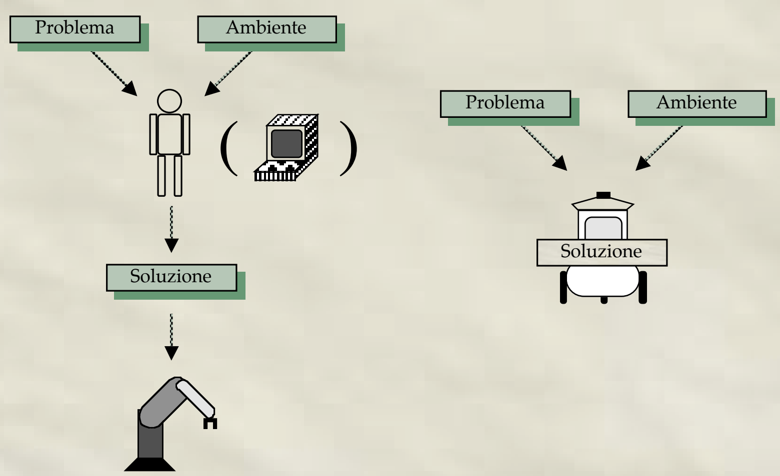
Robotica Mobile

Lezione 18: Strutture di controllo di robot avanzati

Un esempio: la *subsumption architecture*

31-05-2004

Robot tradizionali e robot avanzati:



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Quindi, i passi sono:

Robot tradizionale

- Analisi del problema
- Formulazione dell'algoritmo
- Codifica dell'algoritmo
- Debugging

Robot autonomo

- Esecuzione dell'algoritmo

I programmi che abbiamo scritto sul Pioneer…

- Sono puramente reattivi, o puramente algoritmici
- Reattivo è bello, ma deve essere complesso per ottenere comportamenti sofisticati
- Una formica è reattiva? O pianifica?
- Occorre trovare il modo per combinare insieme tanti comportamenti

L'articolo più famoso della letteratura robotica moderna:

A Robust Layered Control System For A Mobile Robot

RODNEY A. BROOKS

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La novità fondamentale di Brooks:

- Decomporre per comportamenti, non per moduli funzionali

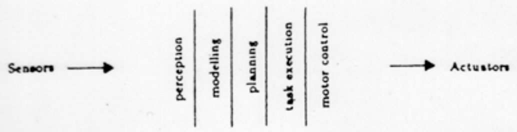

Fig. 1. Traditional decomposition of a mobile robot control system into functional modules.

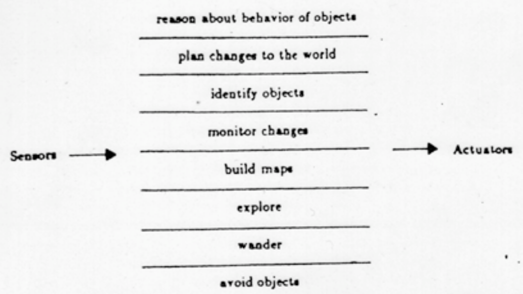

Fig. 2. Decomposition of a mobile robot control system based on task-achieving behaviors.

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L'idea della subsumption

BROOKS: A ROBUST LAYERED CONTROL SYSTEM FOR A MOBILE ROBOT

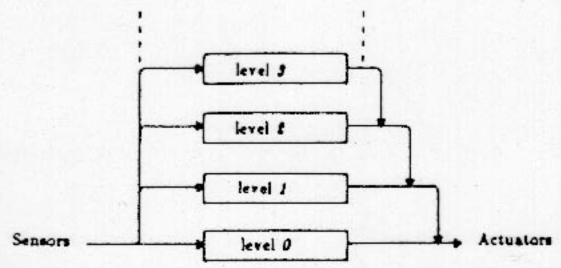

Fig. 3. Control is layered with higher level layers subsuming the roles of lower level layers when they wish to take control. The system can be partitioned at any level, and the layers below form a complete operational control system.

Esempio di una cella:

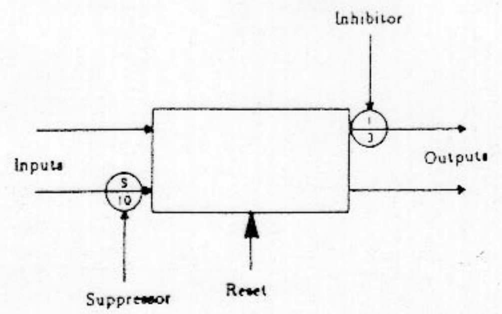

Fig. 4. A module has input and output lines. Input signals can be suppressed and replaced with the suppressing signal. Output signals can be inhibited. A module can also be reset to state NIL.

Subsumption architecture: livello 0

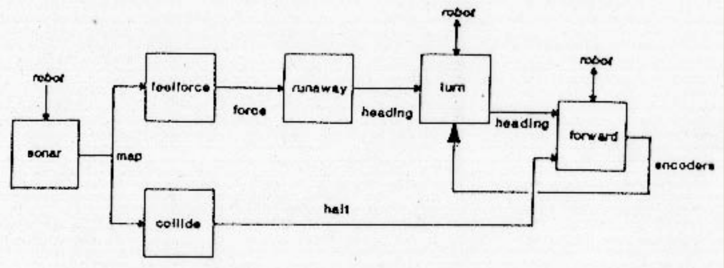

Fig. 5. Level 0 control system.

Livelli 0 e 1

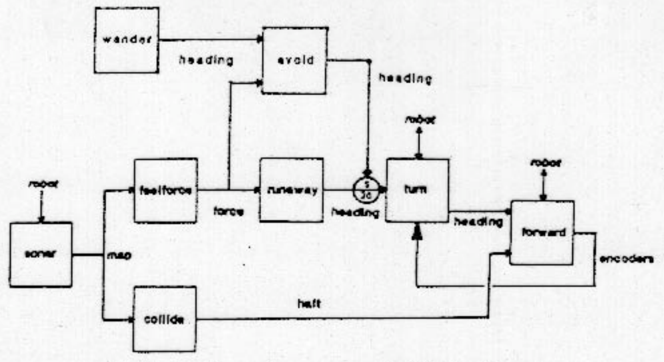

Fig. 6. Level 0 control system augmented with the level 1 system.

Verso la complicazione: livelli 0,1 e 2

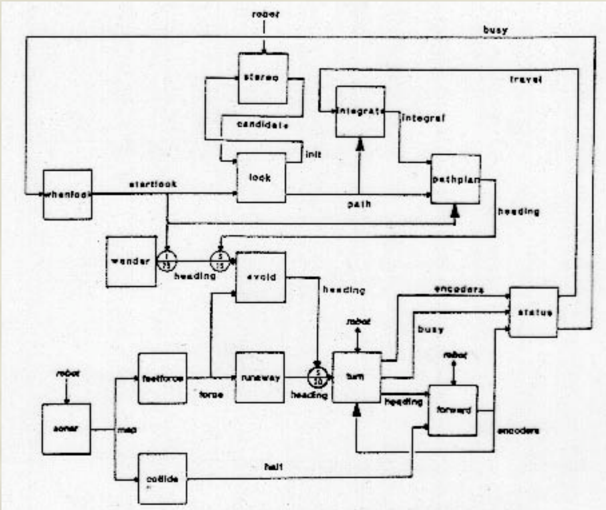

Fig. 7. Level 0 and 1 control systems augmented with the level 2 system.

Ingressi (percettori) e uscite (azioni)

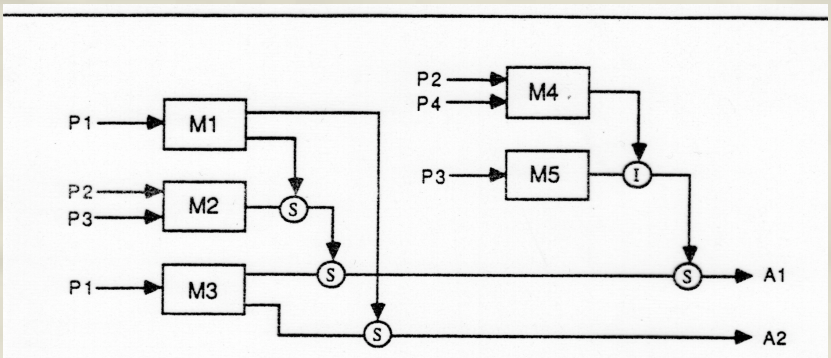

Figure 2-1. Our control system consists of a number modules (the M's), each of which implements a particular behavior. These module use the available sensor primitives (the P's) to directly generate commands for the actuator resources (the A's). The outputs of different modules are combined through a fixed arbitration network, represented here by circles.

La natura semplifica le cose:

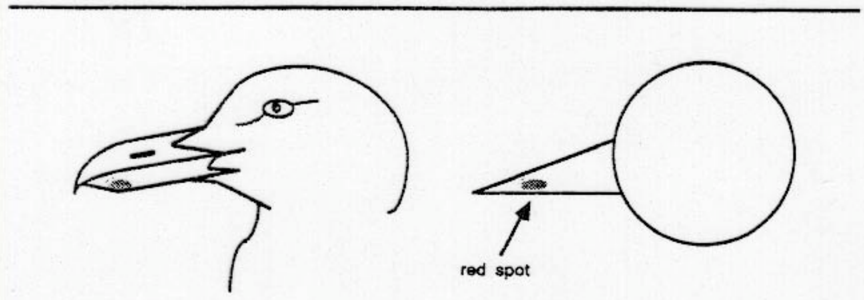

Figure 1-2. Animals seem to use incomplete models for many activities. Baby seagulls respond just as well to the mockup on the right as they do to their own parent (left). The critical features are that the object must be pointed and must have a red spot.

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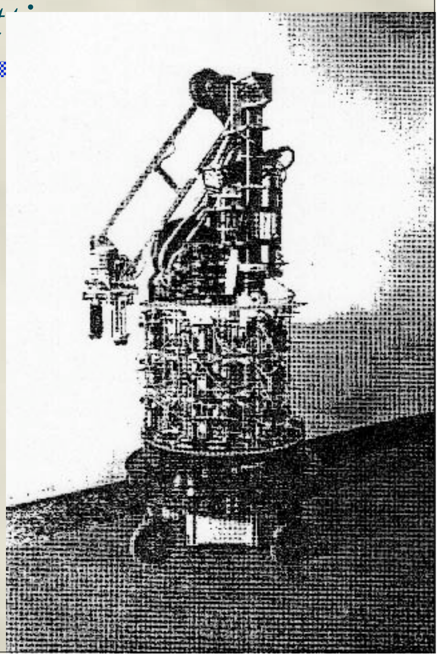
Herbert, il raccatta-lat



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