

tionally, haptels may be configured for use with cell phones or other information transmission apparatus.

[0031] The signal path for a haptel or haptel array may be configured according to various embodiments depending on whether the haptel is an analogue or digital device or a combination of analogue and digital design sub-sections. The present invention is not limited by the embodiment chosen for the signal path. One preferred embodiment for the signal path of an array of 25 analogue I/O haptels is shown FIG. 7. The convention established to describe a signal (signal 40c FIG. 4) generated by a user inputting a force (force 40a FIG. 4), to a haptel, will be maintained in the discussion of FIG. 7. The signal arising from the user's input force will be termed the "input signal" and the signal that results in haptic data being rendered to the haptel will be termed the "output signal," thus the use of the terms input and output define whether haptic data is being input into the haptel or being output onto the haptel.

[0032] With reference to FIG. 7, input signal path 72 directs the 25 haptel input signals, from haptel array 70, into amplifiers 700 through 725. The signal from amplifier 700 passes into analogue-to-digital converter 726 and then into haptel memory buffer 74. The signal for each individual haptel is directed similarly. Haptel memory buffer 74 allows haptic data to be transmitted by transmitter/receiver 78 onto signal path 10.

[0033] Output haptic data, coming in on signal path 10 enters into haptel memory buffer 74 and is converted to an analogue signal by digital-to-analogue converters 776 through 800. The output signals, from the digital-to-analogue converters are amplified by amplifiers 751 through 775. The output signals traverse output signal path 76 into I/O haptel array 70, where the output signals are displayed on I/O haptel array 70.

[0034] Haptel memory buffer 74 may be divided into input and output portions when needed to handle the needs of both forms of data transfer. Haptic data input and output may be implemented in a way that provides a real-time telepresence as previously discussed by continuously updating the haptel.

[0035] In another embodiment, of the present invention, one HRD may send haptic data to a plurality of HRDs. FIG. 8 shows a network of N HRDs. With reference to FIG. 8, HRD 82 is connected with HRD 84, HRD 86, up to a general number N of HRDs, HRD 88, via signal path 10. The HRDs shown in FIG. 8 allow haptic data, input on one HRD, to be output on the other HRDs. For example, haptic data could be input on HRD 82 and be output on HRD 84, 86, up to general number N of HRDs, HRD 88.

[0036] Other uses for haptels are envisioned. For example, the haptel could be used as an input/output device for computer games. A computer game may include doors that are activated by buttons. Haptels could be used to actuate the doors, allowing the user to push the haptel and in so doing operate the button that works in cooperation with the computer game. Another use may be in the field of computer-aided design (CAD).

[0037] A CAD designer would be able to see the 3-D representation of an object rendered on a suitable haptel display. The haptel could render the 3-D geometry of an object the designer had created with a computer graphics

program and as the object rotated on the computer screen, the object rendered on the haptel array could rotate as well.

[0038] Alternatively, the haptel array could be used to read the shape of the object pressed against it. The CAD designer previously discussed could use data input into the haptel in this manner.

[0039] In the foregoing specification, the invention has been described with reference to specific embodiment thereof. It will be, however, evident that various modifications and changes may be made thereto without departing from the broader scope and spirit of the invention. The specification and drawings are, accordingly, to be regarded in an illustrative rather than restrictive sense.

What is claimed is:

1. An apparatus comprising:

a haptel wherein a signal is generated in response to subjecting said haptel to a stimulus.

2. An apparatus, as in claim 1, further comprising an array of haptels.

3. An apparatus, as in claim 1, wherein the stimulus is selected from the group consisting of spatial position, velocity, temperature, force, pressure, and emotion.

4. An apparatus, as in claim 1, wherein said haptel is configured into a computer system pointing-device.

5. An apparatus, as in claim 1, wherein said haptel is configured with an information transmission system.

6. A method comprising:

subjecting a haptel to a stimulus; and

creating a signal responsive to said subjecting.

7. An apparatus, as in claim 6, further comprising an array of haptels.

8. An apparatus, as in claim 6, wherein the stimulus is selected from the group consisting of spatial position, velocity, temperature, force, pressure, and emotion.

9. An apparatus, as in claim 6, wherein said haptel is configured into a computer system pointing-device.

10. An apparatus, as in claim 6, wherein said haptel is configured with an information transmission system.

11. An apparatus comprising:

a haptel, wherein said haptel is responsive to a signal, such that a quantity is rendered on said haptel.

12. An apparatus, as in claim 11, further comprising an array of haptels.

13. An apparatus, as in claim 11, wherein said haptel is configured into a computer system pointing-device.

14. An apparatus, as in claim 11, wherein said haptel is configured with an information transmission system.

15. An apparatus, as in claim 11, wherein the quantity is selected from the group consisting of spatial position, velocity, temperature, force, pressure, and emotion.

16. A method comprising:

receiving a signal; and

setting a haptel in response to the signal, such that a quantity is rendered on the haptel.

17. An apparatus, as in claim 16, further comprising an array of haptels.

18. An apparatus, as in claim 16, wherein the quantity is selected from the group consisting of spatial position, velocity, temperature, force, pressure, and emotion.