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An   expert   system   as   described   here   is   similar
to   a   Perceptron   network. (See perceptron tools.)
The   base   functions   for   an   expert   system
consist   of   ~~mea~~ mesas   with   piece-wise   linear
boundaries.   In   other   words,   the   tops   of   the
mesas   look   like   polygons   from   an   aerial   view.

In   our   example   on   the   next   page   the   mesas
are   square.   The   first   mesa   could   represent
the   following   logical   statement:

$$\text{If} \quad x_1 < \tfrac{1}{2} \quad \text{and} \quad x_2 < \tfrac{1}{2} \quad \text{then} \quad \text{output a } 1,$$

$$\text{else} \quad \text{output a } 0.$$

We   multiply   this   if-then   output   by   a   weight $\overset{w_1}{\wedge}$ that
equals   the   stop   distance   when   the   if-then   is   true.

Our   composite   expert   system   function   on   the   page
following   the   network   illustration   consists   of   four
mesas   covering   the   domain   of (x_1, x_2) values.

If   we   make   the   square   mesas   very   small,   then
we   can   cover   the   domain   with   orthonormal   functions
that   look   like   square   rods.   The   weights   scale   the
heights   of   the   rods   to   give   us   a   stepped   approximation
of   a   surface.   Thus,   we   have   something   resembling
an   orthonormal   basis   for   functions   of   two   variables.

Walsh   functions   are   a   cross   between   the   expert
system   and   the   Fourier   series.   The   basis   functions
for   Walsh   series   are   orthonormal   square   waves.

note: One   of   the   major   drawbacks   to   expert   systems
and   Walsh   functions   is   that   they   give   discontinuous
surface   approximations.

EXPERT SYSTEM / Perceptron (cont.)
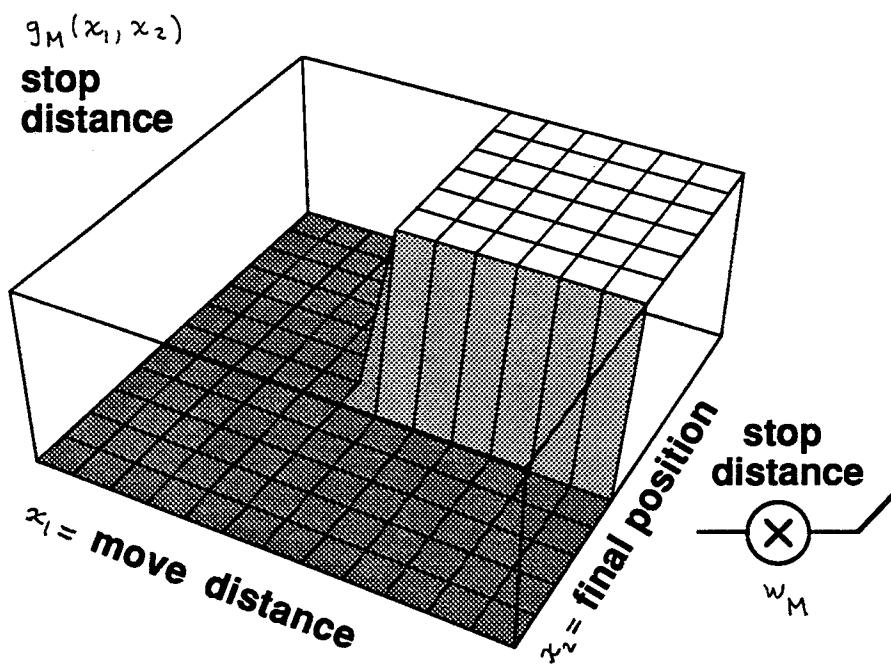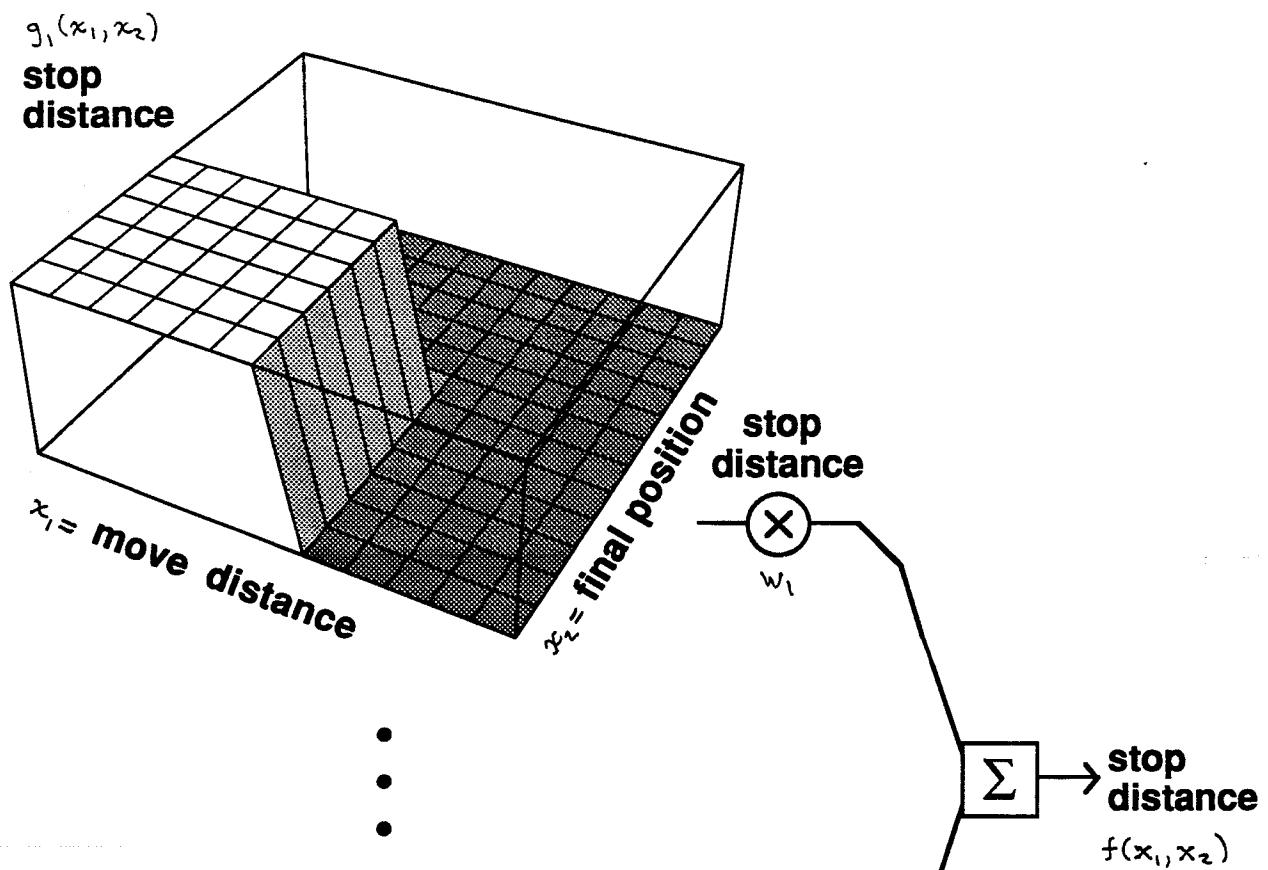
$g_1(x_1, x_2)$

stop distance

x_1 = **move distance**

x_2 = **final position**

stop distance

⊗

w_1

•
•
•

$g_M(x_1, x_2)$

stop distance

x_1 = **move distance**

x_2 = **final position**

stop distance

⊗

w_M

Σ → **stop distance**

$f(x_1, x_2)$

EXPERT SYSTEM / Perceptron (cont.)

$f(x_1, x_2)$ **stop distance**

x_1 = move distance

x_2 = final position
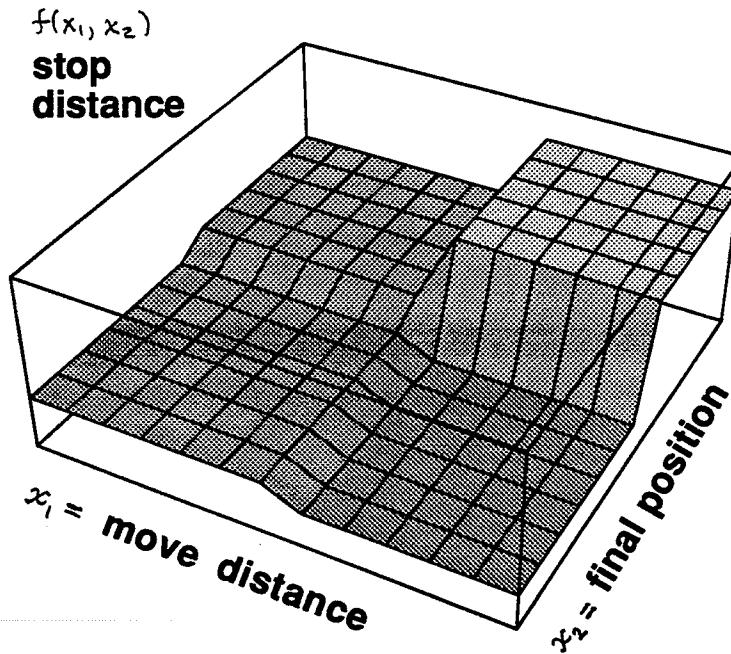
note: the surface appears continuous here because of the plotting sofwared used. In fact the surface is discontinuous.

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