iment illustrated in Figs.5 and 6;

Figure 8 is an example of a primary response network, provided in an architecture having mobility, adapted to cause the architecture to follow an external agent;

Figure 9 is a diagram useful for understanding an application of the architecture of the present invention in a device providing situated personal assistance to a user; and

Figure 10 is an example of a primary response network adapted to optimise an output so as to maximise the probability that external aid will be received, leading to a sympathetic coupling between the architecture and an external agent.

[0017] The basic structure and operation of an architecture implementing self-biased conditioning, according to a preferred embodiment of the invention, will now be described with reference to Figs.1 to 3.

[0018] The structure of the preferred embodiment of architecture will first be discussed with reference to Figs.1 to 3. As shown in Fig.1, this architecture comprises a plurality of sensors S_1, S_2, ..., S_N, S_A and S_B, and a plurality of actuators C_1 to C_Q. The sensors are quite general and can include sensors detecting internal states of the architecture itself and/or sensors detecting parameters of the environment external to the architecture. Similarly, the actuators can include units having an effect on the operation of the architecture itself and/or units interacting with the environment.

[0019] At least one primary response network 1 is provided controlling the operation of one or more of the actuators (C_1 in Fig.1) based upon an input signal received from at least one of the sensors (S_A in Fig.1). The primary response network is initially designed or programmed to implement a particular function, that is, to produce an output which is a particular function of the input received from the connected sensor or sensors.

[0020] The primary response network 1 receives at least one further input (I_2), from a further sensor (S_B in Fig.1), determining (or indicating) whether or not the environment exhibits an expected reaction (or behaviour) consistent with an action of this primary response network. An associative memory 2 is also provided, for correlating the input and output signals from the primary response network 1 in order to condition the behaviour of the primary response network to inputs from other sensors (e.g. S_2 and S_4), either when the further input to the primary response network indicates that the working environment does not exhibit any expected reaction (or behaviour), or when the output of M is not that which is expected.

[0021] The structure and function of the primary response network 1 will now be described in greater detail with reference to Fig.2.

[0022] As shown in Fig.2, the primary response network 1 includes three types of nodes: activation nodes X, expectation nodes Y and motor centres M. More particularly, a primary response network 1 includes at least one activation node X receiving an input signal I_1 from one or more sensors and generating an output O_1 dependent upon the value(s) of the input signal(s) I_1 it receives. The output O_1 of the activation node X is fed to one or more motor centres M in order directly to trigger the motor centre(s) dependent upon the value of the signal(s) I_1 received from the sensor(s). The motor centre M is also connected to positive and negative reinforcement terminals y^+ and y^- which provide respective signals I_3 and I_4 which affect the likelihood of the motor centre being triggered by the signal O_1 output by the activation node X. The output O_3 of the motor centre M serves as the output of the primary response network and controls operation of one or more actuators.

[0023] According to the preferred embodiment of the invention, when the activation node X receives an input signal I_1 taking a particular value, it outputs a signal O_1 taking a value adapted to trigger the motor centre M. It also outputs a (Boolean value) control signal, which is different from O_1, and feeds this to the expectation node Y whereby to activate the expectation node. The expectation node Y is adapted to expect to receive an input signal I_2 taking a particular value at times when the corresponding primary response network is (or should be) in operation. When triggered by the activation node X, the expectation node Y monitors the value of the received signal I_2 and outputs a signal O_2 whose value depends upon whether the expected value of the received signal I_2 is or is not detected (in the example discussed here, O_2 preferably takes the value +1.0 when the expectation fails and 0 otherwise).

[0024] The signals O_1, O_2 and O_3 output by the activation node X, expectation node Y and motor centre M are sent to the associative memory 2 and influence the values of the signals I_3 and I_4 generated at the positive and negative reinforcement terminals y^+ and y^- as will be explained in greater detail below.

[0025] In the preferred embodiment of the present invention, the probability that the motor centre will fire follows equation (1) below:

$$\mathrm{Prob}(t) = \begin{cases} 1.0 - \dfrac{y^-(t)}{X(t) + y^+(t)} & \text{if } X(t) + y^+(t) > 0.0 \\ 0.0 & \text{otherwise} \end{cases} \qquad (1)$$