tion to the presentation of the "DetectedAlarm" set of signals thereby producing its own "eagle alarm call" when such signals are input.

**[0056]** As shown in Fig.7, until around 1300 time steps have elapsed the success rate of the system in generating "eagle alarm calls" at appropriate times fluctuates with a tendency to diminish. However, thereafter the success rate improves as the system develops an appropriate secondary response.

SPA Device Adapting to User's tastes

**[0057]** As mentioned in the introduction, the present invention is particularly useful in applications providing SPA (situated personal assistance) devices. One implementation of such a device learns selectively to generate alarm signals in order to attract the attention of the user to objects which may be of interest to him.

**[0058]** Consider the case where a building, such as the Louvre museum, is provided with transmitters outputting, in a form not directly perceptible to humans, information regarding the properties of the respective different exhibits. An SPA device is provided with sensors adapted to receive the transmitted signals and has one or more primary response networks designed to react to the detection of certain properties of the exhibits by generating a corresponding alarm signal perceptible to the user (e.g. an audible broadcast of the words "16$^{th}$ century painting"). If the user is interested in the corresponding exhibit, the expectation node of the primary response network "expects" that the user will move closer to the exhibit. If this expectation is not fulfilled then the operation of the primary response network is conditioned by enhancement of the negative reinforcement signal.

**[0059]** It will be understood that the above example can be modified in a wide variety of ways. For example, rather than transmitters being provided for broadcasting the properties of the different exhibits, the SPA device may be provided with sensors which directly detect properties of the exhibits.

Tracking of Objects or Agents

**[0060]** Fig.8 illustrates the structure of a primary response network 71 adapted for use in a tracking device. Firstly, there will be described a simple mobile device adapted to track a human user with which the device interacts. Next, a more complex case will be discussed in which a SPA device acts as a partner for navigating through a virtual three-dimensional world.

Tracking of Human User

**[0061]** In the primary response network 71, a single activation node X receives an input signal A indicating when the volume of audio signals detected from the human user falls below a threshold level. In such a case, the primary response of the network is to assume that the human user has moved further away from the device and to trigger action to displace the device towards the human user. The activation node X thus sends trigger signals to four motor centres $M_1$ to $M_4$ respectively controlling displacement of the device towards the North, East, South and West. Initially, the probabilities of motion in the northward, eastward, southward or westward directions are all equal.

**[0062]** The device also includes an expectation node Y, activated upon triggering of the activation node X, and receiving as an input a signal B indicating the distance between the mobile device and the human user. If, when the activation node X triggers the expectation node Y, the human user is close to the mobile device then it is not appropriate for the primary response network 71 to trigger motion of the mobile device and the output from the expectation node is +1.0, whereby to signal that triggering of the motor centre is "inappropriate". On the other hand, if the expectation node determines that the human user is indeed far from the mobile device then this is the "expected" finding and the expectation node outputs 0.

**[0063]** In this application also, the associative memory functions as described above with respect to Fig.3, that is, the reinforcement signals, weight update signals and changes in values of weights are calculated as described with reference to equations (2) to (5) above. Moreover, in this case, the associative memory receives input signals from four sensors indicating, respectively, whether the tracked human user is to the North, East, South or West of the mobile device.

**[0064]** The associative memory determines on the basis of the output signals received from the activation node X, expectation node Y and four motor centres $M_1$ to $M_4$ whether or not the primary response of the network 71 is "abnormal" and, if so, generates weight update signals for the respective positive or negative reinforcement signal components $y_1^+$, $y_1^-$, $y_2^+$, $y_2^-$, $y_3^+$, $y_3^-$, $y_4^+$ and $y_4^-$, as required. This architecture gradually learns to move in the correct direction in order to approach the tracked human user in cases where the volume of audio signals received from the user drops and the user is, indeed, far away.

**[0065]** In a case where the human user himself approaches the mobile device upon noticing that he is far away from it, the conditioning of the architecture for "tracking" will not be triggered. Thus, this architecture is better adapted for tracking agents which seek to flee than for tracking agents which tend to approach of their own accord.