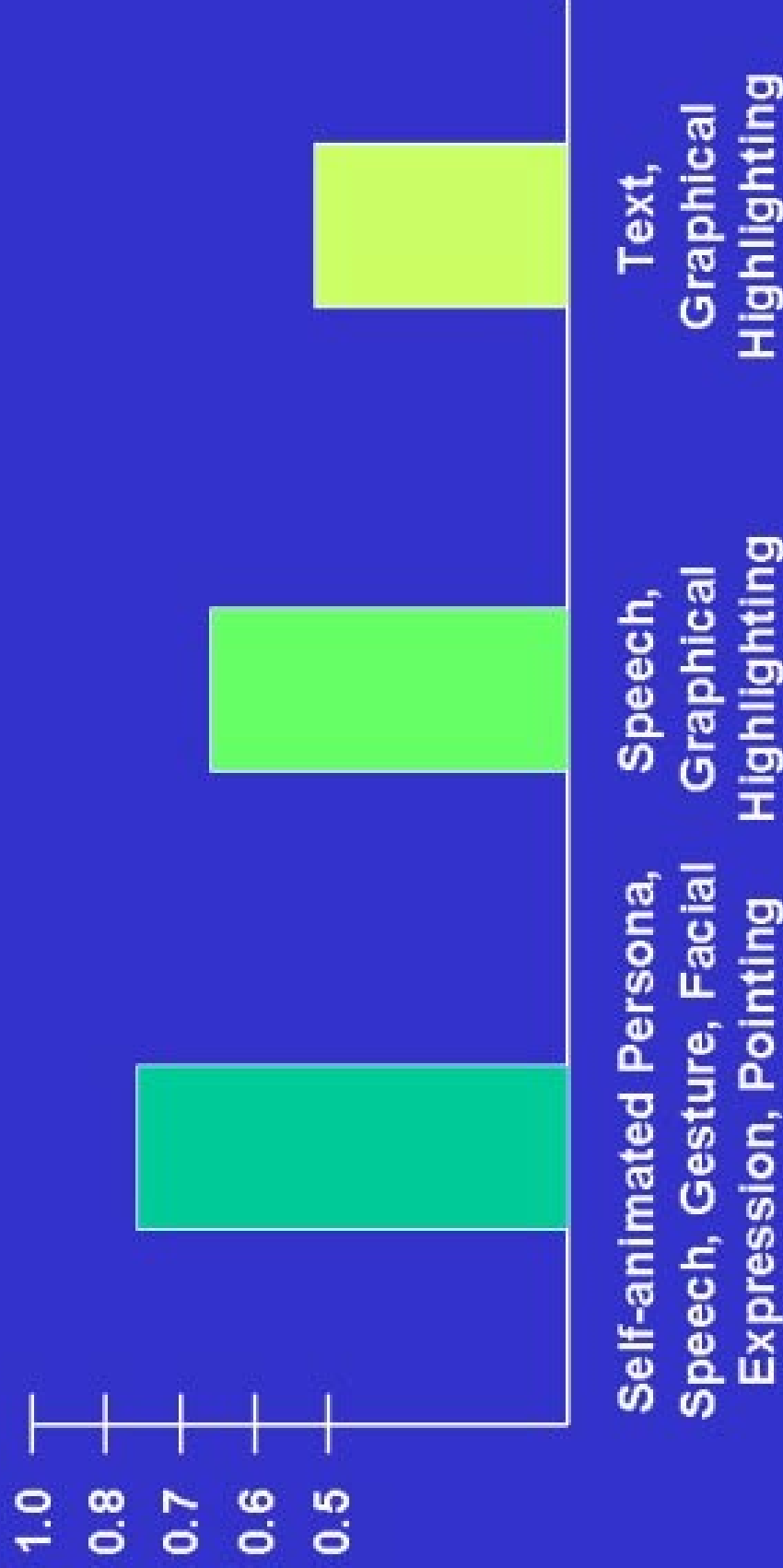


# Use of a Life-like Character for Electronic Commerce



# Personified Agents Increase the User's Trust in the System's Presentation

Experimental evidence for effects of modality on the user's trust (van Mulken, 1999)  
The system gives recommendations, which turn out to be wrong in some cases.  
How much does a user trust the system's advice depending on the modality of a presentation?



# Item watching at e-bay now

Unregistered HyperCam™



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## What is item watching?

Sometimes you find an item that you're not quite ready to bid on yet, but you want to keep track of it so that you can easily bid on it when you're ready. You can use eBay's item watching feature to do just that.

## How does it work?

On every item page, there is a "Watch this Item" link on the right hand side of the page. When you click on the link, you can mark the item to be watched in your [My eBay](#) page. Whenever you want to see the items you're watching, just look at the Watching section of your My eBay page. You'll see a list of all the items you're watching. If you've never used My eBay before, give it a try. In addition to the items you're watching, it lets you view your favorite categories, your recent feedback, your account balance, the items you're selling, and the items you're bidding on, all in one convenient place.

# Item watching with agents

- Agent watches auctions in which you are interested
- Agent warns when your bid is overturned
- Agent warns when it gets interesting to start bidding
- Agent bid (strategically) up till a predefined level

# Vendor and product brokering

- Search agents that compare:
  - [www.MySimon.com](http://www.MySimon.com)
  - [www.activeresearch.com](http://www.activeresearch.com)
  - [www.dealtime.com](http://www.dealtime.com)
  - [www.egg.com](http://www.egg.com)
  - [www.jango.com](http://www.jango.com)

# Agents for C-2-C

- Mobile agents can take your advertisement to either sell or buy an item
- They move to a marketplace
- They try to match your request with the requests of the other agents that are present (or that left a message)
- They report back on the result
- Example based on Tryllian's gossip agents

# Agents for negotiation

- Limited use due to complexity, but
- Very useful for e.g. auctions with:
  - “Simple” world model
  - Predetermined interactions
  - Fixed rules
  - One shot relations
  - centralised infrastructure

# Agents for negotiation

Fully automated AMEC first in situations where:

1. Interactions are fast
2. Interactions are repeated
3. Trade is of relative small value
4. Process is repeated over long periods
5. Products are easy to specify

Examples: stock trade, power trade and telecom

# Agents for logistics

Agent based Work Flow Management:

(From SAP to ASAP)

An agent becomes responsible for delivery of an order

The agent “negotiates” with agents about production/purchase and transport.

When the planning is finished the agent checks and monitors the plan

Deviations of the plan are solved locally

# Agents for logistics

## Advantages:

- decentralised control,
- modularisation,
- reactive planning possible

## Disadvantage:

- Difficult to reach global optimum

# Agents and Institutions

- The use of electronic institutions supports the use of agents for electronic transactions
- Institutions define/standardise the ways of interacting such that agents can be developed independently and interact in the way prescribed by the institution
- Institutions might provide frameworks for agents that only have to be filled by the participating organizations

# Agents and Institutions

Two types of interaction:

- Interaction with institution itself.

I.e. registration as buyer/seller, payment, etc. (use of facilitating services)

- Interactions (within the institution) with other parties.

# Interaction with institution

Protocol determined by institution.

- Agents participating in the institution should “know” how to use the facilities of the institutions.
- There should be a standard way to describe the facilities (and protocols) of the institutions!

# protocols within interactions

- In brokered trading the institution can prescribe the way of interaction. (It has control over this communication).
- In this case protocols can be described using State-charts or Petri-nets.
- Connections between the protocols can also be precisely defined.
- Communication handling is easy for the agents

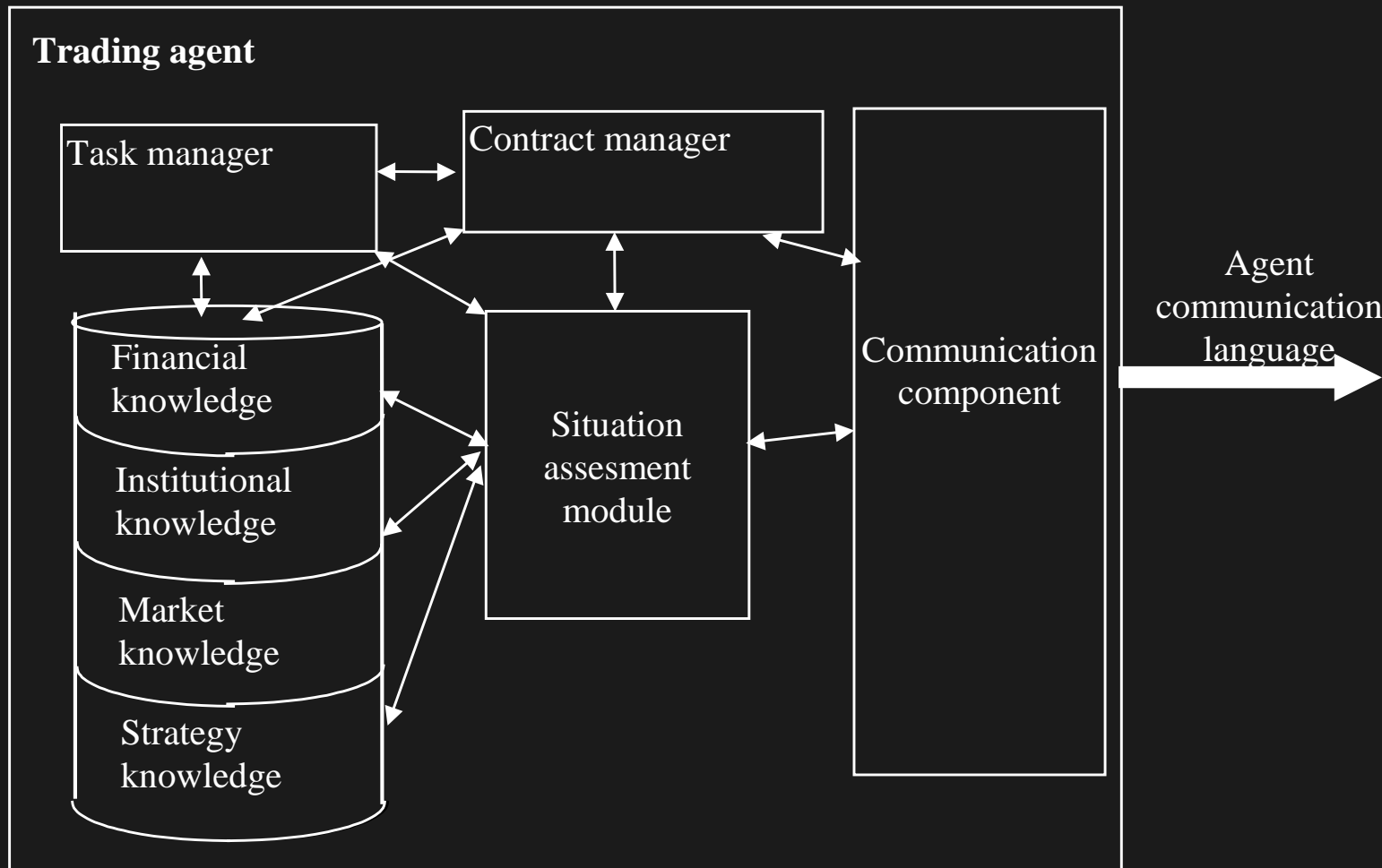
# protocols within interactions

- In direct transactions the institution can only prescribe the conventions of interactions within the institution.
- In this case only the boundaries of the interactions are described.
- The institution cannot prescribe the moments and order of interaction with the facilities of the institution.
- The communication handling for the agent can be very complex.

# Agents and institutions

- Agents need to be able to find out the different possible transactions, conventions and protocols of an institution.
- In case of direct transactions, agents should first determine each other capabilities and set up a protocol of interaction.
- In general: Less control of institution means more complex communication between agents.

# Need for Mediating Trading Agents

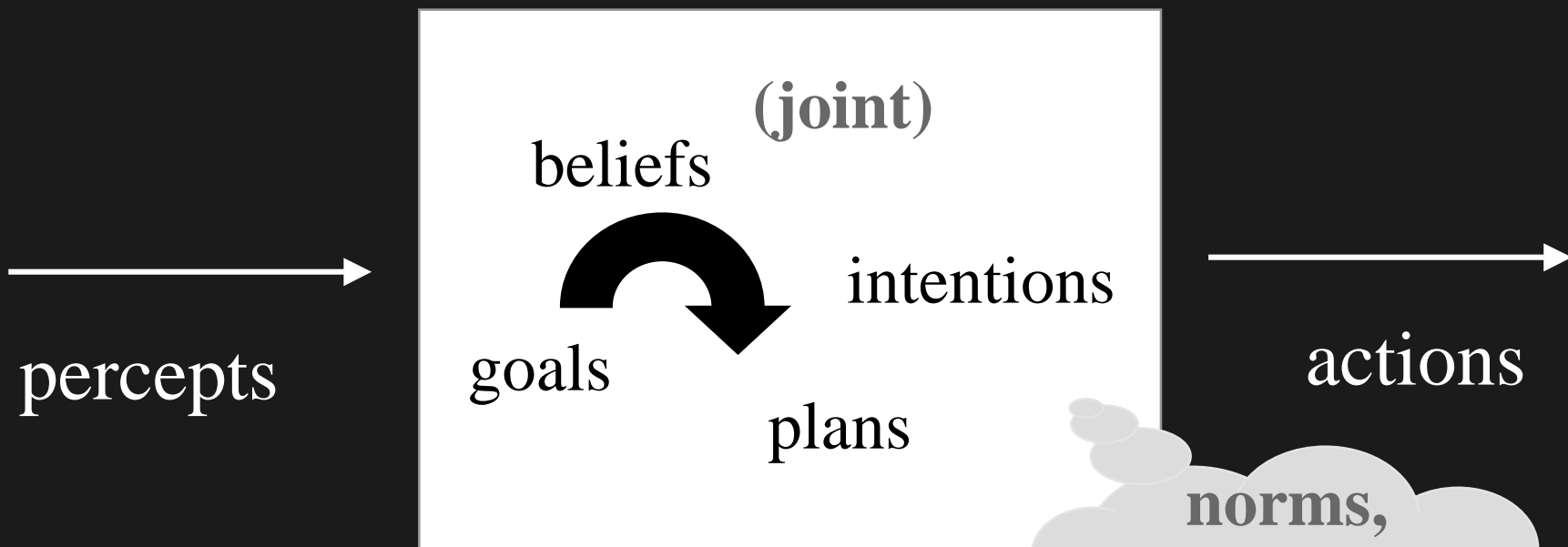
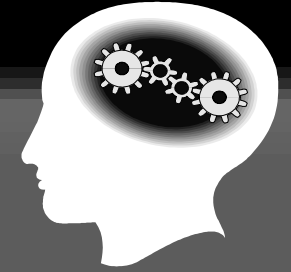


# Research issues

## 1. Internal for agents

- Solid integrated theory for agents that deliberate, plan, act, react and communicate
- Social concepts (obligations, commitments, trust,...)
- More business intelligence
- Learning (user preferences, adaptation,...)

# BDI deliberation cycle with social influences



norms,  
obligations &  
commitments



# Strategies for markets/auctions

- Multiple parallel auction strategies (how to bid on eBay)
- Combinatorial auctions
- Interrelated auctions
  - organize a trip with flight, hotel, etc.
  - Fish market, flower market, power market
- New forms of auctions?

# Research issues

## 2. Design and implementation

- Development methodology for multi-agent systems (connected to multi-agent theory)
- Implementation tool kit
- Agent components library

# Research issues

## 3. Coordination between agents

- Agent communication
- Negotiation
- Institutions

# Agent Communication/coordination

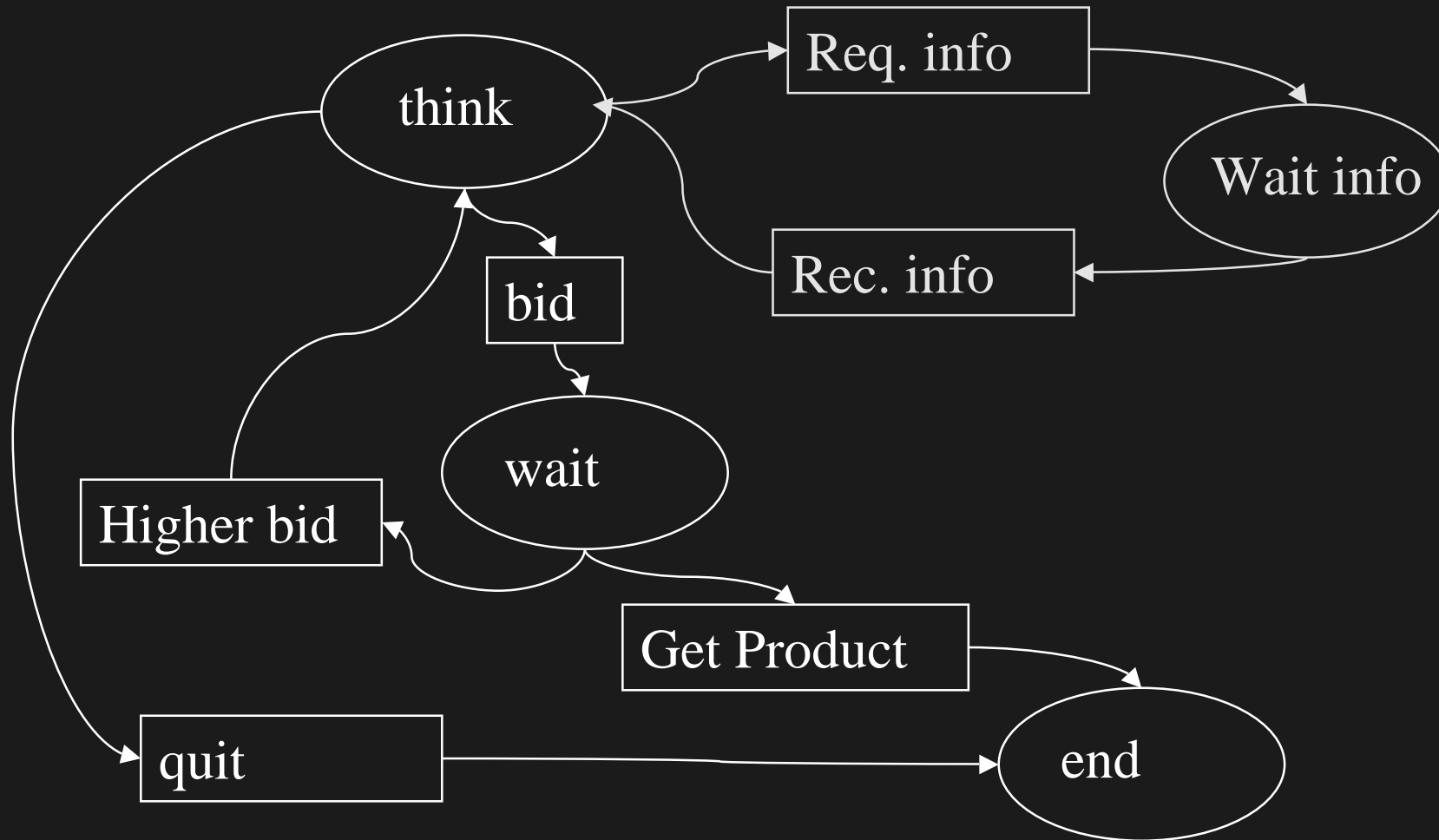
- From fixed protocols to conversations
- Ontologies for semantics of messages
- Integration of conversation plans and other plans
- Checking the adherence to a protocol

# Constructing conversations

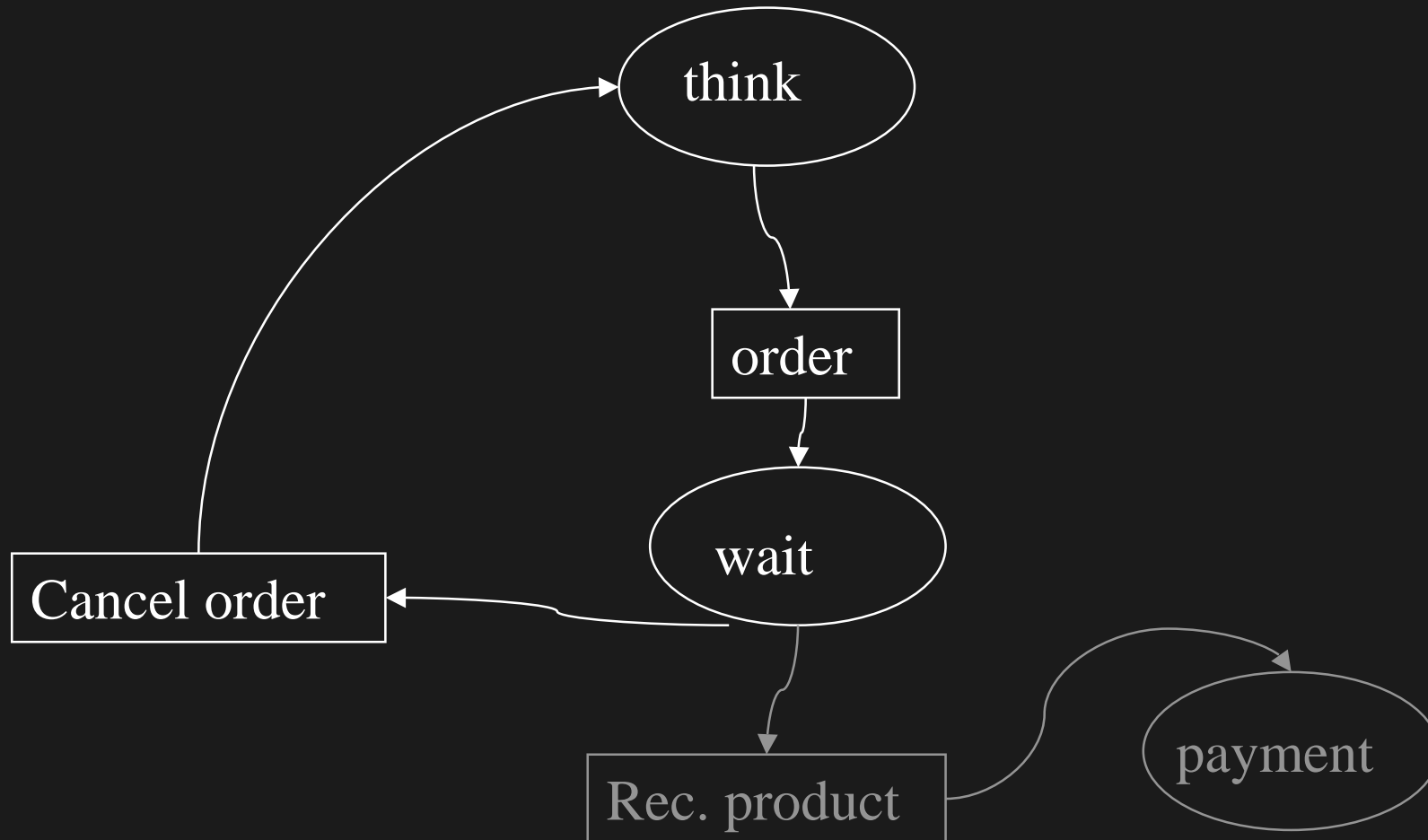
- Speech acts have to be planned as a means to reach a goal
- Therefore it should be possible to reason about consequences of conversations
- These should be combined with other agent tasks
- Thus conversations can be seen as joint tasks/intentions/goals!

# Compliance to a protocol?

## I. implement all possible sequences?



## II. Implement subset



# Negotiation

From auctions and Contract Net to argumentation

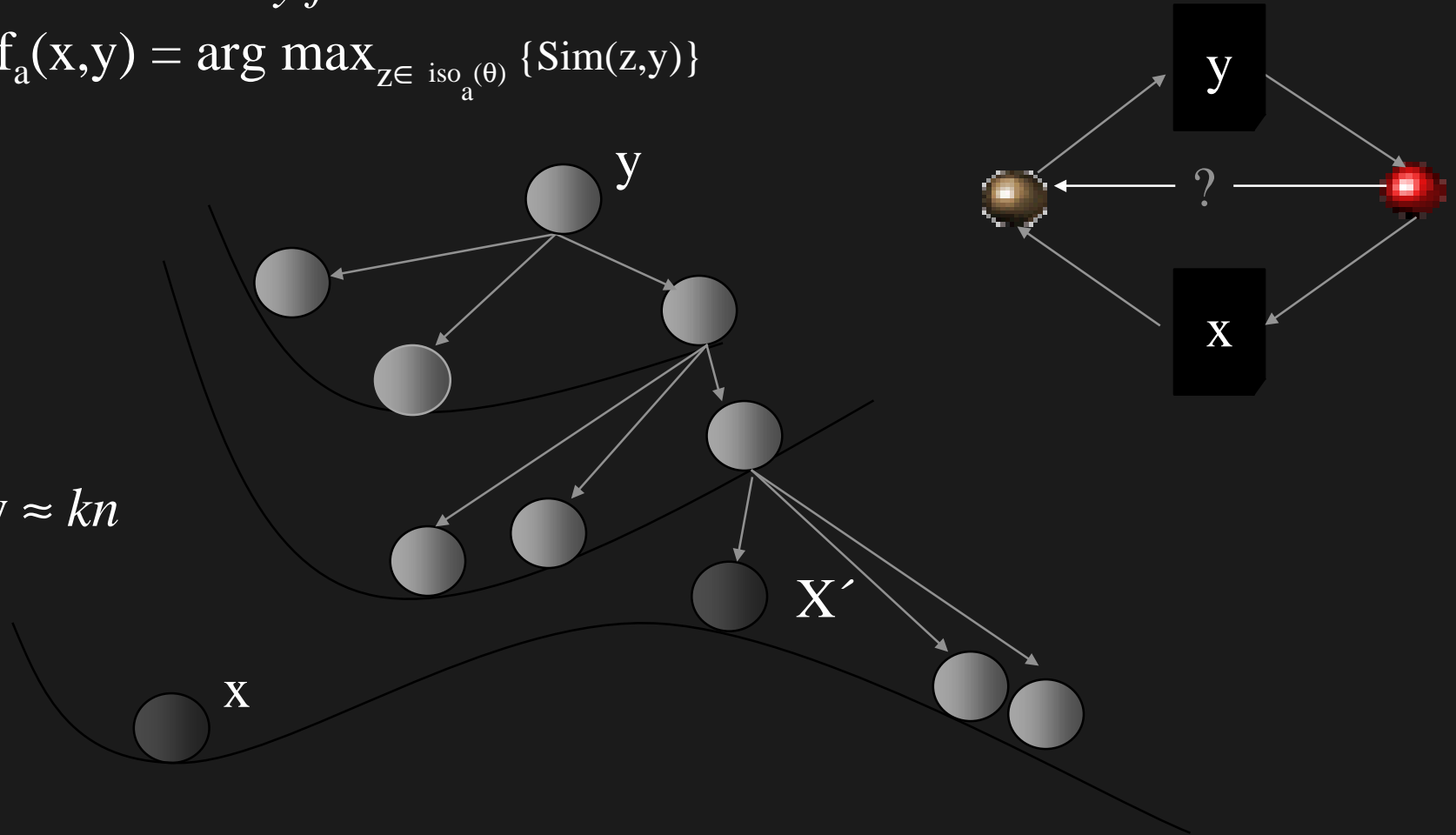
- Fix protocol and discover optimal strategy
  - Bargaining
  - Multi-attribute bargaining
- No protocol but next move based on context (argumentation)

# The Trade-off Algorithm

*To be beneficial to the other the preference of the other must match the similarity function*

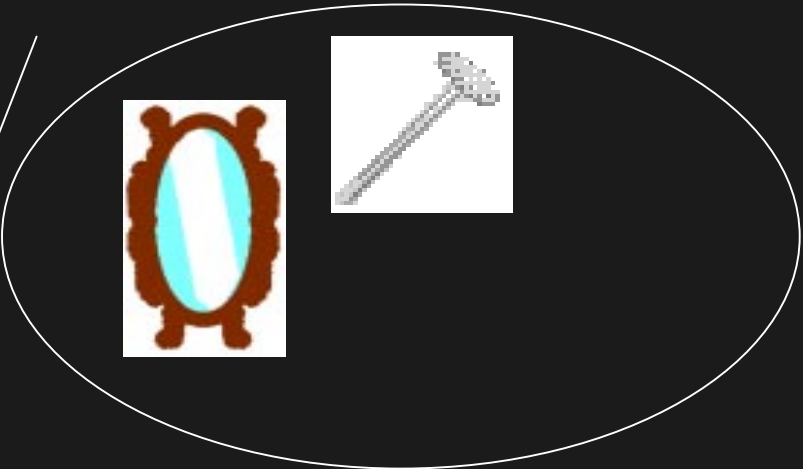
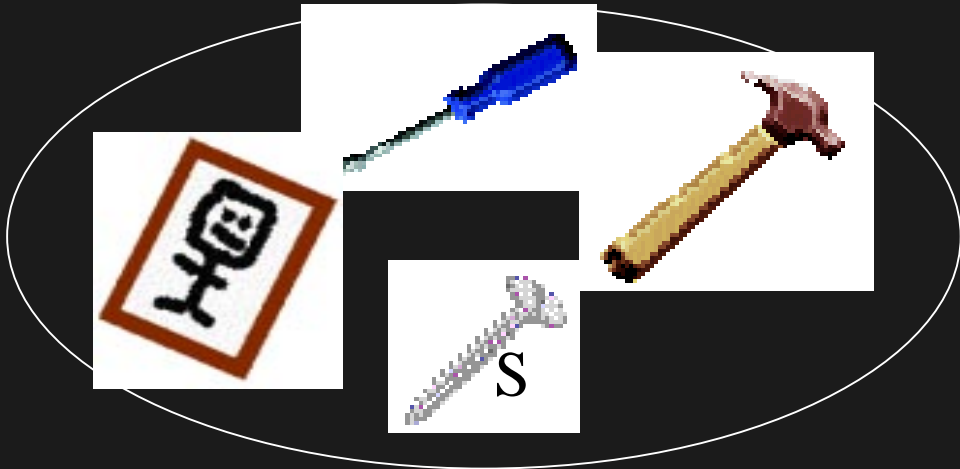
$$\text{trade-off}_a(x,y) = \arg \max_{z \in \text{iso}_a(\theta)} \{\text{Sim}(z,y)\}$$

complexity  $\approx kn$



# Argumentation

- Autonomy leads to negotiation and to argumentation.
- Many problems cannot be solved by a simple offer/counter offer negotiation protocol.
- When arguing, agent offers may include knowledge, information, explanations.
- The dialogue includes critiques on each others proposals.
- Agents must be able to generate arguments as well as rebutting and undercutting other agents' arguments.
- Which argument to prefer may depend on logical criteria or on social considerations.
- A logically-based approach to building agents seems natural.



 +  +  -> Hang Mirror

 +  +  -> Hang Mirror

 +  +  -> Hang Picture

Hang Picture

Hang Mirror

A

B

# Institutions

- Institutions are the places where the agents interact
- They should be described formally and define:
  - Scenes of interaction (e.g. register, buy, pay)
  - Interaction protocols (e.g. English auction)
  - Rules for non-compliance

# Institutions

- A market should be “fair” to all its stakeholders. I.e. take the interests of all stakeholders into account when designing market mechanism
- How can this be checked?
- E.g.
  - English electricity market place
  - UMTS auctions
  - Radio frequency auction

# Conclusions

- e-Business is business
- From operational excellence to relational excellence
- Agents fit very well in this development of (e-) business
- Time has come to fulfill promises:
  - Theory has to be fleshed out
  - Implementation industrialised

# Agents and EC: reality!

