Aiming & Arm-hand Steadiness

University of Jordan

Lab Human

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Part A: Aiming

❖ Objectives:

Measure the aspects of Aiming, eye-hand coordination.

❖ Background:

Aiming entails the ability to accurately guide one's hand to a fixed point, differing from arm-hand steadiness as it involves deliberate motion rather than maintaining stillness. Such abilities are especially vital in tasks demanding precision, as seen in dentistry where a dentist meticulously positions a drill on a specific tooth.

Hole-Type Steadiness Tester:
This tester measures hand stability and coordination by having participants insert a stylus into various holes, starting from the largest. It can indicate stress levels and physical readiness.

Slot-Type Steadiness Tester:
Assessing arm steadiness and coordination, this tester requires participants to move a stylus from a wider to a narrower slot. It's useful for tasks involving both movement and precision.

❖ Equipment:

The hole plate, a manual dexterity assessment, tasks participants with maneuvering a metal-tipped stylus through increasingly smaller holes without contacting the sides.

Hole diameters: 1.156, 1.125, 0.5, 0.312, 0.25, 0.187, 0.109, 0.093, 0.078 inches.

Stylus diameter: 0.0625 inche.

❖ Procedure:

1. Stand comfortably, holding the stylus in your dominant hand.
2. Reset the counter and stopwatch to zero.
3. Set the toggle switch to the starting position.
4. Begin the stopwatch.
5. Swiftly insert the stylus into each of the 9 designated holes without touching the edges. Note the time and any errors.
6. Stop the stopwatch upon removing the stylus from the final hole.
7. Record the time taken and the number of contacts on the impulse counter.

For the slot-type plate:

1. Reset the counter and stopwatch to zero.
2. Set the toggle switch to the starting position.
3. Begin the stopwatch.
4. Guide the stylus from the wider end to the narrower end.
5. Document touches, time, distance of the initial error, or progress over multiple attempts.

Note: Keep the stopwatch and counter running until all 9 holes are completed.

Scoring:

The score includes the time elapsed, and the number of contacts registered on the impulse counter.

Note: Subjects should avoid resting their arm on the table to prevent an arc-like hand movement that could hinder performance. Moving the arm along the table can act as a guide, potentially improving performance. Proper equipment alignment, parallel to the subject and at the correct distance from the elbow/shoulder, is essential.

❖ Tables:

Trail 1

Males	Time exp.	Time error	# of errors
1	7.92	0.941	8
2	9.83	0.105	2
3	6.1	0.314	3
4	5.71	0.104	2
5	5.18	0.924	6
6	5.13	1.516	11
7	13.42	0.453	4
8	7.06	0.523	6

Trail 2

Males	Time exp.	Time error	# of errors
1	6.98	0.504	6
2	9	0.053	1
3	6.2	0.612	6
4	4.98	0.052	1
5	6.33	0.472	5
6	6.23	0.748	7
7	7.91	0.314	5
8	9.1	0.522	5

Trail 1

Females	Time exp.	Time error	# of errors
1	13.16	0.487	6
2	11.21	0.61	6
3	6.92	0.313	3
4	9.65	0.401	5
5	7.9	0.419	4
6	13.53	1.917	20
7	9.06	0.662	7
8	8.85	0.122	2

Trail 2

Females	Time exp.	Time error	# of errors
1	8.77	0.278	3
2	11.36	0.62	5
3	6.11	0.158	2
4	8.94	0.678	5
5	12.29	0.244	2
6	10.16	1.255	14
7	9.1	0.365	3
8	9.93	0.366	6

Trail 3

Males	Time exp.	Time error	# of errors
1	5.95	0.349	6
2	7.26	0.175	2
3	10.86	0.211	3
4	9.18	0.332	6
5	6.53	0.382	4
6	6.38	0.608	8
7	7.63	0.245	3
8	9.21	0.715	8

Trail 3

Females	Time exp.	Time error	# of errors
1	9.88	0.191	3
2	9.32	0.261	2
3	5.14	0.123	2
4	9.31	0.487	4
5	10.71	0	0
6	10.47	0.505	7
7	8.66	0.453	6
8	8.63	0.192	3

Trail 1

Males	Time exp.	Time error	# of errors
Mean	7.54	0.61	5.25
Std.dev	2.853	0.487	3.151

Trail 2

Males	Time exp.	Time error	# of errors
Mean	7.09	0.41	4.50
Std.dev	1.461	0.252	2.268

Trail 3

Males	Time exp.	Time error	# of errors
Mean	7.88	0.38	5.00
Std.dev	1.715	0.191	2.330

Trail 1

Females	Time exp.	Time error	# of errors
Mean	10.04	0.62	6.63
Std.dev	2.394	0.552	5.655

Trail 2

Females	Time exp.	Time error	# of errors
Mean	9.58	0.50	5.00
Std.dev	1.863	0.355	3.928

Trail 3

Females	Time exp.	Time error	# of errors
Mean	9.02	0.28	3.38
Std.dev	1.741	0.186	2.264

1.Fastest and Most Accurate Subjects:
- Fastest Subject: Identify the individual with the lowest mean error time from the provided data for both females and males.
- Most Accurate Subject: Identify the individual with the lowest mean error from the provided data for both females and males.

What it Indicates:
- A faster subject suggests superior hand-eye coordination and aiming proficiency.
- A more accurate subject implies greater precision in stylus placement, minimizing errors.

2. Effect of Decreasing Hole-Diameter on Errors:
As the hole diameter decreases, there's a proportional increase in task difficulty and the likelihood of contacting the edges. Smaller holes offer less room for error, making it harder for subjects to insert the stylus without touching the sides.

3. Visual Acuity's Role:

Visual acuity could be significant in this experiment, particularly as it involves maneuvering a stylus into progressively smaller holes. Subjects with better visual acuity might have an advantage in accurately placing the stylus without errors, as they can discern the hole boundaries more precisely.

FACTORS THAT EFECT Aiming:

1. Experience and Training:

Individuals with greater experience or specific training in aiming tasks tend to demonstrate enhanced accuracy and consistency.

2. Psychological Factors:

Psychological aspects such as attention, concentration, and motivation play a crucial role in determining performance in aiming tasks.

3. Target Characteristics:

The size, shape, and contrast of targets on the aiming device significantly affect the ease or difficulty of achieving accurate aim.

4. Distractions:

External disturbances like noise or movement in the environment can disrupt concentration and adversely affect aiming performance.

5. Feedback and Reinforcement:

The timing and availability of feedback or reinforcement during the aiming task play a vital role in influencing performance and the learning curve.

❖ Sources of Error:

1. Human Variability:

Individual disparities among participants, encompassing differences in motor skills, coordination, and perception, can introduce variability into the results.

2. Equipment Limitations:

Inherent limitations within the equipment utilized, including the aiming device or measuring devices, may influence the outcomes.

3. Aiming Device Design and Instructions:

The design of the aiming device and the clarity of instructions provided to participants can inadvertently introduce errors into the process.

4. Human Error and Biases:
Errors in recording measurements, misinterpretation of data, or biases in data analysis are potential sources of inaccuracies that can affect the validity of the results. .

Conclusion:

Q: What is the effect of decreasing the hole diameter on the number of errors shown on the counter?
A: Decreasing the diameter of the hole leads to an increase in errors in both segments of the experiment.

Q: Is there a need for visual acuity in this experiment?
A: Yes, visual acuity is essential, particularly for enhancing eye-hand coordination and improving performance in the aiming experiment. However, it doesn't significantly impact the steadiness aspect of the experiment.

Part B: Arm-hand steadiness

❖ Objectives:

Measure the aspects of steadiness, arm-hand coordination.

❖ Background:

Arm-hand steadiness pertains to the ability to sustain a particular hand and arm position for a short duration, which is especially vital in precision-focused occupations such as dentistry or watch repair. In these professions, it's imperative to hold precision tools steadily for brief periods. Unlike aiming tasks, arm-hand steadiness doesn't rely on eye-hand coordination.

❖ Equipment:

Using a hole plate manipulative dexterity test, participants are instructed to hold a metal-tipped stylus within 9 holes of decreasing diameter without contacting the sides.

Hole diameters: 1.156, 1.125, 0.5, 0.312, 0.25, 0.187, 0.109, 0.093, 0.078 inches.
Stylus diameter: 0.0625 inches.

❖ Procedure:

1. Stand comfortably near the hole plate, grasping the stylus with your dominant hand.
2. Reset both the counter and stopwatch to zero.

3. The instructor, holding the stopwatch, prepares to flip the toggle switch.
4. Flip the toggle switch and start the stopwatch simultaneously.
5. Insert the stylus into each of the specified 9 holes without touching the edges for 15 seconds. Record any errors on the counter for each edge touch.
- Note: Reset the stopwatch for each hole but do not reset the counter until all 9 holes are completed.

6. Record the total number of contacts registered on the counter.

Scoring: The score is determined by the cumulative number of contacts across all nine holes, reflecting the participant's arm-hand steadiness throughout the task

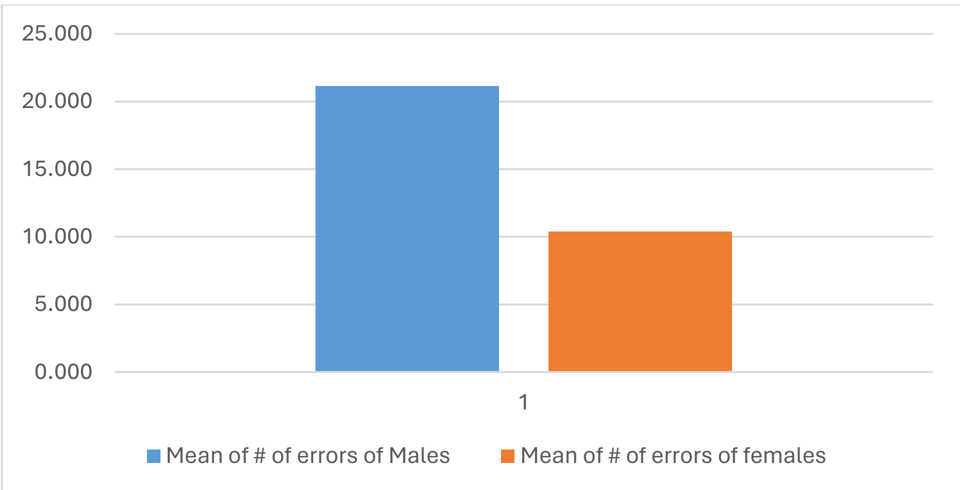
❖ Tables:

Name	Number of errors	Time of error
1	27	6.801
2	49	7.048
3	28	18.219
4	5	7.952
5	0	0.000
6	40	4.964
7	6	2.628
8	14	1.062
Mean	21.125	6.084
Std.dev	17.732	5.702

Table 1: Male's Data

Name	Number of errors	Time of error
1	11	0.700
2	6	0.452
3	1	0.052
4	2	0.332
5	10	2.263
6	21	1.690
7	26	2.403
8	6	0.382
Mean	10.375	1.034
Std.dev	8.895	0.937

Table 2: Female's Data



FACTORS THAT EFECT arm-hand steadiness

1. Individual Factors:

a. Age: Older individuals might experience diminished muscle control and heightened tremors, potentially impacting arm-hand steadiness.

b. Physical Fitness: General strength, muscle tone, and coordination abilities play a role in steadiness.

c. Medications: Certain medications can induce muscle weakness or tremors, influencing steadiness.

2. Task Duration:

Longer durations can induce fatigue, which may affect arm-hand steadiness over time.

3. Environmental Factors:

a. Temperature and Humidity: Extreme temperatures or humidity levels can affect hand grip and muscle function, potentially impacting steadiness.

b. Lighting Conditions: Poor lighting can hinder depth perception, affecting hand-eye coordination and steadiness.

❖ Sources of Error:

1. Variations in individual abilities, coordination, and tremor levels among participants can introduce variability in the results.

2. Equipment related errors: The instruments used to measure arm and hand steadiness, such as sensors, force transducers, or motion tracking devices, may have some inherent limitations.

3. Errors can occur during data collection, recording, or analysis. Human error in recording measurements or software glitches in data processing can introduce inaccuracies.

4. The specific tasks chosen for the experiment may not fully capture the complexities of real-world arm and hand movements.

Conclusion:

1. The difference between aiming and arm-hand steadiness procedure lies in their focus and execution:

- Aiming involves aligning the eye, hand, and target in a straight line and making adjustments based on feedback. It's about precision and accuracy in directing towards a target.
- Arm-hand steadiness focuses on maintaining stability in the hand and arm while holding or moving an object, minimizing tremors or unwanted movements that could affect accuracy. It's about stability and control.

2. Effect of Decreasing Hole-Diameter on Errors:

Decreasing the hole diameter increases the difficulty and likelihood of contacting the edges. Smaller holes offer less room for error, making it harder to insert the stylus without touching the sides.

3. Need for Visual Acuity:
Visual acuity, the ability to discern fine details and objects, is crucial for this experiment. It impacts the accuracy and speed of inserting the stylus into holes of different sizes. Poor visual acuity may lead to difficulty in perceiving hole edges clearly, potentially resulting in more errors or contacts with the sides. Therefore, visual acuity significantly influences subject performance in the experiment.