A

camera

target

x_t

x_{dv}

x_{ee}

θ_2

θ_1

c_2

c_1

B

Hand position in
camera-centered coordinates

x_{ee}

θ

Arm configuration in
joint coordinates

Newts cannot adapt to rotation of their eyes

Roger Sperry rotated the eyes of newts by 180°. Light that comes from above now hits retinal cells that normally get light from below.

"When the piece of meat was moved back and forth in the water several centimeters above and a little to one side of the animals, they tilted their heads downward on that side and began to move toward the bottom of the aquarium. Even though the newts happened to be resting on the bottom when the lure was thus waved above them, they cocked their heads down under them and began pushing about among the pebbles of the bottom with the nose and forefeet. If the lure was placed below the animals, the head and forebody were tilted upward and the newts started toward the surface."

Dove Prisms
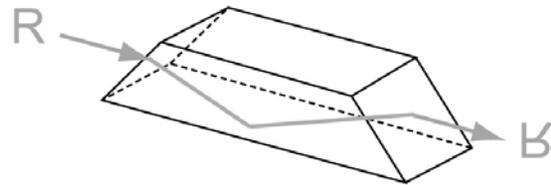
Objects above appear below
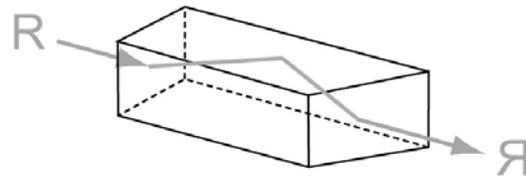
Objects on the left appear on the right

Monkeys adapting to left-right Dove prisms

A

Boo: day 25

Boo: day 54
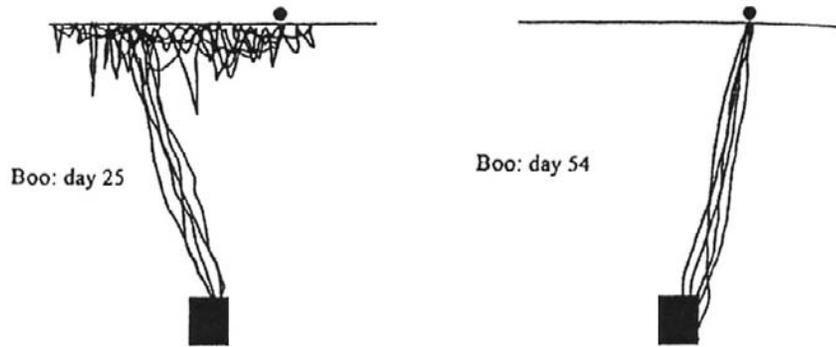
B
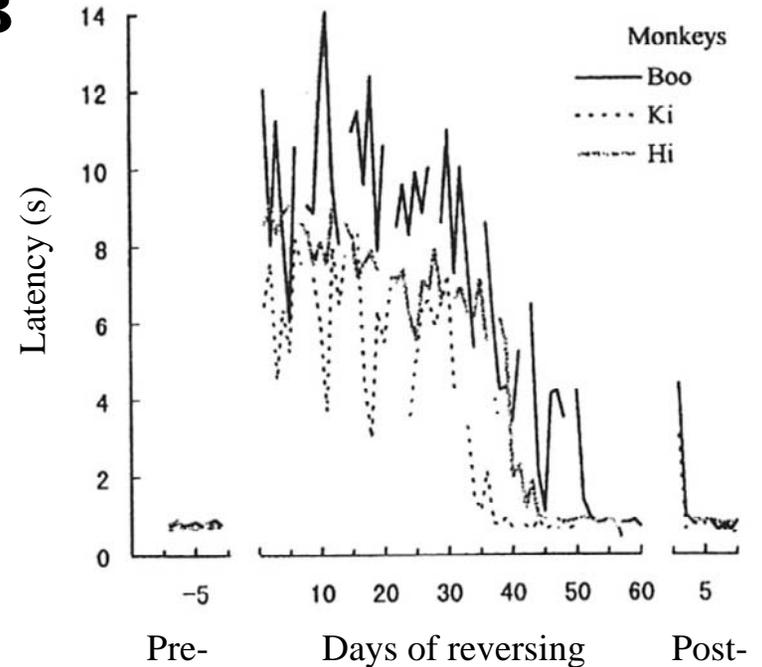

Four months of continuous prism wearing.

Gradual adaptation.

Upon removal, aftereffects.

Much faster re-adaptation to no-prism condition.

Sugita (1996)

Humans adapting to left-right Dove prisms
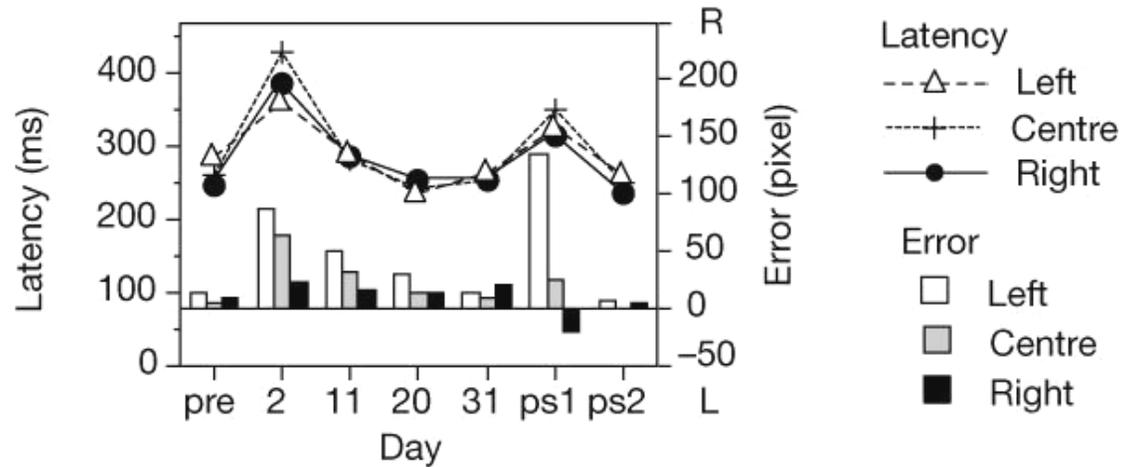

Day 3   Day 34

Humans adapting to wedge prisms

A

B

Martin et al. (1996)

A NAIVE

PC = 12.6   AC = 11.1   AC = 17.3

HORIZONTAL DISPLACEMENT (cm)

BEFORE   PRISMS   AFTER

B 6 WEEKS

PC = 3.0

HORIZONTAL DISPLACEMENT (cm)

BEFORE   PRISMS   AFTER

C

HORIZONTAL DISPLACEMENT (cm)

AFTER: LEARNING COEFFICIENT = 2.4 WEEKS

PRISMS: LEARNING COEFFICIENT = 1.4 WEEKS

NAIVE WEEK 1 WEEK 2 WEEK 3 WEEK 4 WEEK 5 WEEK 6 9 MO. 18 MO. 27 MO.

POST-TRAINING

SESSION
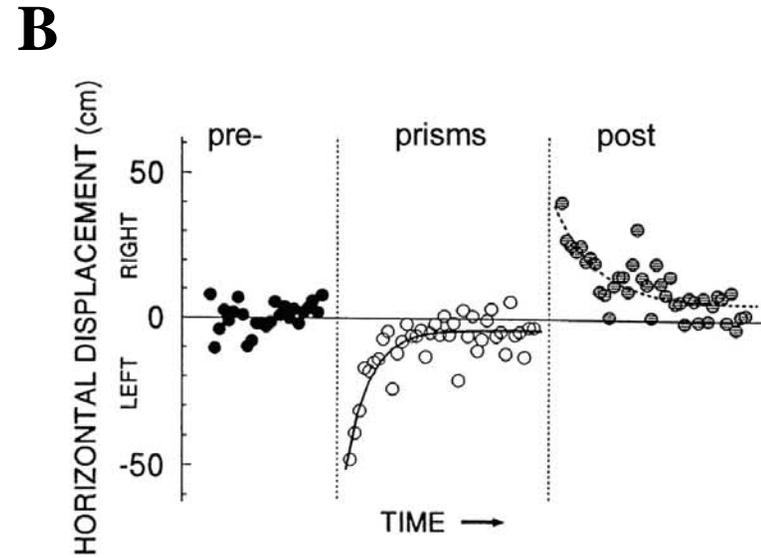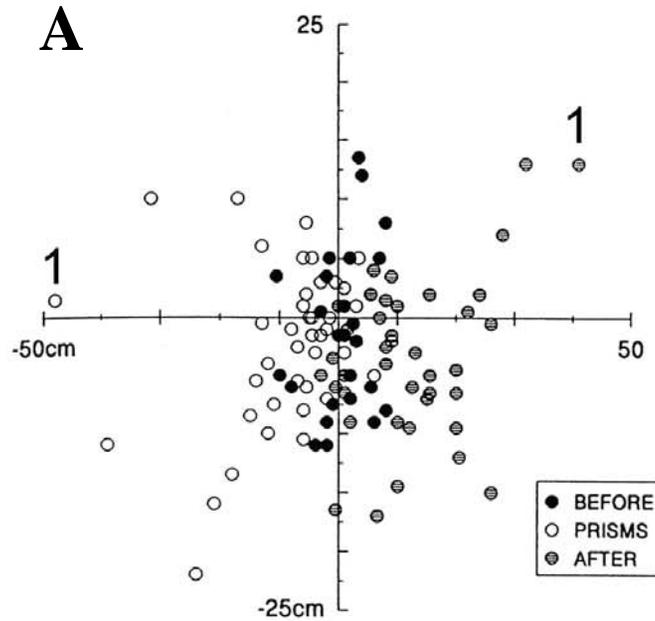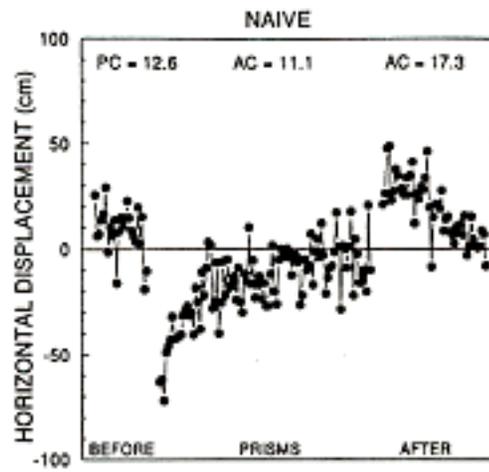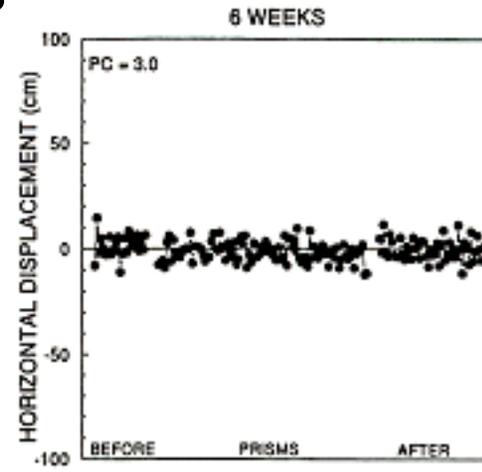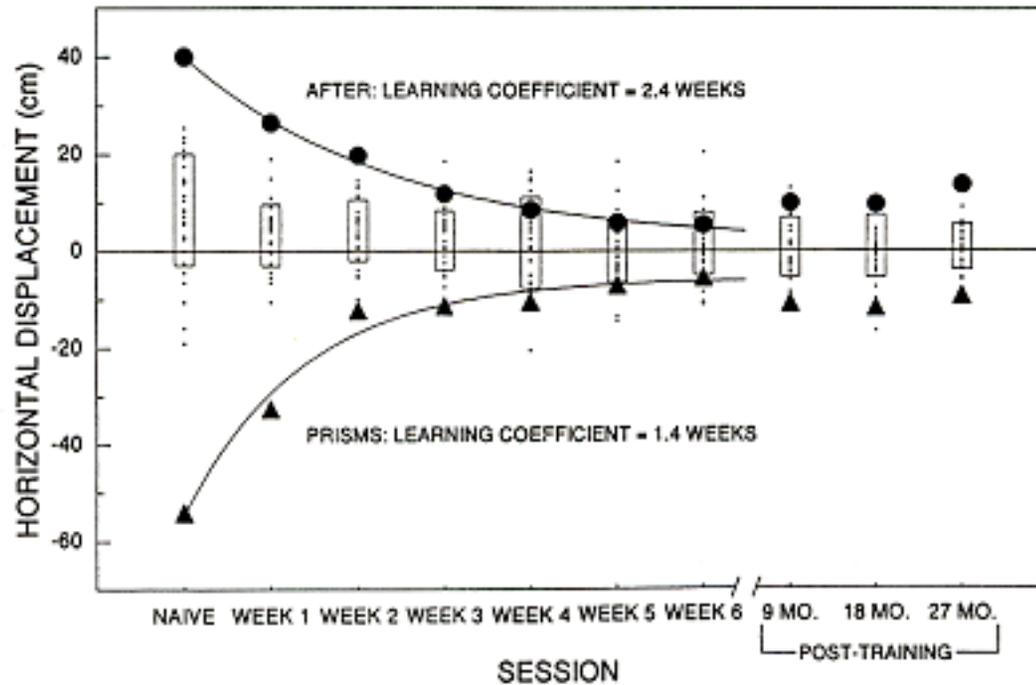
Accuracy on the first throw

A

Prism

Real

Viewed

x_t x_{dv}

x_2

x_{ee}

x_1

θ_2

θ_1

x_{dv} Δx_2 $\Delta\theta_2$

Δx_1 $\Delta\theta_1$

B

Viewed

Alignment need in:
Location-map
Displacement-map

C

Real

Estimated

$\Delta\theta_2$

Δx_2

Δx_1 $\Delta\theta_1$

D

Real

Viewed

E

F

Aftereffect
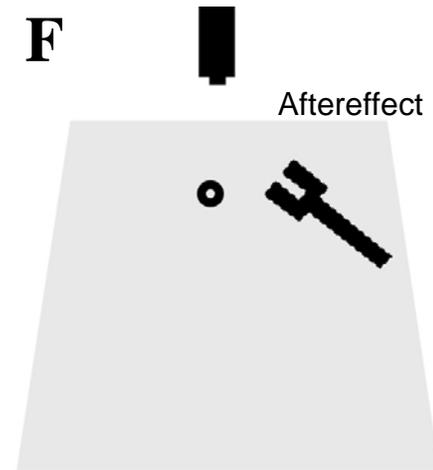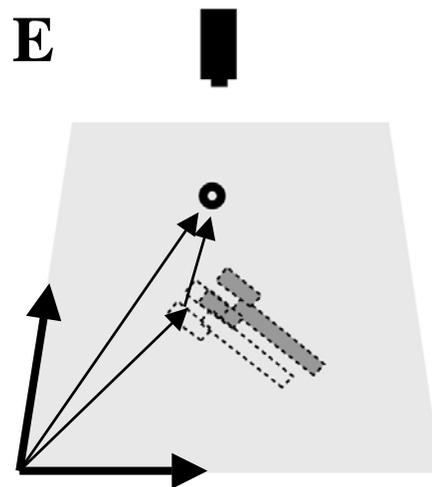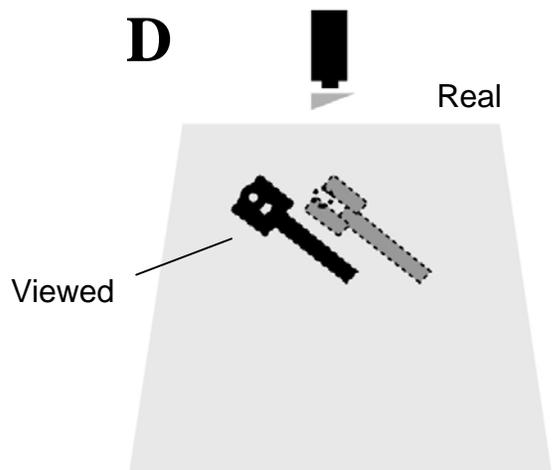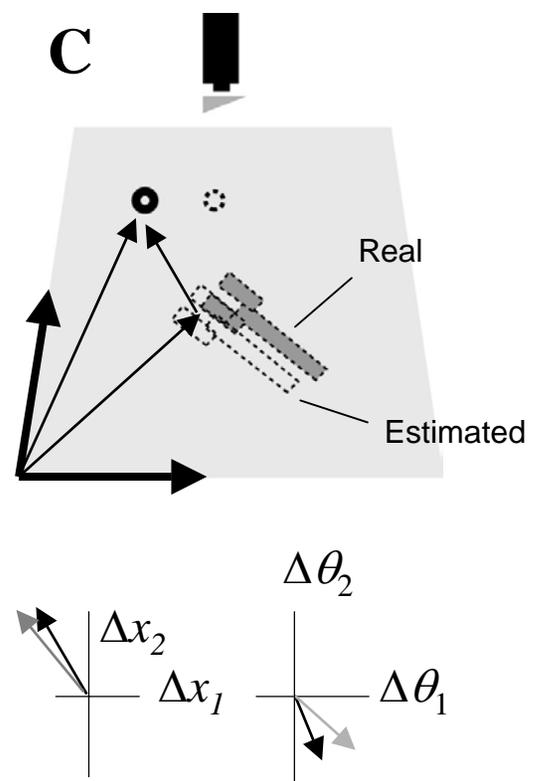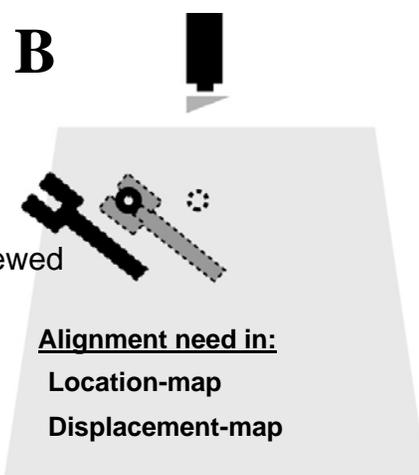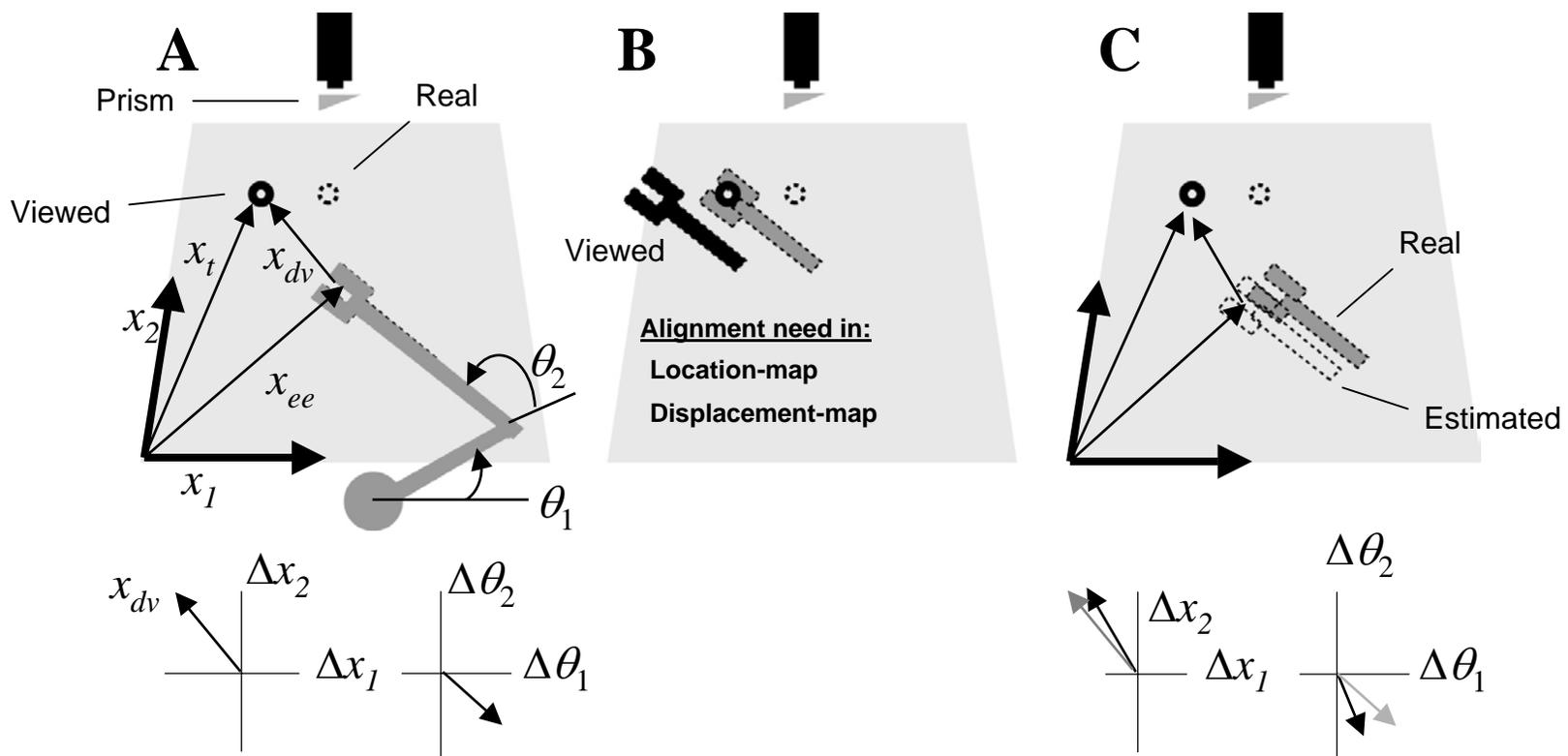
**Fixating a target straight
ahead with prisms**

Fixation point

Result of pointing $+$ ┅┼┅ **Target (real space)**

θ_2

θ_1
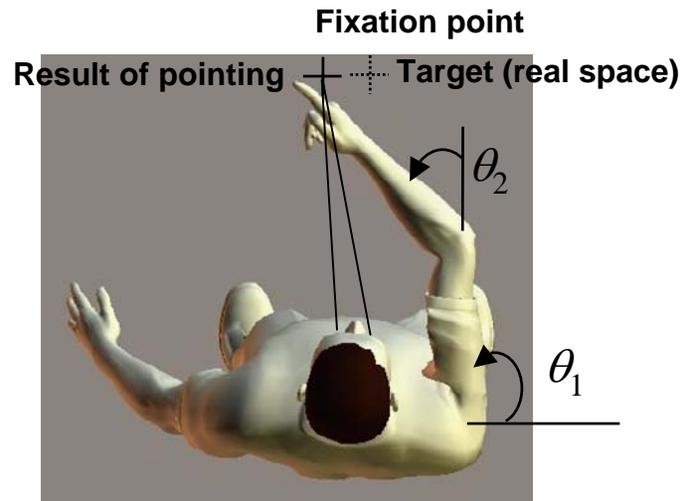
**Fixation
point**

Target

**Hand position
(viewed at end of reach)**

Fixation point

x_{ee}

x_{dv}

x_{dv}
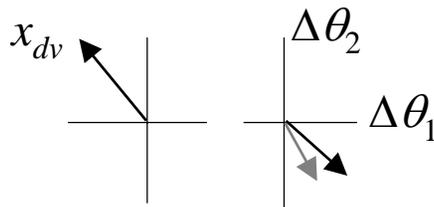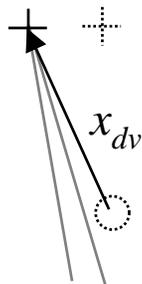
**Actual hand
position**

**Estimated and
actual hand
position
(start of reach)**

x_{dv}

$\Delta\theta_2$

$\Delta\theta_1$

**Estimated hand
position**

Prism-adaptation with right hand. Point with left hand to right hand shows after effects.

The actual sight of the hand has more influence over adaptation than the sight of something that represents hand location. That is, reaching movements should adapt more rapidly if you can see your hand, as opposed to seeing a video image of your hand.