OCULOGRAVIC ILLUSION

AUDIOGRAVIC ILLUSION

ILLUSIONS OR REFERENCE FRAME SHIFT?

EXTERNAL REFERENCE FRAME SHIFT

OCULOGRAVIC ILLUSION

AUDIOGRAVIC ILLUSION

INTERNAL REFERENCE FRAME SHIFT

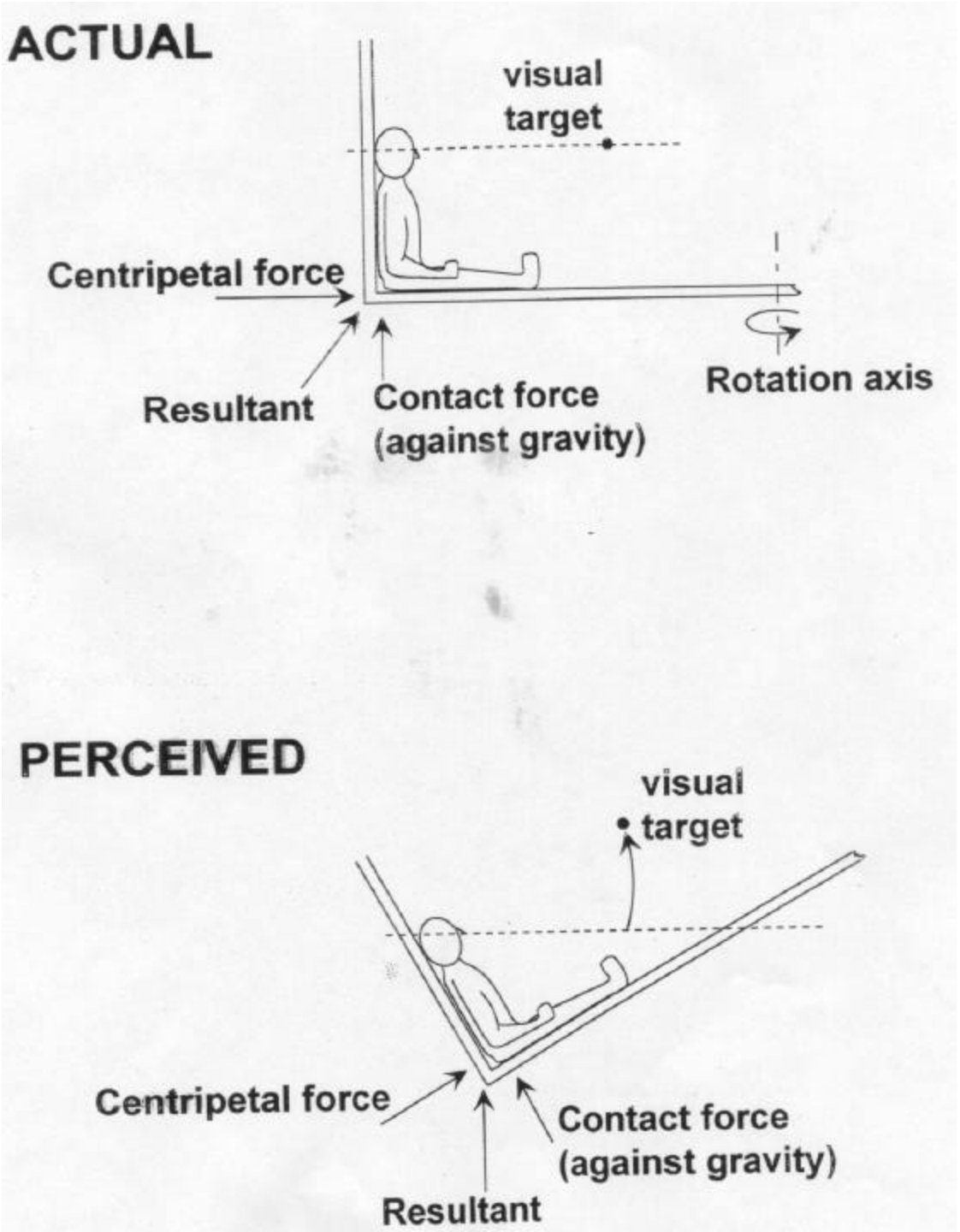
VISUAL LOCALIZATION

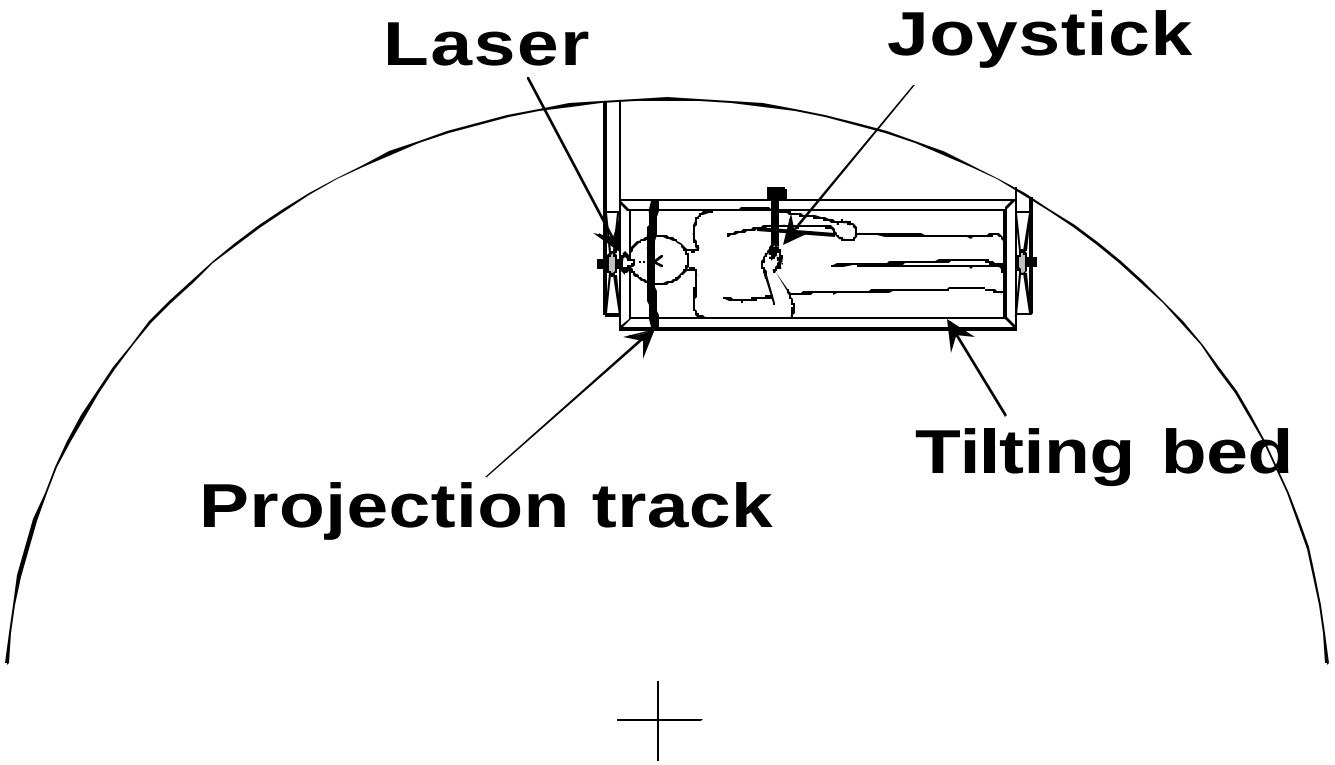
AUDITORY LOCALIZATION

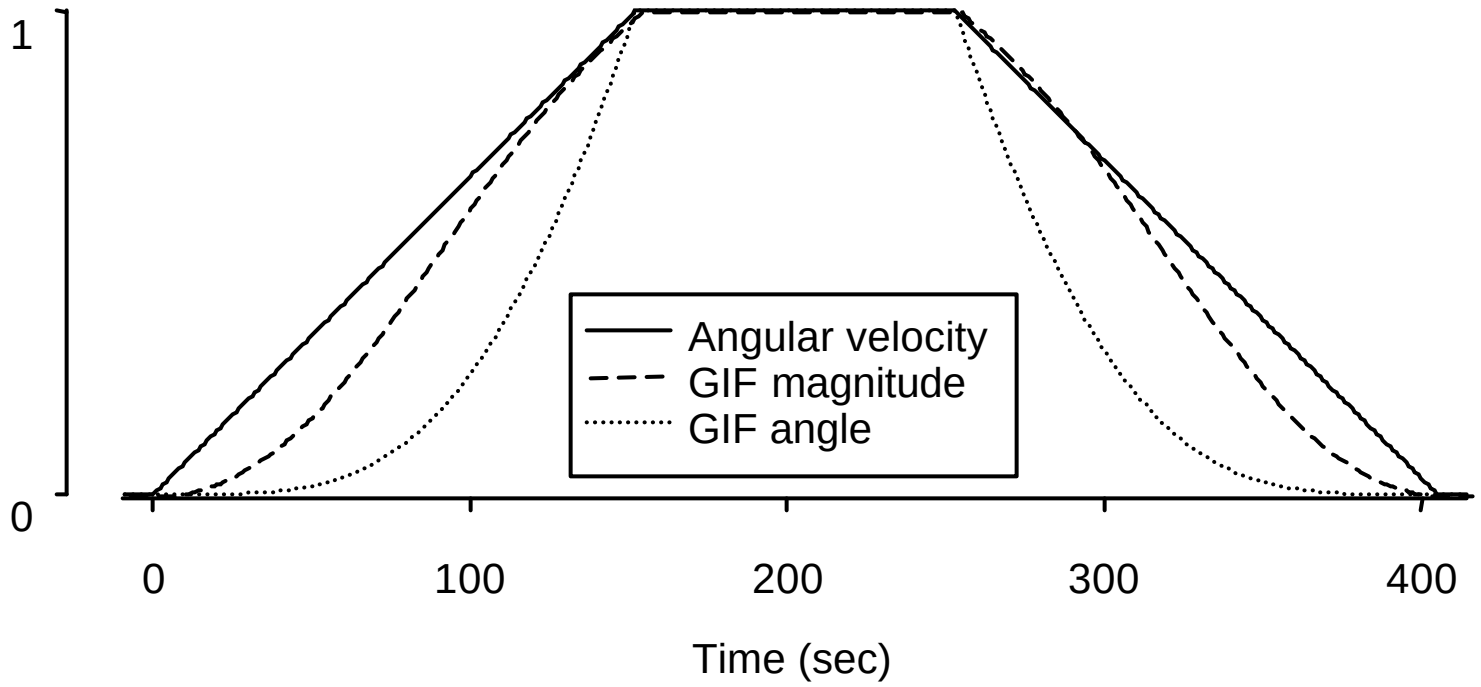
SOMATOSENSORY LOCALIZATION

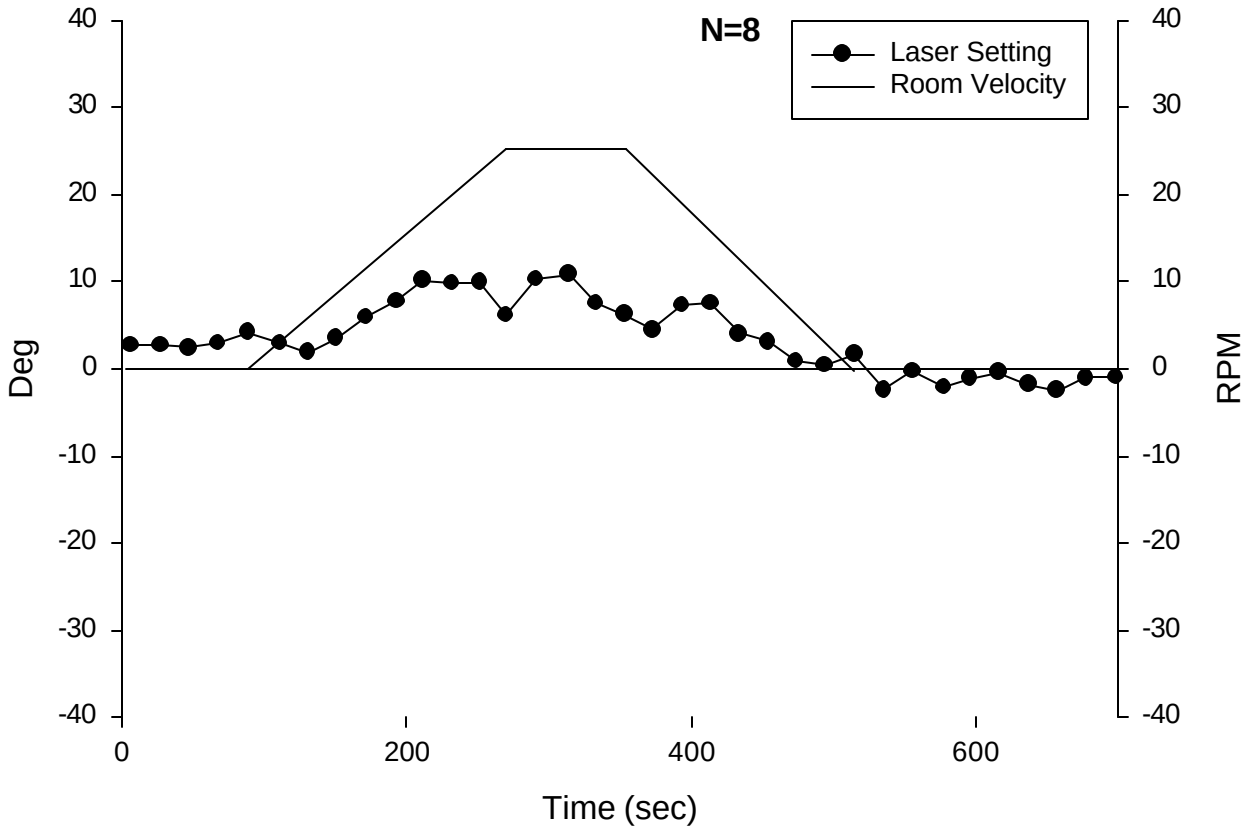
PHYSIOLOGICAL IMPLICATIONS

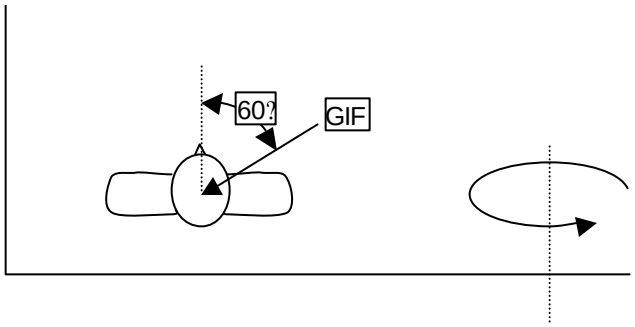
PRACTICAL IMPLICATIONS

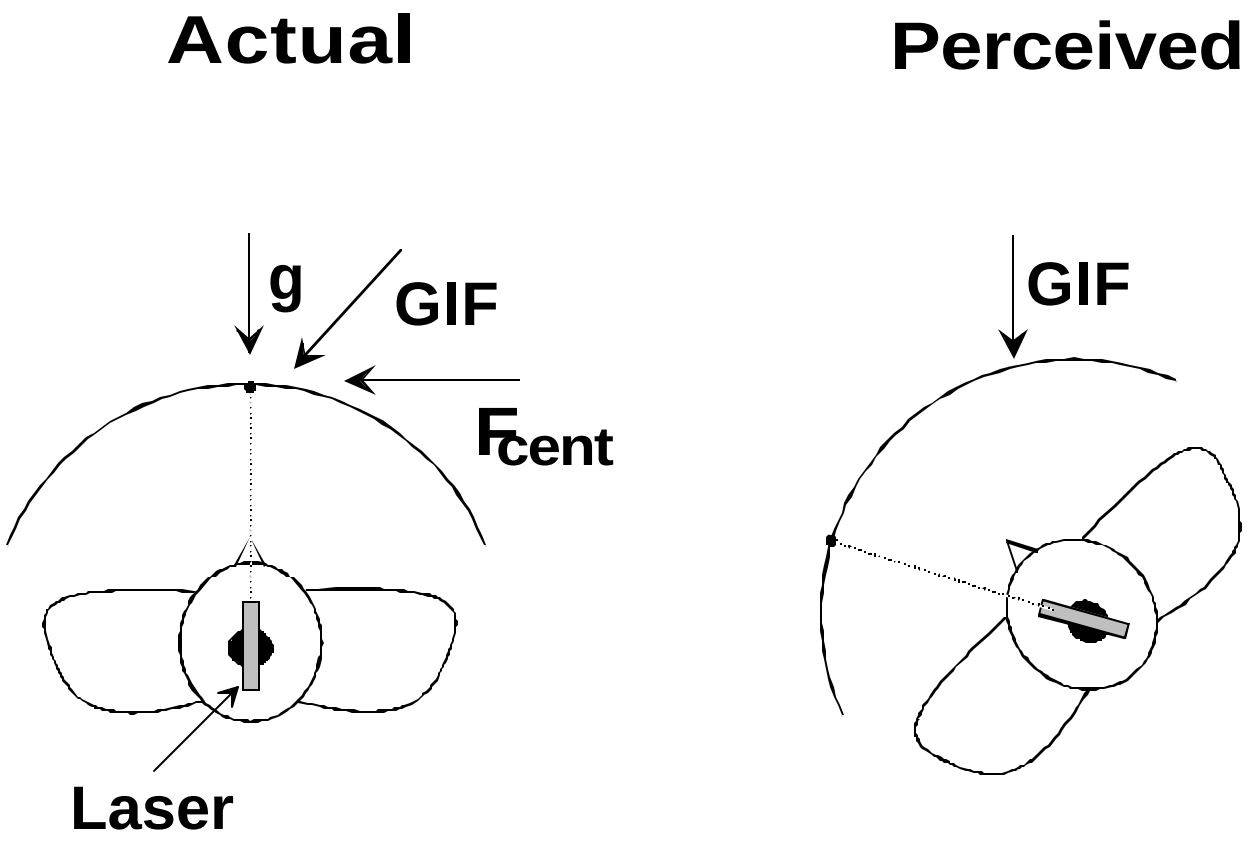

ACTUAL
visual
target
Centripetal force
Resultant
Contact force
(against gravity)
Rotation axis
PERCEIVED
visual
target
Centripetal force
Contact force
(against gravity)
Resultant


Laser
Joystick
Tilting bed
Projection track


1
0
0
100
200
300
400
Time (sec)
Angular velocity
GIF magnitude
GIF angle


N=8
Laser Setting
Room Velocity
Deg
RPM
Time (sec)
40
30
20
10
0
-10
-20
-30
-40
0
200
400
600


60?
GIF


Actual
Perceived
g
GIF
F
cent
Laser
GIF

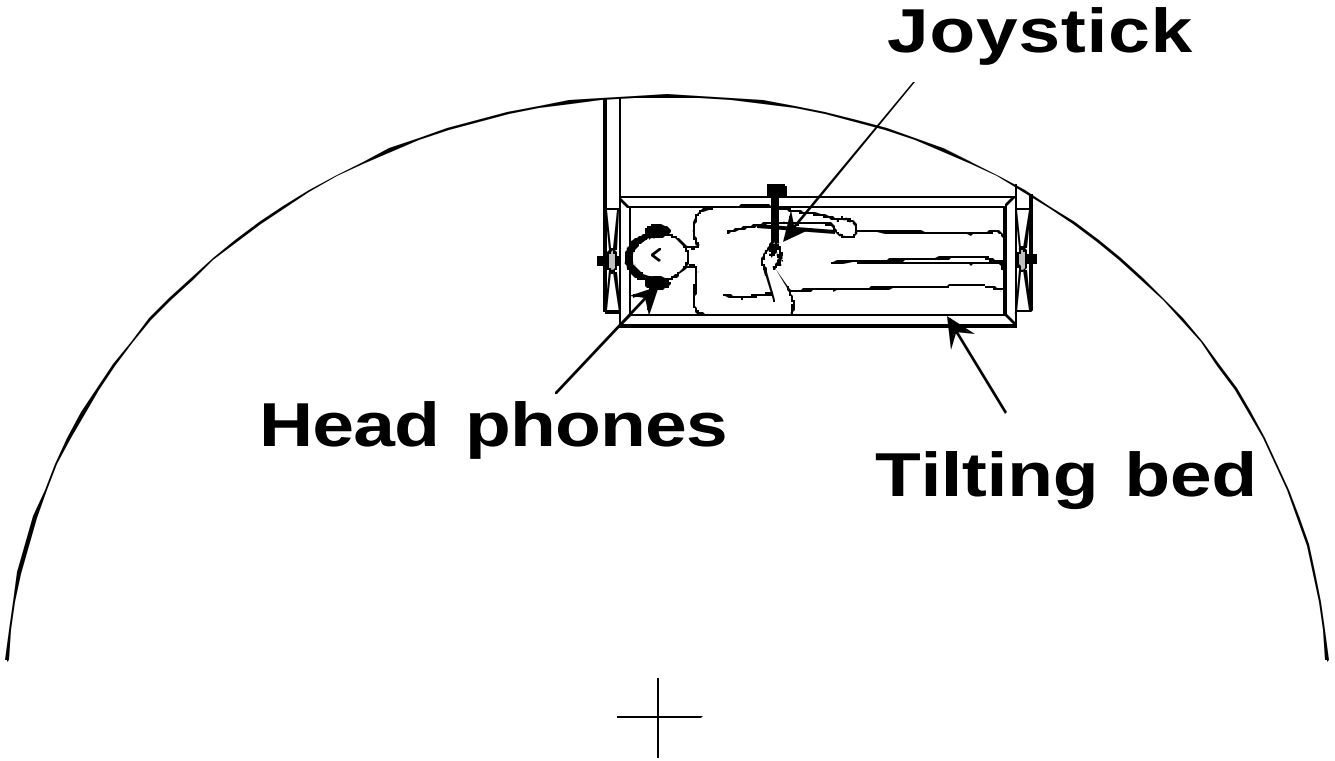
AUDITORY SPATIAL LOCALIZATION CUES

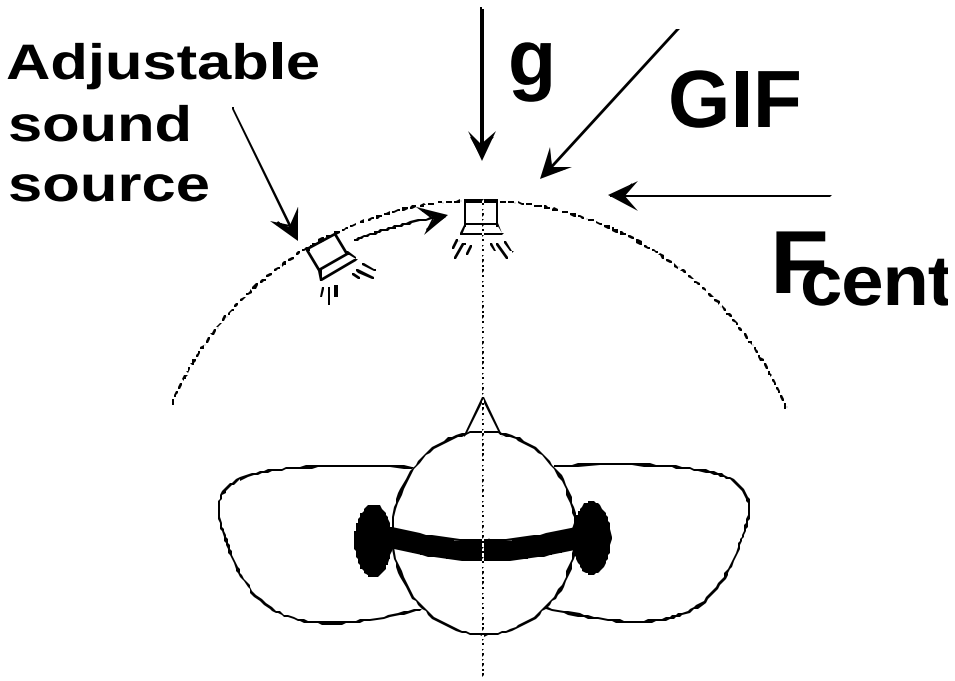
INTERAURAL TIME DIFFERENCES

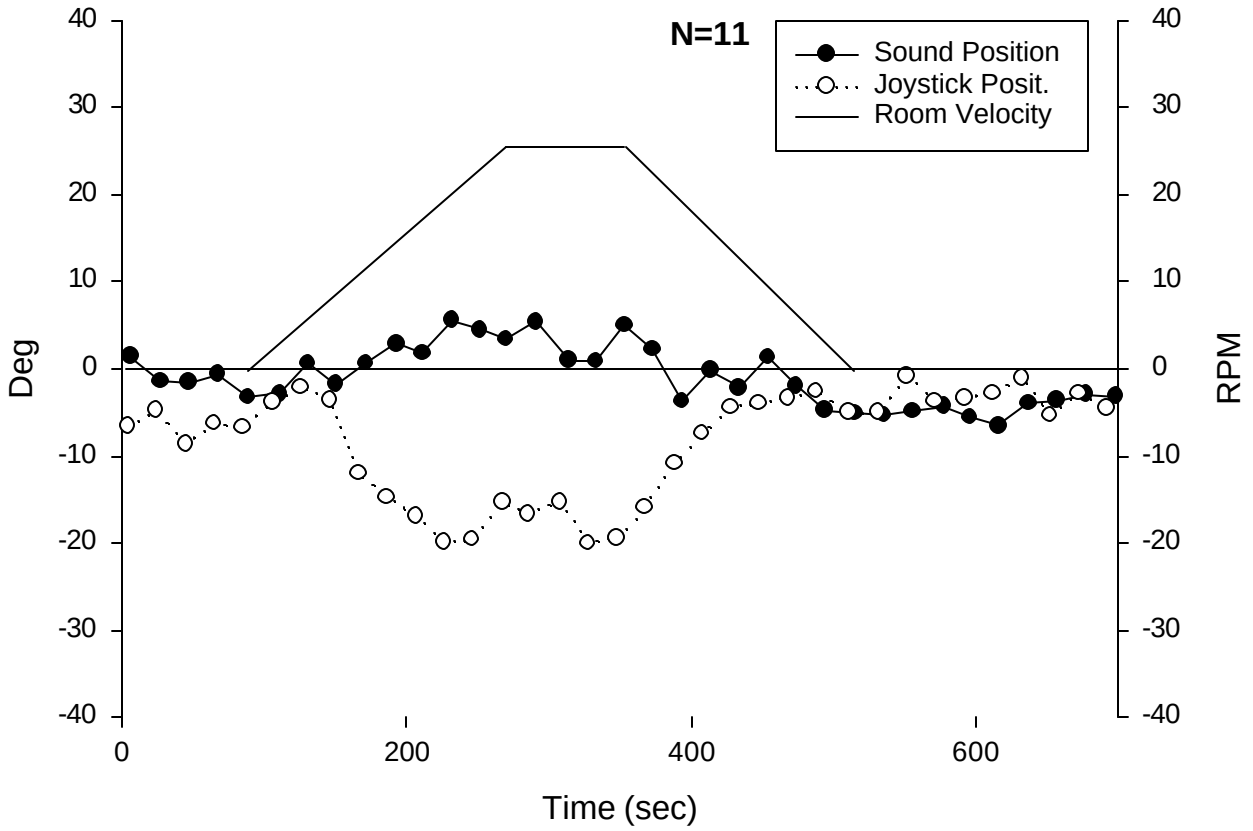
INTERAURAL INTENSITY DIFFERENCES

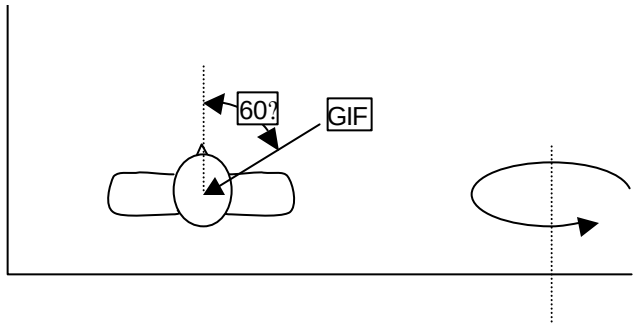
HEAD RELATED TRANSFER FUNCTIONS

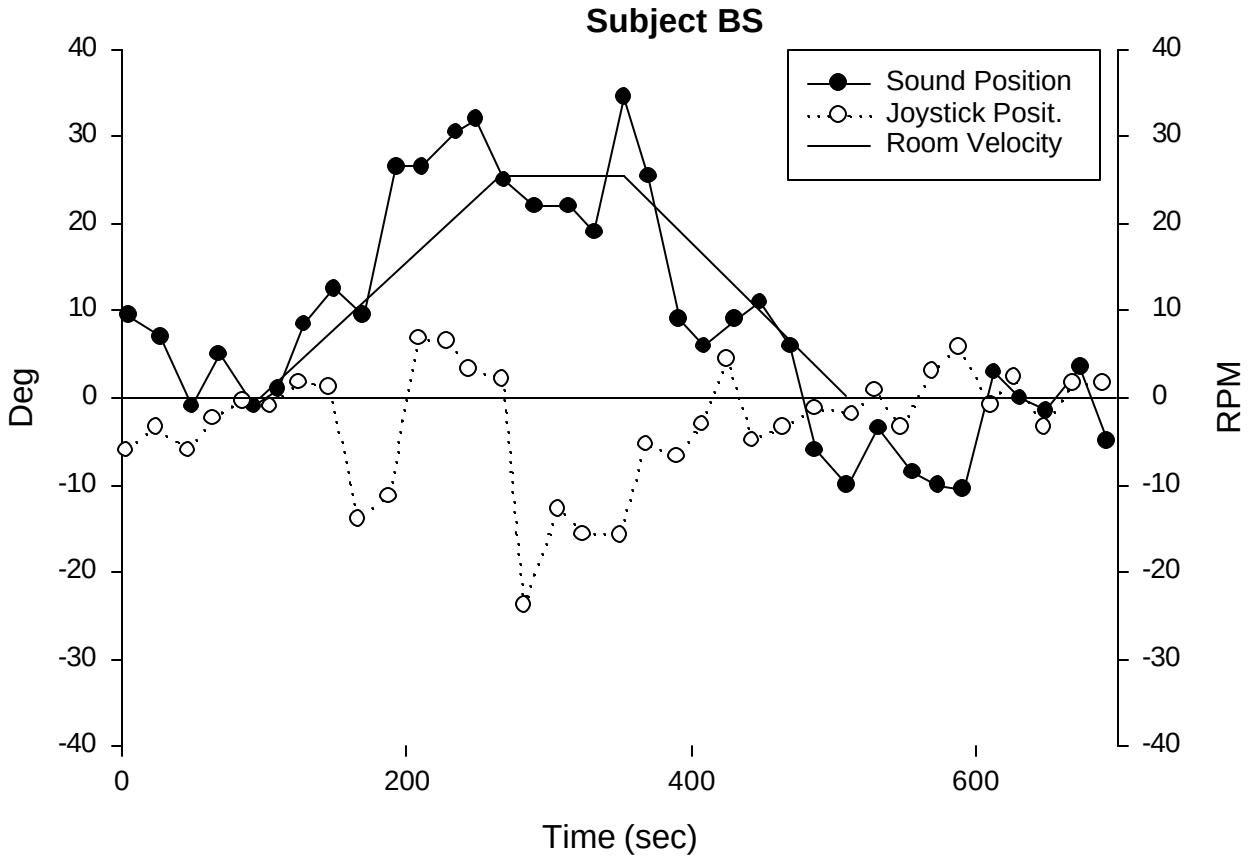
CONVOLVOTRON

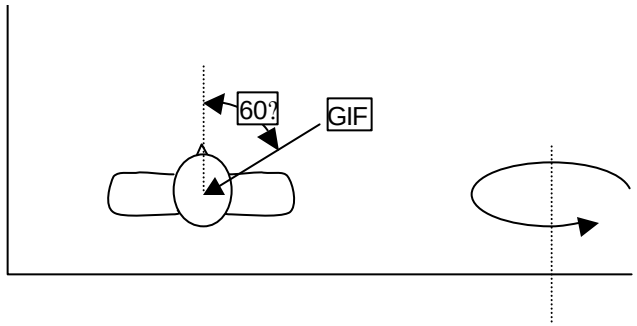

Joystick
Head phones
Tilting bed


Adjustable
sound
source
g
GIF
Fcent

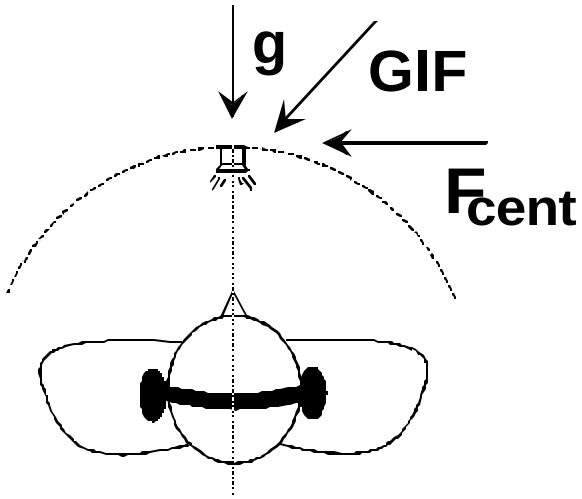

N=11
Sound Position
Joystick Posit.
Room Velocity
Deg
RPM
Time (sec)
40
30
20
10
0
-10
-20
-30
-40
0
200
400
600


60?
GIF

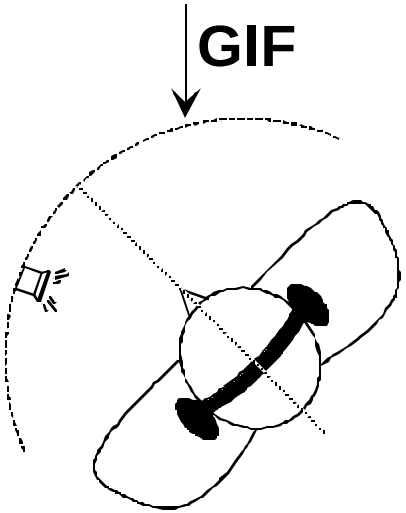

Subject BS
Sound Position
Joystick Posit.
Room Velocity
Deg
RPM
Time (sec)
40
30
20
10
0
-10
-20
-30
-40
0
200
400
600

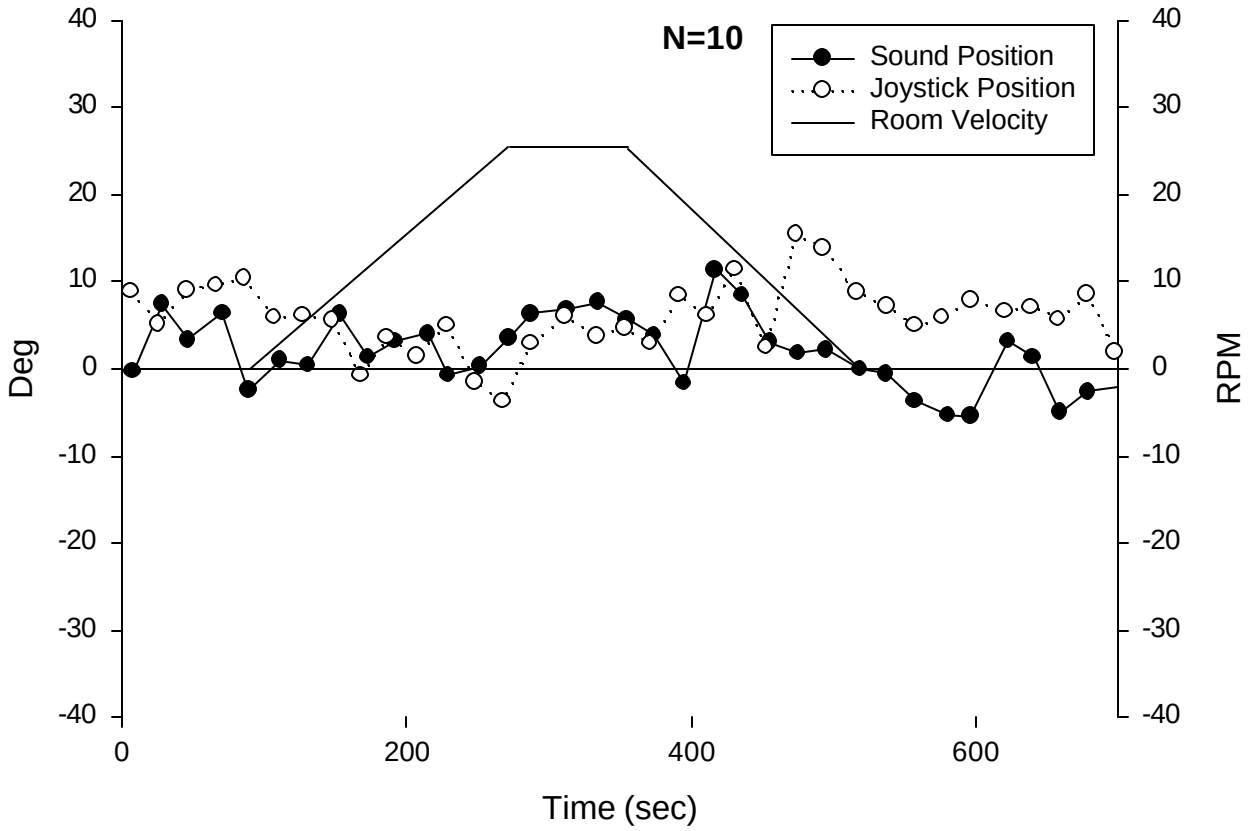

60?
GIF

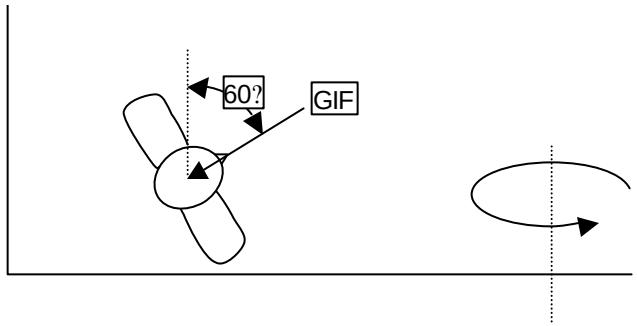
Actual



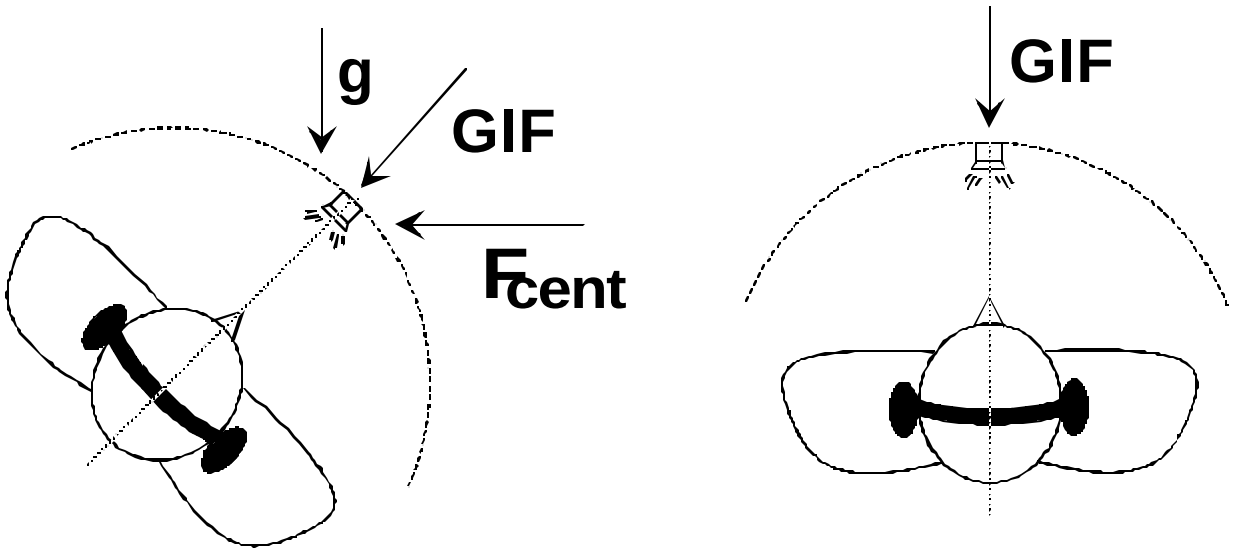
Perceived

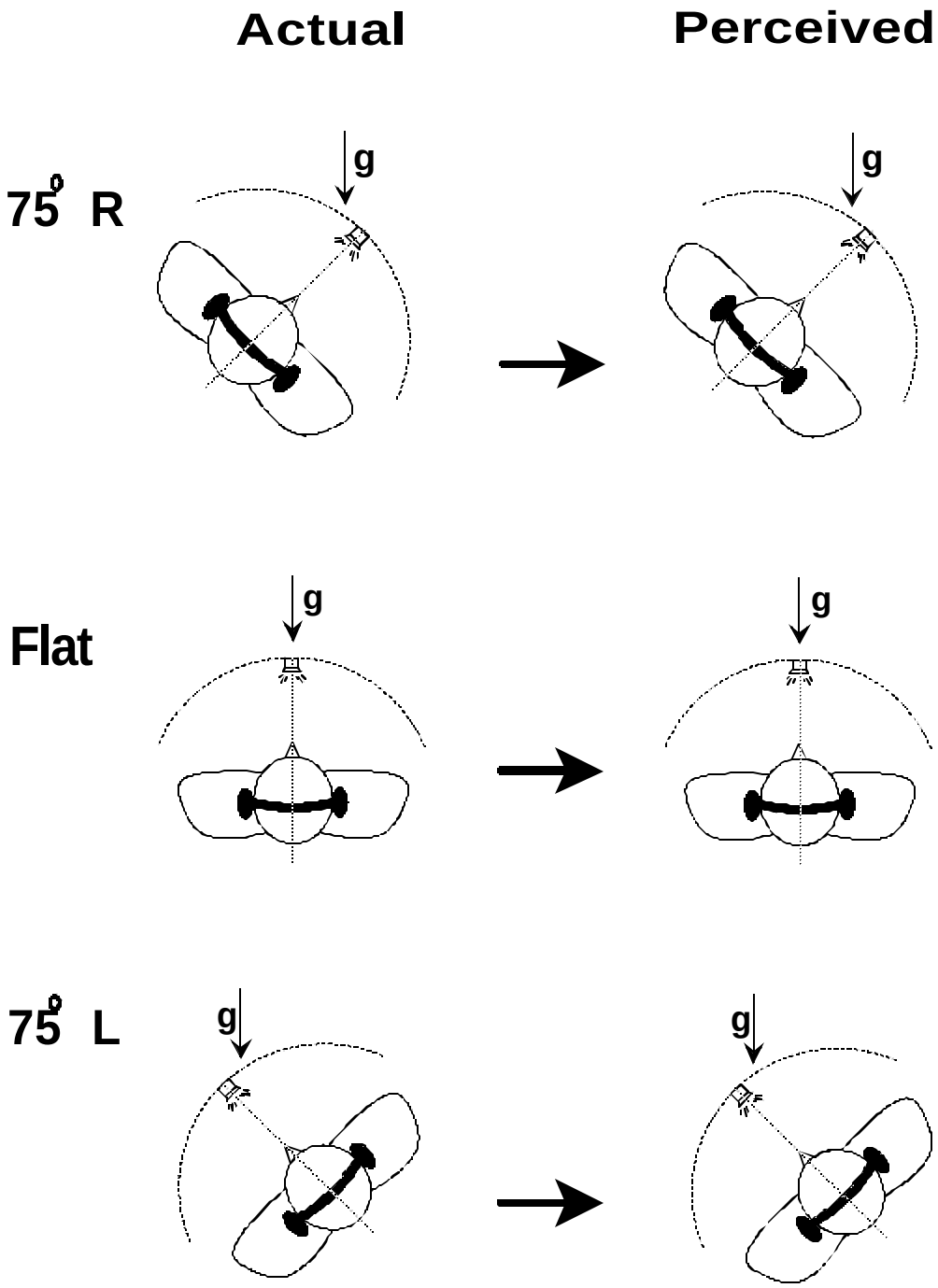


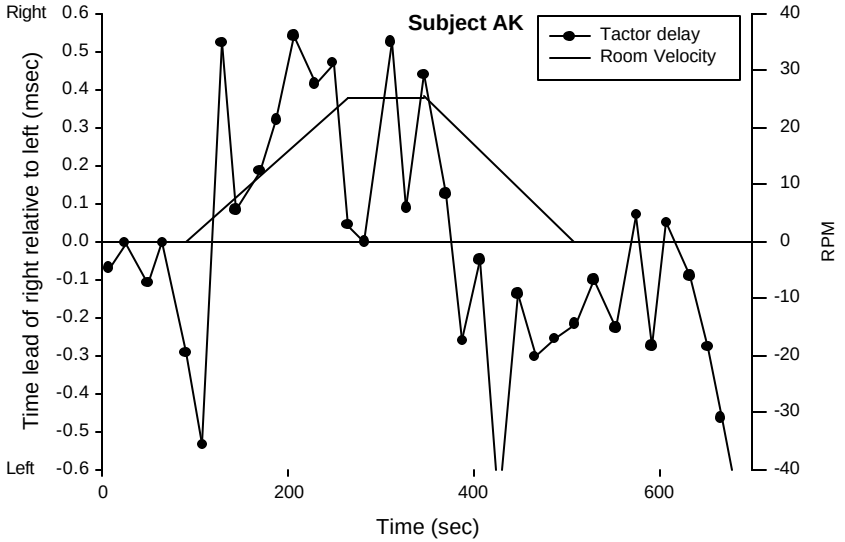

N=10
Sound Position
Joystick Position
Room Velocity
Deg
RPM
Time (sec)
40
30
20
10
0
-10
-20
-30
-40
0
200
400
600

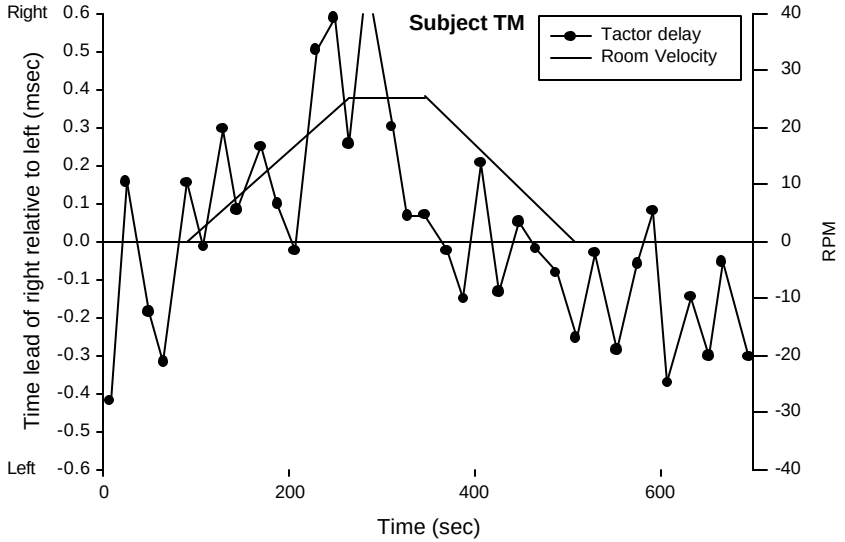

60?
GIF

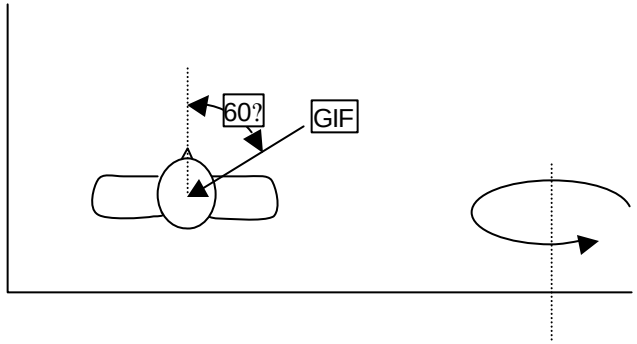
Actual **Perceived**



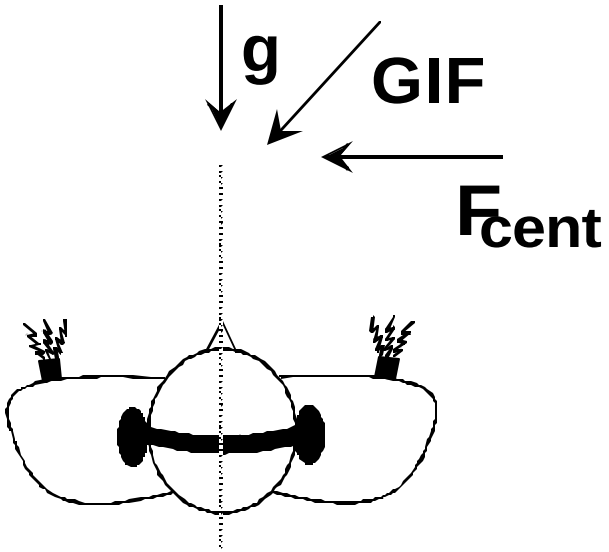

Actual
Perceived
75° R
g
g
Flat
g
g
75° L
g
g


Subject AK
Tactor delay
Room Velocity
Right
Left
Time lead of right relative to left (msec)
RPM
Time (sec)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
40
30
20
10
0
-10
-20
-30
-40
0
200
400
600

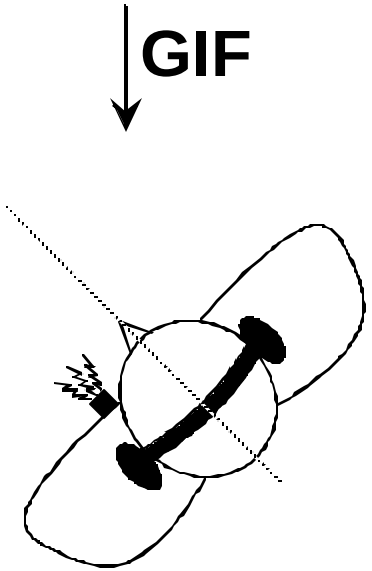

Subject TM
Tactor delay
Room Velocity
Right
Left
Time lead of right relative to left (msec)
RPM
Time (sec)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
40
30
20
10
0
-10
-20
-30
-40
0
200
400
600


60?
GIF

Actual



Perceived



CONCLUSIONS

EXPOSURE TO HIGH GIF LEVELS NON-PARALLEL WITH THE SAGITTAL PLANE ELICITS:

1. SHIFTS IN APPARENT BODY ORIENTATION RE EXTERNAL SPACE

2. ALTERATIONS IN BODY-RELATIVE LOCALIZATION OF VISUAL, AUDITORY, AND SOMATOSENSORY STIMULI

GIF-INDUCED ALTERATIONS IN BODY-RELATIVE SENSORY LOCALIZATION RAISE THE POSSIBILITY THAT SENSORY SPATIAL-CUEING DEVICES TO PREVENT DISORIENTATION COULD EXACERBATE THE PROBLEM IN DYNAMIC CONDITIONS.