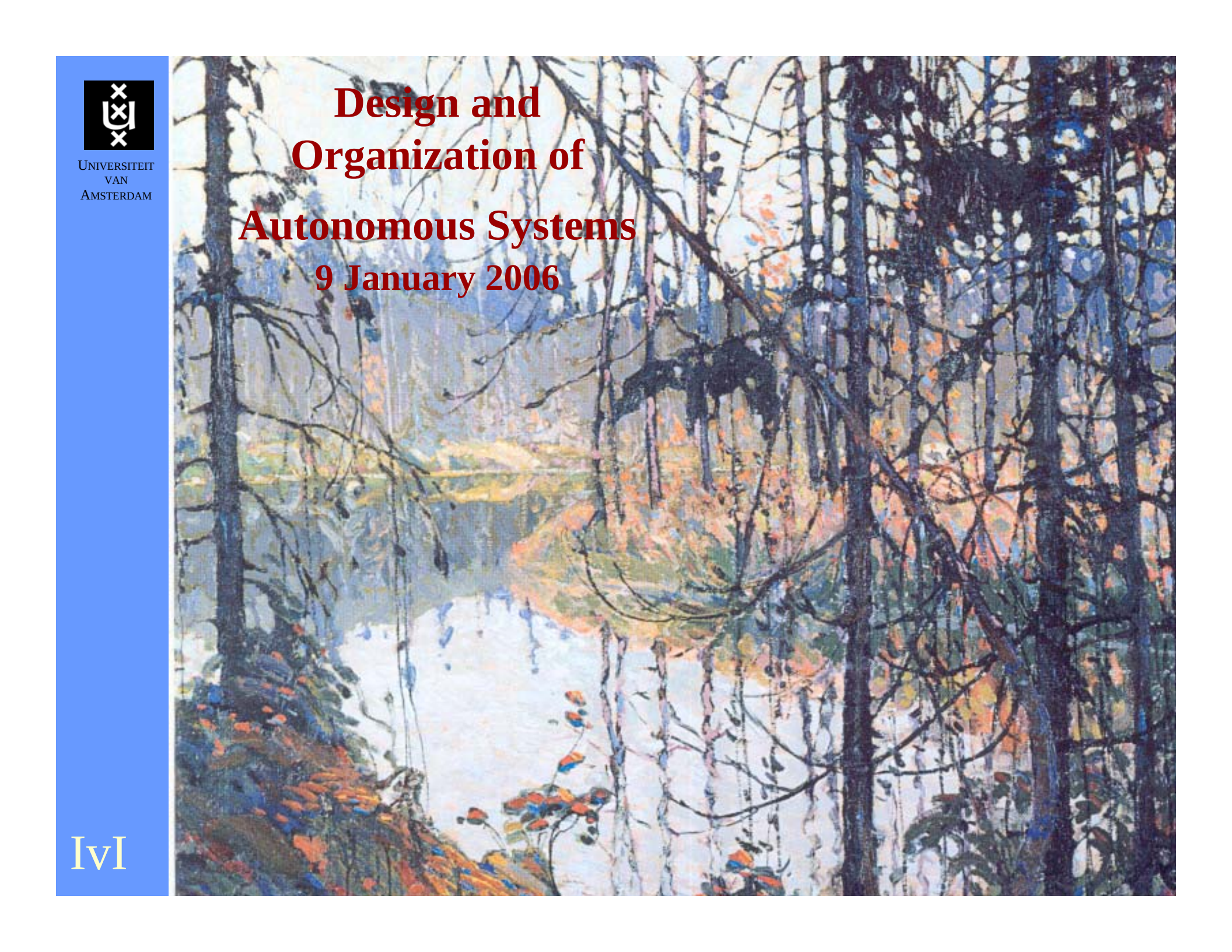
Universiteit
van
Amsterdam
Design and
Organization of
Autonomous Systems
9 January 2006
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# Objectives DOAS

- Know the concepts that are important in the design of Intelligent Autonomous Systems.
- Understand the problems that are to be solved.
- Identify the solutions found.
- Build a framework to organize future developments.

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# Organization DOAS

- **Course** consists of lectures and projects on system architecture and design
- **Lectures** in first two weeks.
- **Project** assignments for 5-6 students.
- **Examination**

  The grade for this course will be based on the results of the **Project**. All registered students will be assigned to a project.

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# DOAS

## Topics lectures:

- Architectures used in autonomous systems (general aspects, distributed and embedded systems).
- Case studies: AIBO and Intelligent vehicles

## Project:

- Case study in integration
- Applies the material of the lectures
- Clear assignment of tasks to the members of the team
- Team writes an article about their project and review the articles of the others
- Final mini conference with external invites

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# Projects 2006

- **LifeForm** *Peter van Lith*
- **Simple voice recognition system** *Peter van Lith*
- **Cycle Detection in Distributed Perception Networks** *Gregor Pavlin*
- **Reinforcement Learning of Traffic Light Controllers Adapting to Accidents** *Bram Bakker*
- **Joint actions for an Aibo team** *Arnoud Visser*
- **Identifying People** *Marinus Maris*
- **Mobile landmark recognition** *Frans Groen*

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# Schedule week 2

| day | room | lecturer | subject | remarks |
|---|---|---|---|---|
| Monday 9th, 10:00-13:00 | P.016 | All | Kick-off meeting Projects | |
| Tuesday 10th, 10:00-12:00 | P.016 | Arnoud Visser | Architectures of Autonomous Systems | |
| Wednesday 11th, 10:00-12:00 | P.016 | Arnoud Visser | Case studies of Autonomous Systems | Aibo Architecture |
| Thursday 12th, 10:00-12:00 | P.016 | Marinus Maris | Distributed Systems | Hand-out |
| Friday 13th, 14:00-16:00 | | Peter van Lith | Embedded Systems | Hand-out |

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# Schedule week 3

| day | room | lecturer | subject | remarks |
|---|---|---|---|---|
| Monday 16th, 15:00-17:00 | P.016 | Dariu Gavrila | Looking at people | |
| Tuesday 17th, 15:00-17:00 | P.018 | Dariu Gavrila | Intelligent Vehicles | |
| Wednesday 18th, 10:00-13:00 | I.301 | All | Progress meeting Projects | |

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# Schedule project

## Project

All registered students will be assigned to a project. Three times plenair meetings will be scheduled.

week 2: kick-off meeting (Monday 9th, P.016, 10:00-13:00)

week 3: progress meeting (Wednesday 18th, I.301, 10:00-13:00)
Half hour presentations

week 5: deadline draft article (Tuesday 31th, 16:00, pdf on website)
week 5: deadline review article (Wednesday 1th, 16:00, see form)
week 5: deadline final article (Thursday 2nd, 16:00, pdf on website)
week 5: mini-conference (Friday 3th, F0.13, 9:30-13:00)
Half hour presentations,

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# Program for today

- 10.00-10.20 **Frans Groen:** Introduction of the course DOAS and the project assignment
- 10.25-10.30 **Peter van Lith:** LifeForm
- 10.35-10.40 **Peter van Lith:** Simple voice recognition system
- 10.40-11.00 **Coffee break**
- 11.00-11.10 **Gregor Pavlin:** Cycle Detection in Distributed Perception Networks
- 11.10-11.20 **Marinus Maris**: Person identification system
- 11.20-11.30 **Bram Bakker:** Reinforcement Learning of Traffic Light Controllers Adapting to Accidents
- 11.30-11.40 **Arnoud Visser**: Joint actions for an Aibo team
- 11.40-12.00 Assignment of students to projects
- 12.00-13.00 Detailed discussion of projectleaders with their studentteam

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# Project assignments

- Consists of literature study of the assigned topic
- Proposal of architecture and design of an Autonomous System
- Realization of a critical part of the selected approach
- Evaluation of the selected approach against other initiatives
- Mini-conference Article and Presentation.

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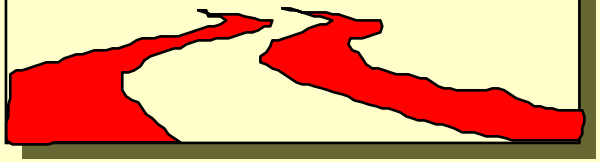
# Perception - Action Cycle

Real world

**Perception**

**Action**

Model of the world



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# Components

- **Perception**
  - computer vision
  - sound interpretation
  - touch (also on a distance)
- **Model**
  - representation
  - modeling
  - data fusion
- **Action**
  - adaptive behavior
  - planning
  - exploration, navigation

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# Global aspects

- Architecture
- Learning and adaptation because the robot can perceive the results of its action
- Simulation
- Dynamic intelligent sensor networks

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# Application Area's (1)

- **Service**

  cleaning devices, goods (food, mail) distribution, robot guide dog
- **Space**

  planetary rovers, robot arms in space
- **Surveillance and Safety**

  watching over public places, fire and pollution detection/ inspection after disasters, elderly care
- **Transport**

  driver assistance , intelligent vehicles, automated highway, container transport

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# Application Area's (2)

- **Agriculture**

  harvesting, spraying
- **Defense**

  mine detection, bomb dismantling, unmanned vehicles, robot soldier
- **Entertainment**

  microsoccer, intelligent adaptive games, robots in film industry
- **Mining**

  unmanned excavation

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# Trends

- From ***structured static*** environments to ***unstructured dynamic*** environments
- From ***robots*** to ***embedded autonomy*** in existing systems
- Form single robots to **multi-robot** systems
- To **semi-autonomous** systems interacting with humans

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# Needs

- Real robustness
- Reactive to human gestures (motion) and speech (sound)
- Human understandable communication between systems.
- Autonomy well integrated with tele-operation

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# Project: Mobile Landmark Recognition

- Special case: Project proposed by students
- Make as tourist a picture of a landmark or point of interest.
- Your phone tells you what it is, when it is opened etc.

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# Mobile Landmark recognition

- Use computing power of you mobile phone
- Needs robust feature extraction under different views and lighting conditions
- Needs learning and a (dynamic) database of objects.

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