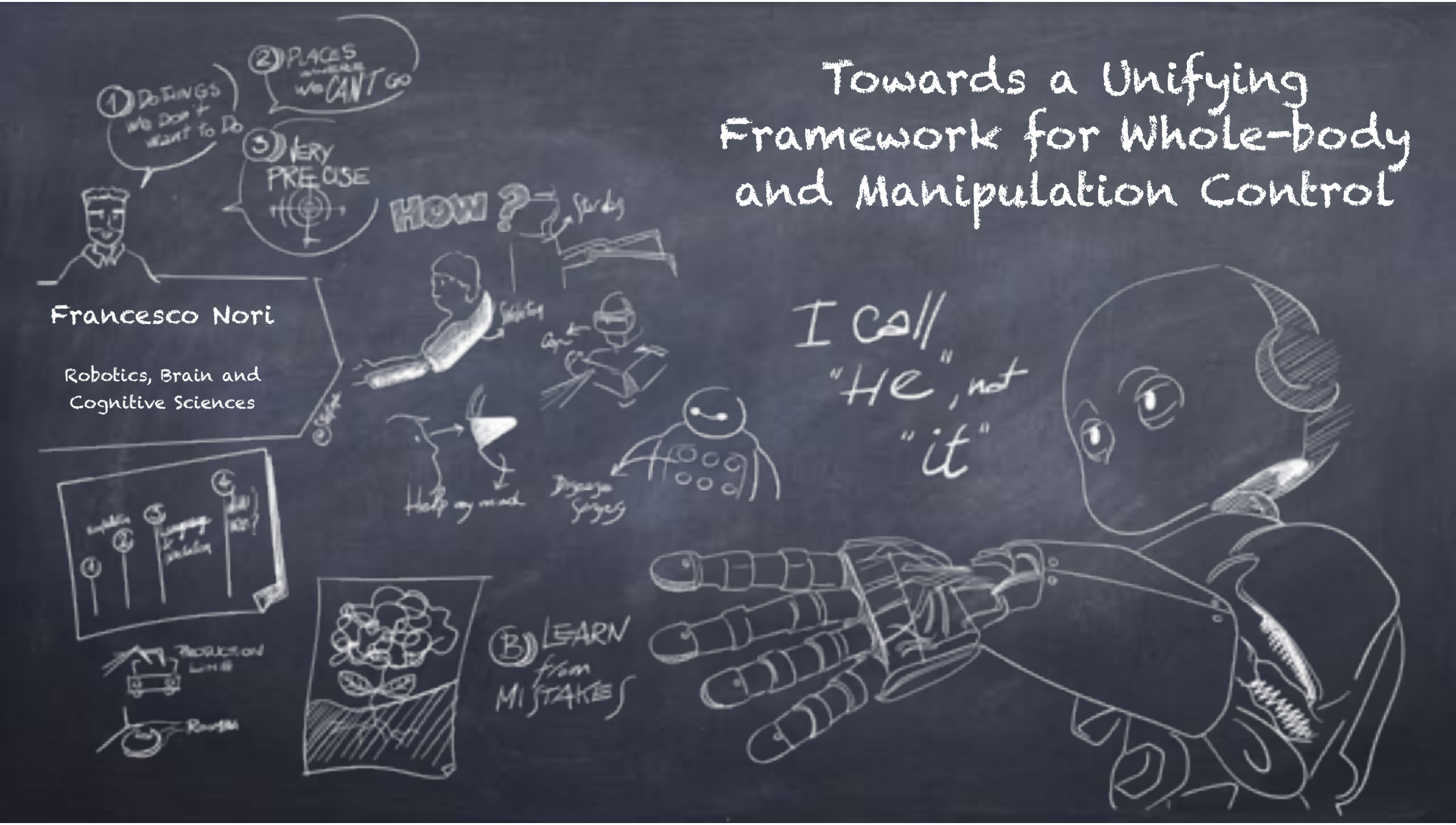
Towards a Unifying Framework for Whole-body and Manipulation Control
Francesco Nori
Robotics, Brain and Cognitive Sciences
1) DO THINGS WE DON'T WANT TO DO
2) PLACES WHERE WE CAN'T GO
3) VERY PRECISE
HOW ?
I call "He", not "it"
B) LEARN from MISTAKES

Towards a Unifying Framework for Whole-body and Manipulation Control

Francesco Nori

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WHAT

HOW

Self

$$\mathrm{M}(\mathrm{q})\dot{\mathrm{v}}_{\mathrm{q}} + \mathrm{C}(\mathrm{q}, \mathrm{v}_{\mathrm{q}})\mathrm{v}_{\mathrm{q}} + \mathrm{g}(\mathrm{q}) = \begin{bmatrix} 0 \\ \tau_{\mathrm{q}} \end{bmatrix} + \mathrm{J}^{\top}(\mathrm{q})\mathrm{f}$$

Other

$$\mathbb{M}(\mathbb{q})\dot{\mathbb{v}}_{\mathbb{q}} + \mathbb{C}(\mathbb{q}, \mathbb{v}_{\mathbb{q}})\mathbb{v}_{\mathbb{q}} + \mathbb{g}(\mathbb{q}) = \begin{bmatrix} 0 \\ \tau_{\mathbb{q}} \end{bmatrix} + \mathbb{J}^{\top}(\mathbb{q})\mathrm{f}$$

Contact

$$\begin{bmatrix} \mathrm{J}(\mathrm{q}) & \mathbb{J}(\mathbb{q}) \end{bmatrix} \begin{bmatrix} \dot{\mathrm{v}}_{\mathrm{q}} \\ \dot{\mathbb{v}}_{\mathbb{q}} \end{bmatrix} + \dot{\mathrm{J}}(\mathrm{q}, \mathrm{v}_{\mathrm{q}}) + \dot{\mathbb{J}}(\mathbb{q}, \mathbb{v}_{\mathbb{q}}) = 0$$

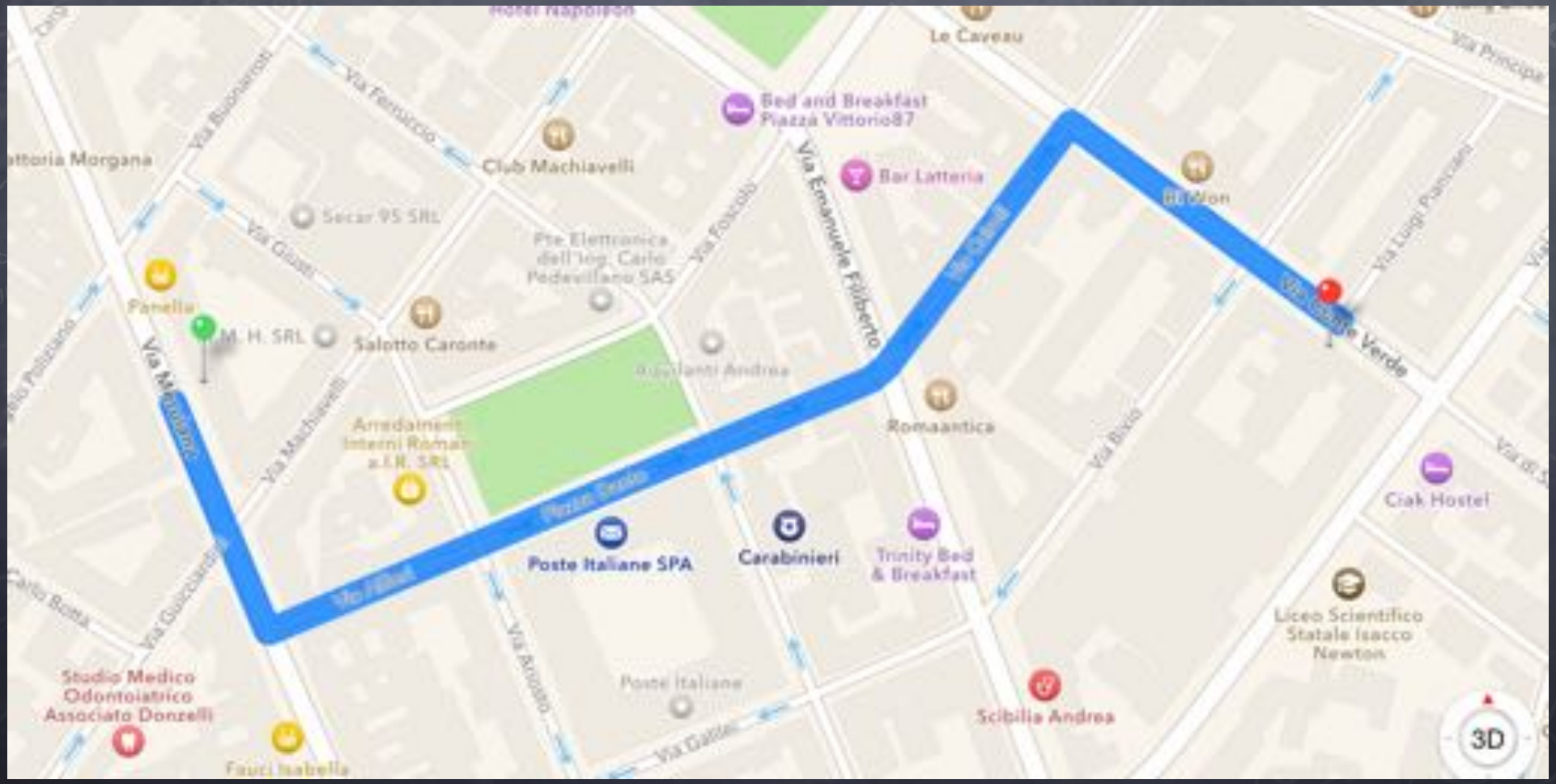
Workshop open questions

- Should we find a level of abstraction such that manipulation and whole-body motion control can be treated as unique problem?

- Hand motion synergies have been found in humans and have been proven to be useful in the design of robotic hands. Can we apply a similar principle in whole-body motion control?

- Several stability principles and contact models have been defined in both manipulation and whole-body motion. Do the peculiar differences in the two control tasks justify the necessity of different models?

Ristorante Da Nino
Via Merulana, 74, 00185 Rome, Italy



08:45-09:00 F. Nori - IIT
09:00-09:30 A. Del Prete - LAAS, CNRS
09:30-10:00 K. Hauser - Duke University

10:30-11:00 M. Ciocarlie - Columbia University
11:00-11:30 S. Kim - MIT
11:30-12:00 A. Bicchi - University of Pisa, IIT

14:30-15:00 S. Shaal - USC, Max-Planck-Insitute
15:00-15:30 E. Todorov - Washington University

16:00-16:30 Q.-C. Pham - NTU
16:30-17:00 D. Prattichizzo - University of Siena
17:00-17:30 M. A. Roa - DLR

17:30-17:45 Round table