



Verifying Autonomy

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Some Applications of Autonomy

- › Mobility
 - › Cooperative autonomous vehicles.

- › Military Vehicles
 - › Underwater mine hunting
 - › Swarms for surveillance
 - › (Semi-) Autonomous ship cooperating in a task group
 - › Meaningful human control for LAWS



Developments in Autonomy: Automation

- › Algorithms for Situation assessment
- › Algorithms for Situation management
- › Developments: dealing with more complex situations and better cooperation between autonomous systems
- › Advantages: fast, transparent
- › Disadvantage: not dealing well with failures and unexpected situations



Developments in Autonomy: Learning

- › Online learning (learning on the job)
- › Offline learning (training)

- › Developments: faster learning (faster computers, efficient algorithms)
- › Advantages: very flexible tool
- › Disadvantages:
 - › still very slow for complex systems in complex situations
 - › difficult to understand how it works and why it works
 - › inherently unpredictable and more easy to deceive (online)
 - › not dealing well with failures and unexpected situations (offline)



Consequences of this view for verification and role human

- › Difficult to derive sub-system performance measures
- › System has to be verified in many, many different situations
- › Human as fail-safety agent
 - › When the autonomous system is failing the human intervenes.
- › Human as a moral agent
 - › The human makes moral decisions and intervenes when autonomous system does not act in a morally acceptable way.



Developments in Autonomy: self-determination

- › It involves self-assessment
 - › What are my resources: sensors, computation, communication, actuators?
 - › How well am I doing?

- › And self-management
 - › Now that I know and understand myself and my environment how should I manage myself in order to reach my goals?

- › Advantages
 - › Self-assessment and management can be used for sub-system verification
 - › Faster than learning and can deal better with failures/unexpected situations
 - › Can better explain to the human what it is doing and why it is doing it