expectation node Y which, when activated monitors the input thereto $I_2$ in order to verify whether this input indicates that the primary response of the network is "appropriate" or "normal" at this time. If the expectation node determines that the signal $I_2$ takes the "expected" value or pattern of values, then the output $O_2$ of the expectation node Y represents this determination, for example by taking a value 0. However, if the expectation node Y determines that the signal $I_2$ does not takes the "expected" value or pattern of values, then the output $O_2$ of the expectation node Y changes so as to reflect this finding, for example, by taking a value +1.0.

**[0036]** The output signals $O_1$, $O_2$ and $O_3$ from the activation node X, expectation node Y and the motor centre M are received by the associative memory and serve to generate the update signals PR+ and PR- if the behaviour of the primary response network is "abnormal". The behaviour of the primary response network can be "abnormal" in a number of different ways. For example, the behaviour of the primary response network is "abnormal" either if:

a) the motor centre M is triggered at times when the expectation node Y determines that it should not be triggered - in which case it is necessary to inhibit the triggering of the motor centre M by increasing the value of the negative reinforcement signal $I_4$ applied to the negative reinforcement terminal y-, or
b) the motor centre M is not triggered at times when the expectation node Y determines that it should be triggered - in which case it is necessary to promote the triggering of the motor centre M by increasing the value of the positive reinforcement signal $I_3$ applied to the positive reinforcement terminal y+.

**[0037]** In the present embodiment, the update signals PR+ and PR- can be generated in a very simple manner. More particularly,

$$\begin{aligned}&\text{the update signal PR+ can be generated when } O_1 - O_2 - O_3 > Th_1 \text{, and}\\&\text{the update signal PR- can be generated when } O_2 > Th_2 \text{,}\end{aligned} \qquad (4),$$

where $Th_1$ and $Th_2$ are threshold levels which can be set different from one another but which, in this particular case, are both set to 0.0. (recalling that the expectation node will output a signal $O_2$ = +1.0 at times when it is <u>not</u> appropriate for the primary response network to trigger the motor centre M).

**[0038]** At a time when the weight update signal PR+ is generated, the positive reinforcement weights applied to the signals output by the sensors $S_1$ to $S_N$ are updated, for example taking into account the values of the signals output by the sensors $S_1$ to $S_N$ at that time. In other words, the primary response network is conditioned such that its primary response is promoted or reinforced taking into account the values of the signals output by those of the sensors $S_1$ to $S_N$ which had a large-value signal at the times when the weight update signal PR+ was generated.

**[0039]** Similarly, at a time when the weight update signal PR- is generated, the negative reinforcement weights applied to the signals output by the sensors $S_1$ to $S_N$ are updated, for example taking into account the value of the signals output by the sensors $S_1$ to $S_N$ at that time. In other words, the primary response network is conditioned such that its primary response is inhibited taking into account the values of the signals output by those of the sensors $S_1$ to $S_N$ which had a large-value of the signal at the times when the weight update signal PR- was generated.

**[0040]** It has been found to be advantageous to update the positive and negative reinforcement weights in a manner which takes into account not only the values of the signals output by the sensors $S_1$ to $S_N$ at the time when the weight update signals are generated but also the values of these signals over a number of preceding time intervals. More particularly, the change in the value of the positive (or negative) reinforcement weight is preferably calculated according to the following equation:

$$\Delta w_i(t) = g \sum_{j=1}^{\tau} c_j \mid w_i(t-j) \mid [\Delta x_i(t-j)]^+ \qquad (5)$$

where $[\Delta x_i(t-j)]^+ = \max(\Delta x_i(t-j),0)$, $\Delta w_i(t)$ represents the change made at time t to the weight applied to the $4_i$th signal line (that is, the change in the value of the weight applied for time interval t and that applied at t+1, that is one time interval later), $\Delta x_i(t-j)$ represents the change observed at time interval (t-j) in the value of the signal $x_i$ output by the sensor $S_i$ (that is, the change in the value of the signal $x_i$ between that observed during time interval t-j-1 and that observed during time interval t-j), $\tau$ is a time period (equal to an integral number of time intervals) over which delay conditioning is effective, $c_j$ is an empirically-determined learning-rate constant that is proportional to the effectiveness of the conditioning when the inter-stimulus interval is j, and g is 1 when the weight update signal is produced and 0 when the weight update signal is not produced.

**[0041]** Although in the above-described example the output signals $O_1$ to $O_3$ are all binary, the present invention is