

Human Autonomy within Assistive Autonomy

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Associate Professor of Computer Science, Mechanical
Engineering, Physical Medicine & Rehabilitation
Center for Robotics and Biosystems

Shirley Ryan AbilityLab [Rehabilitation Institute of Chicago]
Faculty Research Scientist



Perspective



B.S. in Mathematics

[music, biology, pre-med]



Research assistant in computational neuroscience



PhD in Robotics

[robot soccer, robot learning]



Postdoc in robot learning

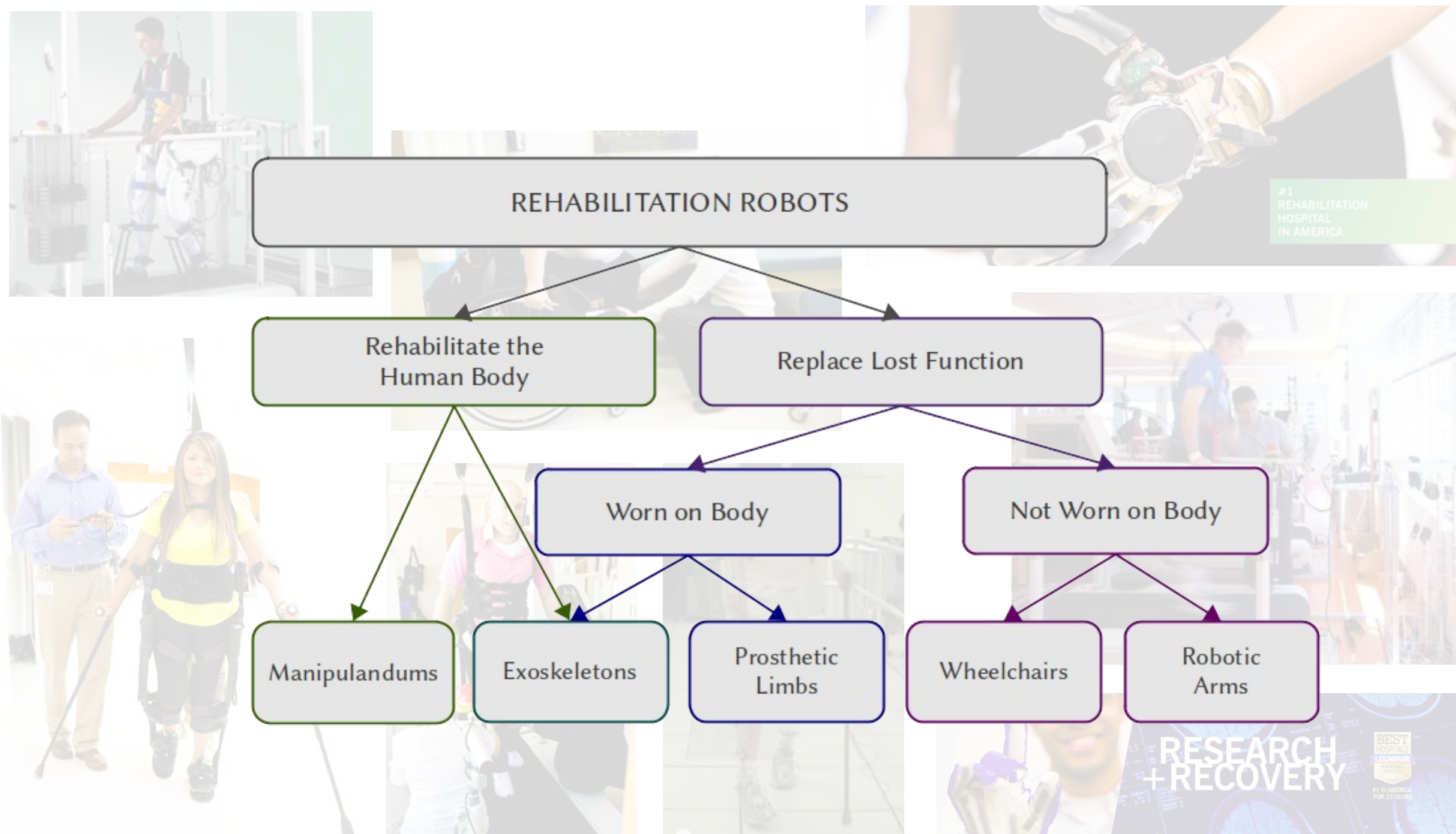


Faculty in rehabilitation robotics

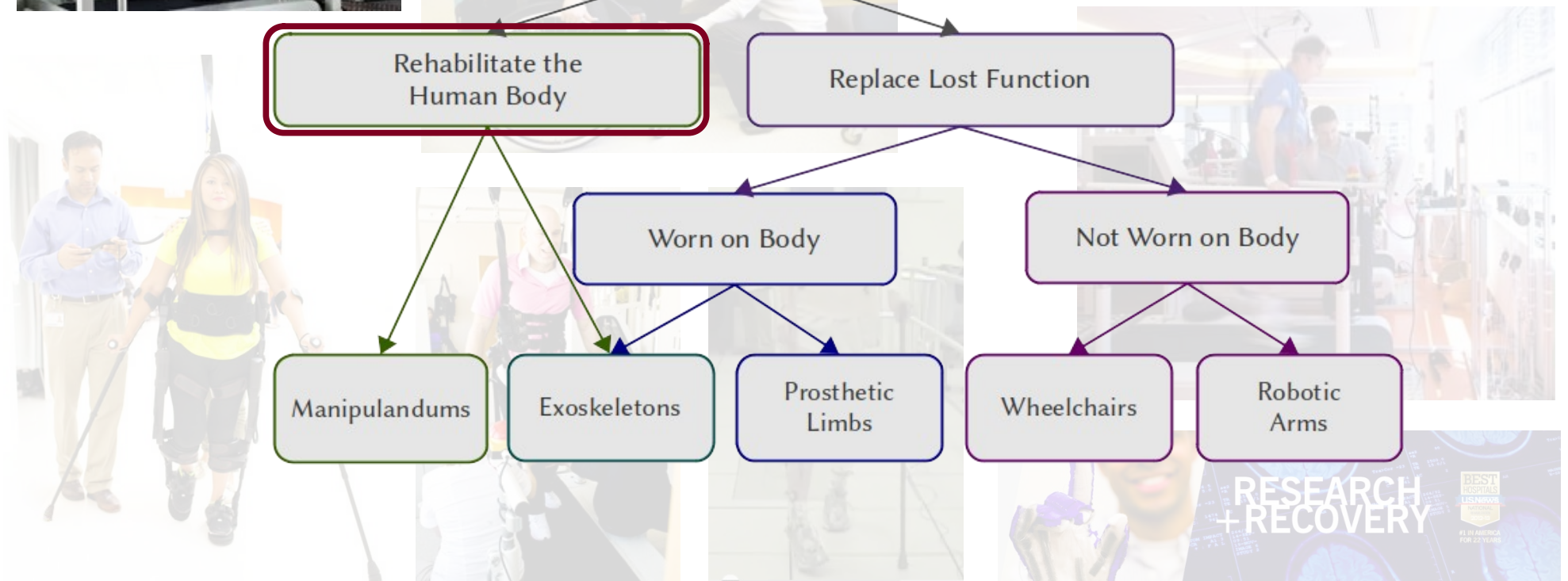
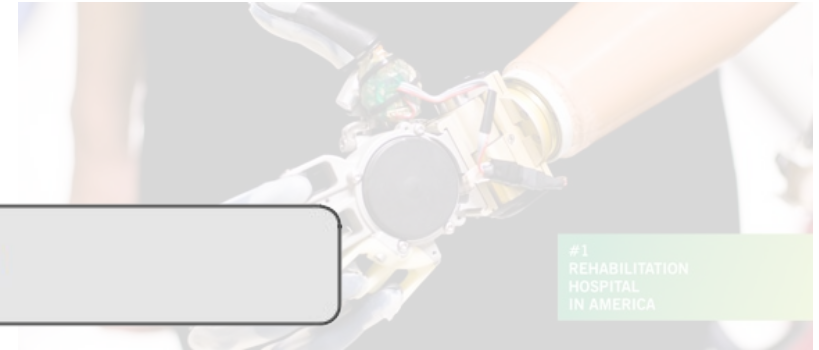
[ME, CS, PMR]



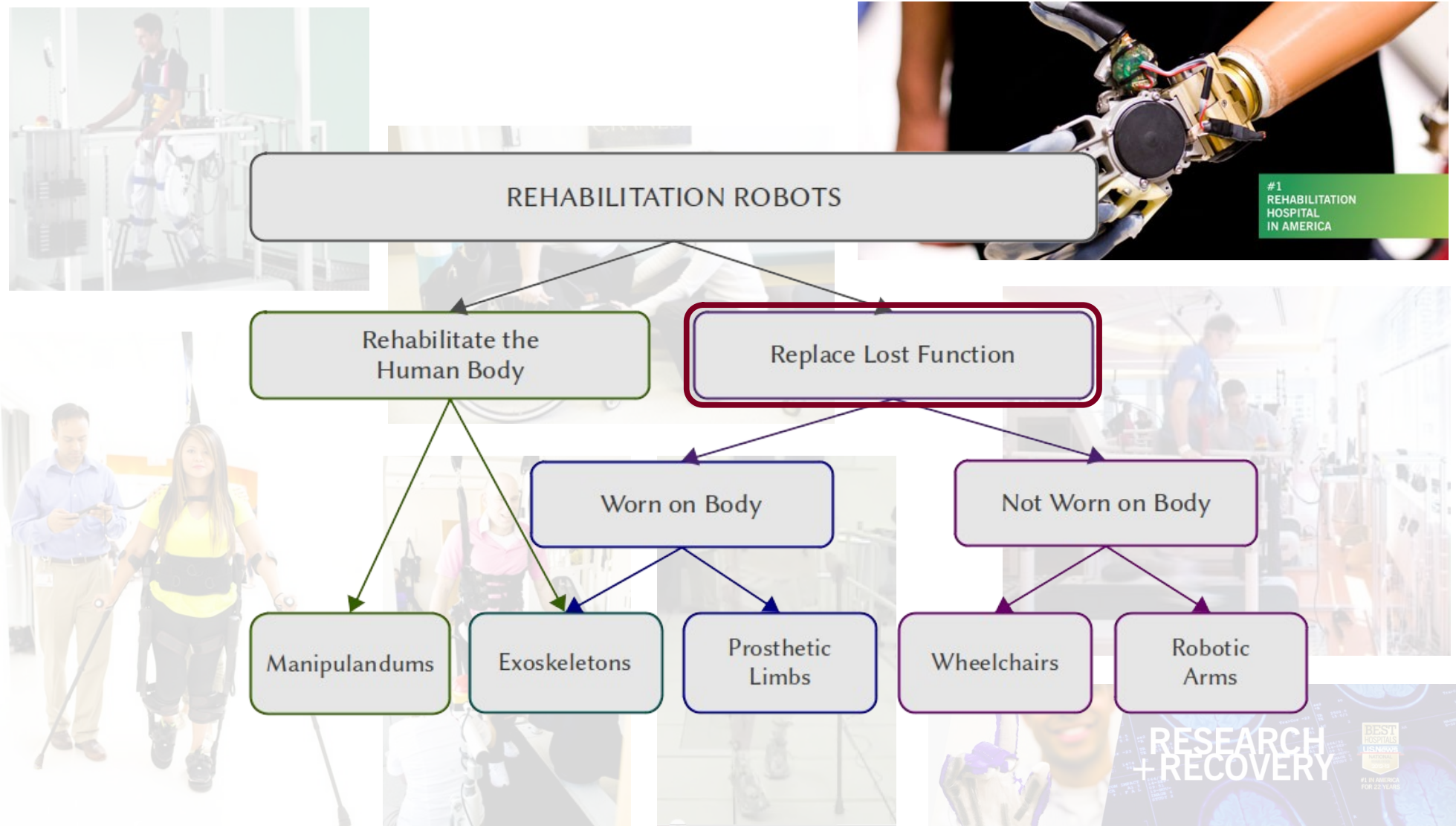




B. Argall, *Autonomy in Rehabilitation Robotics: An Intersection*. Annual Review of Robotics, Control, and Autonomous Systems, 2018.



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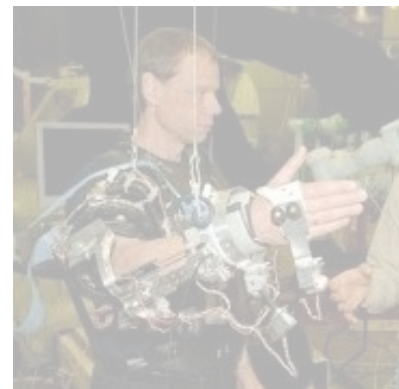
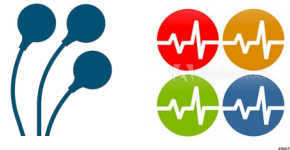


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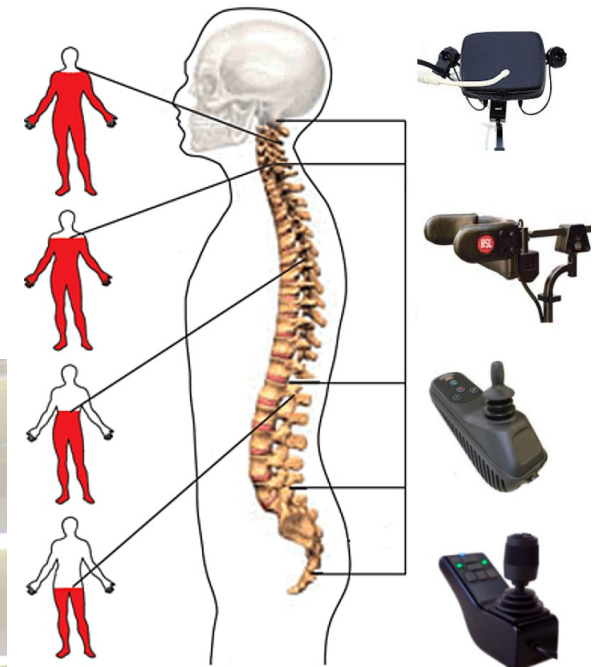
Functionally Assistive Machines



Functionally Assistive Machines



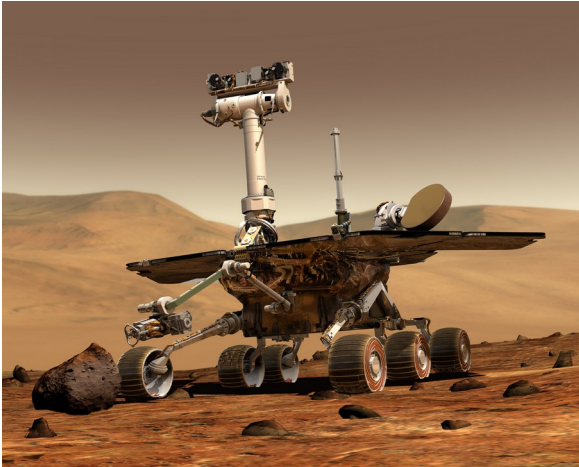
Functionally Assistive Machines



Limited Communication Bandwidth



Science
of
Autonomy



NASA, Spirit Mars Rover

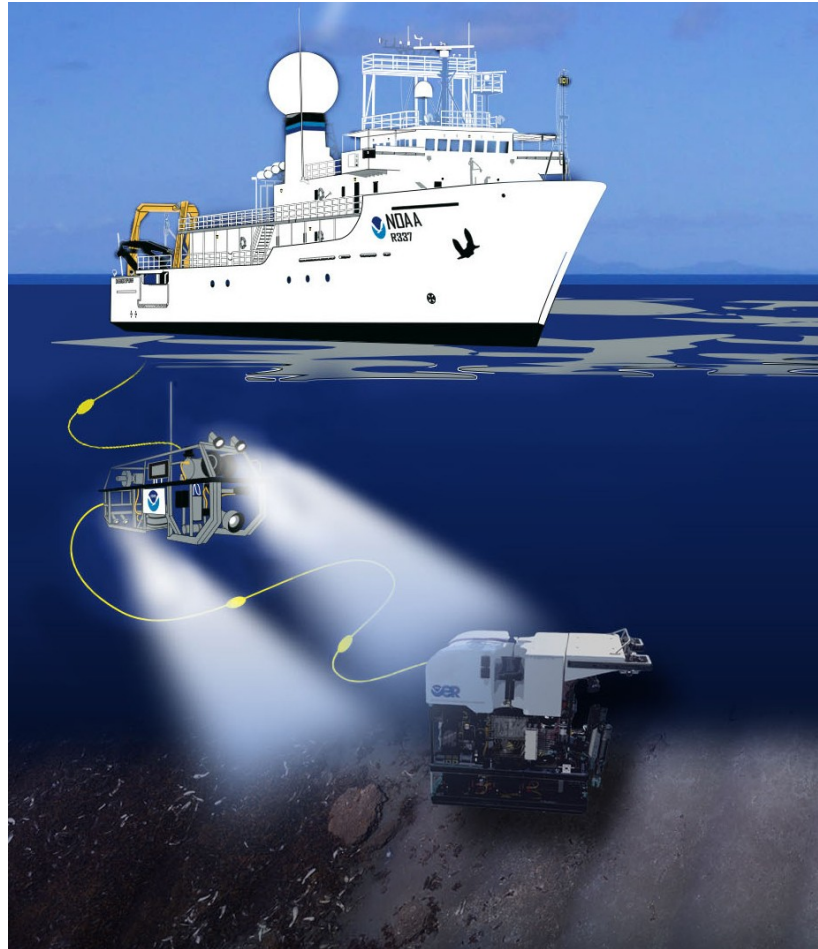
Distance

Limited Communication Bandwidth



NASA, Spirit Mars Rover

Distance



NOAA, Okeanos Explorer Ship and ROV

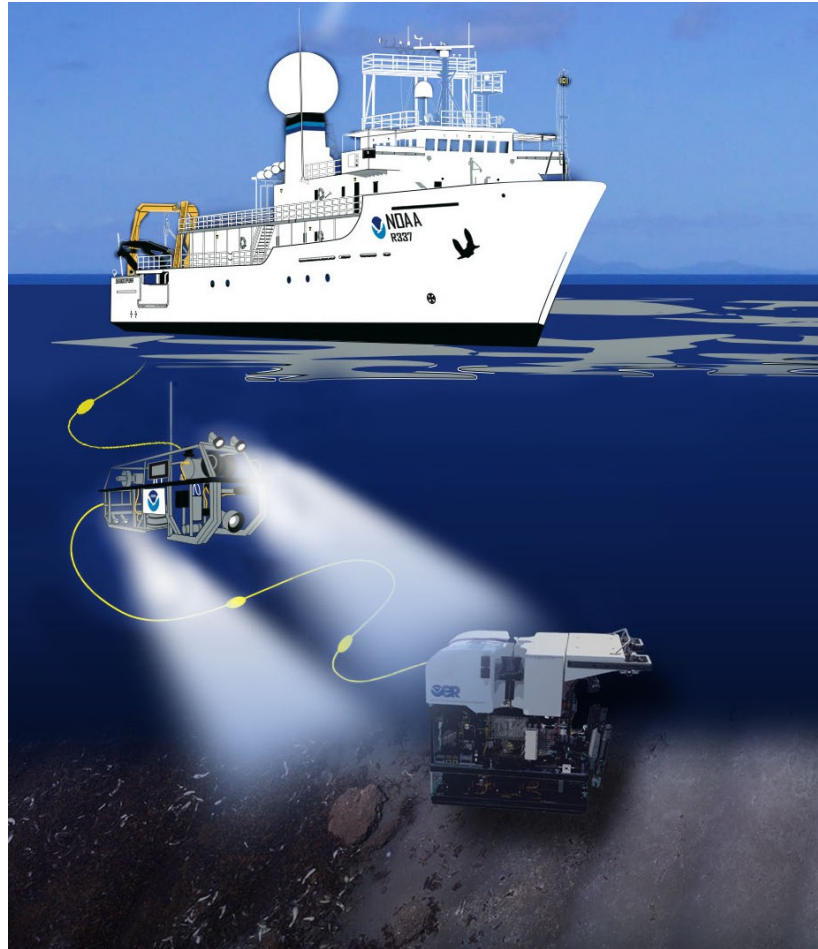
Difficult & Adversarial Environments

Limited Communication Bandwidth



NASA, Spirit Mars Rover

Distance



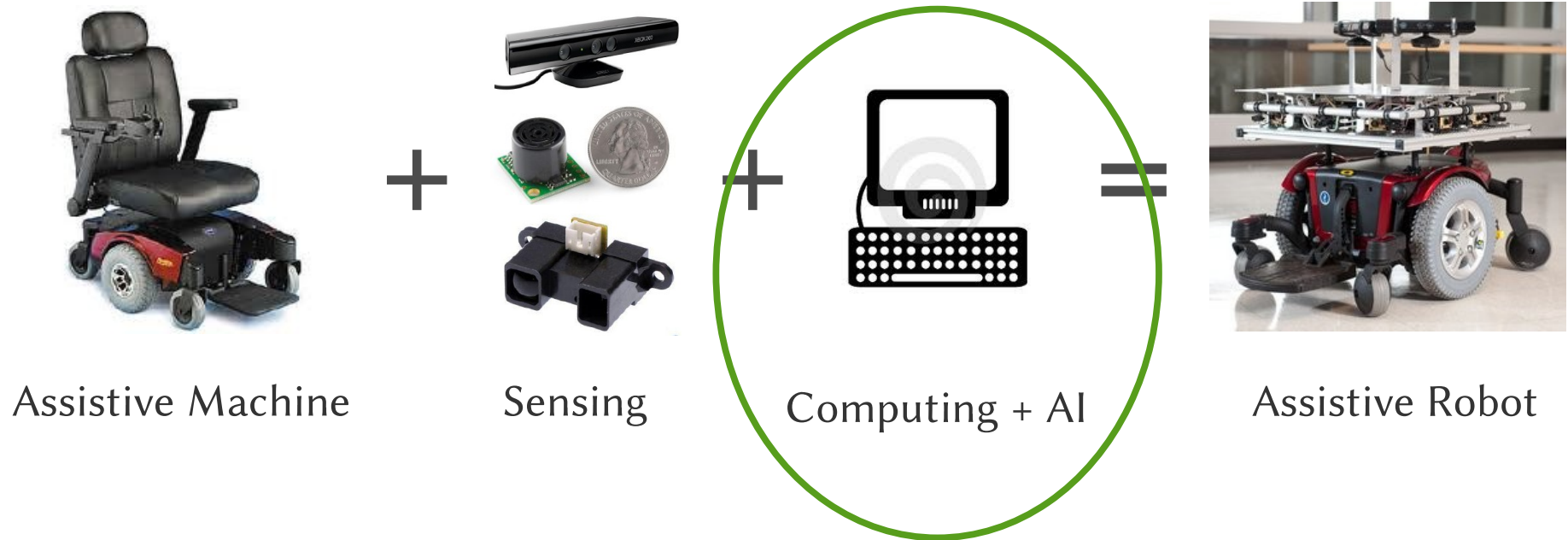
NOAA, Okeanos Explorer Ship and ROV



Motor Impairments
+
Limited Interfaces

Difficult & Adversarial Environments

Assistive Machine → Robot



Adaptive Assistive Autonomy



Masked and filtered information.

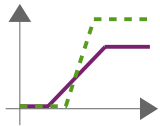
True human intent. Can the *autonomy* trust the *human*?

Adaptive Assistive Autonomy



Masked and filtered information.

True human intent. Can the *autonomy* trust the *human*?



Feedback signal for adaptation.

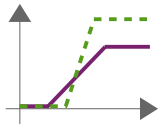
Reward? Supervised label? Correction? Demonstration? Explicit? Implicit?

Adaptive Assistive Autonomy



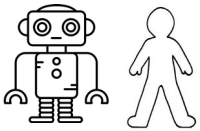
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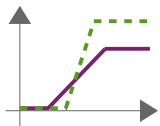
Human-autonomy co-adaptation.

Adaptive Assistive Autonomy



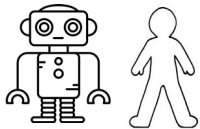
Masked and filtered information.

True human intent. Can the *autonomy* trust the *human*?



Feedback signal for adaptation.

Reward? Supervised label? Correction? Demonstration? Explicit? Implicit?



Human-autonomy co-adaptation.

...because if the autonomy steps in at the wrong time, or with the wrong control signal, it *takes away* from the *human's autonomy*.