Gender Differences in the Effects of Subjective Feedback – a Computer Game-Based Experiment

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Overview 1.

Does the effect of subjective feedback on performance differ by gender?

- Types of supervisory (teacher, boss) feedback
  - **Performance feedback**: info about performance
    - „You scored 67 points."
  - **Praise**: info about performance + the environment's valuation of it
    - „67 points, good job!"
  - **Encouragement**: info about environment's expectation of future performance
    - „You can do it."
- Model: individual's choice of effort in a given task
  - Expected benefit – expected cost
  - **Differential impact of feedback types by personality and gender**
    - **Self confidence**

Overview 2.

Does the effect of subjective feedback on performance differ by gender?

- **Test**: online computer game, randomized feedback
  - Control: Objective feedback (score)
  - Treatment 1: Objective feedback (score) + Praise
  - Treatment 2: Objective feedback (score) + Encouragement

- **Analysis**: effort and performance
  - mean differences in outcomes by feedback type
  - difference in these differences by gender

➔ **Gender differences in response to subjective feedback**
➔ **Channel: differences in personality/self-confidence**

Implications

Does the effect of subjective feedback on performance differ by gender?

- Females could perform better in a different environment, a a more **suitable „mix" of feedback**
- Current/undifferentiated supervisory communication may lead to **gender differences** and **quantifiable losses in performance** (inefficiency)
- Also important for student/employee **motivation by personality type**
- Different effectiveness of feedback types along ability distribution

Previous literature: Psychology & IO Psychology

- **Motivational impact of feedback**, forms of praise, channels (Henderlong and Lepper, 2002)
  - little about encouragement
- Various theories:
  - Self-determination theory (Deci and Ryan 1985, 2000)
  - Cognitive evaluation theory (Deci et al 1975)
  - **Goal setting theory** (Locke 1996, Bandura 1986)
    - Basis of our model
  - **Core Self-Evaluations,CSE** (Judge, Locke and Durham 1997)
    - Focus on self confidence
- Common conclusions:
  - **Individual differences** can lead people to interpret the same feedback as encouraging, neutral, or discouraging
  - **Individual factors** as well as **environmental factors** play an important role

Previous literature: Economics

- The impact of **objective performance feedback**
  - Bandiera et al 2012 - grade,
  - Azmat and Iriberri 2010 – own grade and class grade,
  - Hannan et al 2008 – relative performance feedback under various compensation schemes
- Usually find a **positive** impact
  - High ability, low self confidence females

- Economic methodology:
  - large-scale experiments
  - heterogeneity (which groups are effected?)
  - Focus on performance – economic implications
  - but: less detailed in discussing underlying theories and channels

Contribution

- Bring together theories and evidence on **objective/subjective feedback** from **economics/psychology**
- **Build an encompassing model:** allows the analysis of both objective and subjective feedback
    - Praise, encouragement not studied in economic framework yet
    - Encouragement rarely studied even in a psychology framework
    - Types not previously tested in relation to each other
- **Online game method**
  - Large potential sample, easy utilization,
  - High quality, detailed data
  - Possibilities for future tests: combinations of feedback types, by task type, by frequency of feedback, by source of feedback, peer effects and competitiveness, differences in goal-setting, task clarity, etc…

Model: Information content of feedback types

- I_o: **objective information** about performance:
  - **Performance feedback (score)**

➔ Shown to affect expectations of performance

- I_E: **subjective information** about performance from enviroment
  - I_{EP}**: Praise** : about **past** performance
  - I_{EF}**: Encouragement** : about **future** performance

➔ May affect **expectations of the environment and performance**

- Focus on I_E – differentiation of I_{EF} and I_{EP} is trivial

Utility maximization

Individuals choose effort (e) to:

$$\max_{e} E(U) = \{\Psi + \Gamma(S)\} * e$$

- e: effort
  - play or not ($e = 1$ or 0)
  - how hard you try (($e = [0 \ldots \infty]$)
- Basic idea: Goal-setting theory (Locke 1996)
  - Ψ: success-independent part
  - $\Gamma(S)$: success-dependent part
- S: success = to reach a set goal
    - Be as good as you can, beat previous high score
  - Goals set by players endogenously, or by us?
    - Goal-setting may differ by personality/gender
    - No competition/peer info/ranking in our case

$$E(U) = \{\Psi + \Gamma(S)\} * e$$

1. Success-independent part: Ψ

$$\Psi_t = E_t(X) * R_{Xi} + I_{E,t-1} * R_{IE}$$

- X_i: factors that influence the individual's expected utility
  - e.g. *time, energy, learning, enjoyability, etc.*
- $E_t(X_i) = X_{t-1}$
  - baseline expectation (X_0): previous experience with games, game description
- R_{Xi}: returns (utility) the individual draws from factor i
  - $R_i < 0$ if factor i decreases the person's utility, e.g. time
- I_E: subjective environmental feedback
  - may serve as a direct source of utility

$$\Psi_t = X_{t-1} * R_X + I_{E,t-1} * R_{IE}$$

$$E(U) = \{\Psi + \Gamma(S)\} * e$$

2. Success-dependent part: $\Gamma(S)$

$$\Gamma_t(S) = E_t(S) * E(R) - \big(1 - E_t(S)\big) * E(L)$$

- $E_t(S)$ = individual's expected probability of success at time t

$$\mathrm{E_t(S)} = \mathrm{C_0} + \mathrm{I_{o,t-1}} * \mathrm{w_{IO}} + \mathrm{I_{E,t-1}} * \mathrm{w_{IES}}$$

  - baseline self confidence (C_0)
  - available information ($I_{o,t-1}$, $I_{E,t-1}$)
  - and the individual's weighting of the information (w_{IO} and w_{IE})

- $E(R)$ and $E(L)$: expected rewards and losses, constant over time
  - e.g.: prize/punishment, achievement/failure, praise/scolding, public pride/public shame, increased self-confidence/decreased self-confidence

$$\Gamma_t(S) = \big\{C_0 + I_{o,t-1} * w_{IO} + I_{E,t-1} * w_{IE}\big\} * E(R) - \big(1 - \big\{C + I_{o,t-1} * w_{IO} + I_{E,t-1} * w_{IE}\big\}\big) * E(L)$$

Optimal choice

$$E_t(U) = \{\Psi + \Gamma(S)\} * e = \left\{ \begin{matrix} \mathrm{X}_{\mathrm{t-1}} * \mathrm{R}_X + \mathrm{IE}_{,\mathrm{t-1}} * \mathrm{R}_{\mathrm{IE}} + \\ + \left(C + I_{o,t-1} * w_{IO} + I_{E,t-1} * w_{IE}\right) * E(R) - \\ -\left(1 - \left\{C + I_{o,t-1} * w_{IO} + I_{E,t-1} * w_{IE}\right\}\right) * E(L) \end{matrix} \right\} * e$$

- Choose $e^* = 1$ if $\frac{\partial E(U)}{\partial e} >= 0$
- $\varphi = \frac{\partial E(U)}{\partial e} = \Psi + \Gamma(S) = \left\{ \begin{matrix} \mathrm{X}_{\mathrm{t-1}} * \mathrm{R}_X + \mathrm{IE}_{,\mathrm{t-1}} * \mathrm{R}_{\mathrm{IE}} + \\ + \left(C + I_{o,t-1} * w_{IO} + I_{E,t-1} * w_{IE}\right) * E(R) - \\ -\left(1 - \left\{C + I_{o,t-1} * w_{IO} + I_{E,t-1} * w_{IE}\right\}\right) * E(L) \end{matrix} \right\}$
- **Effect of subjective feedback:** $\mathbf{\partial\varphi / \partial I_E = R_{IE} + w_{IE} * (E(R) + E(L))}$

Test 1: Subjective feedback

Does positive subjective feedback increase effort and performance?

- **Treatment effect:** I_E (treatment) raises $\mathrm{Prob}(e^* = 1)$, if:

$$\partial\varphi/\partial I_E = R_{IE} + w_{IE} * (E(R) + E(L)) > 0$$

  - R_{IE}: preference for supportive environment > 0
    - IE reflects how friendly / hostile the environment is towards me, thus I gain information about the environment (Bandura 1986)

  and/or

  - w_{IE}: belief updating parameter of subjective feedback > 0
    - IE reflects how the environment sees me, thus I gain information about myself that may enhance self-efficacy (E(S)) (Bandura 1986)

➔ Compare mean outcomes of control & treatment groups
  – cannot differentiate whether due to R_{IE} or w_{IE}

Test 2: Gender differences

- Large literature on **gender differences in personality traits**
  - Feingold 1994: males are more assertive and have higher self-esteem
  - McCarty 1986: women have lower self-confidence than men (even after positive feedback)
- **Different effect** of objective and subjective feedback by **personality**
  - Deci and Ryan (1980, 1985), Katz et al. (2006)
- Important channel: **self-confidence**

➔ Differences in personality by gender may lead to different feedback effects

Test 2: Gender differences

- R_{IE} and w_{IE} may be different along personality types (p)

$$\partial\varphi/_{\partial \mathrm{I_E}} = R_{IE}(p) + w_{IE}(p) * \big(E(R) + E(L)\big)$$

$$p = \begin{cases} 0 \;\; for\ low\ type: less\ confident \\ 1\ for\ high\ type: more\ confident \end{cases}$$

- Females may be less confident on average

$$\frac{1}{n} \sum_{i=1|i\ female}^{n} p_i < \frac{1}{k} \sum_{i=1|i\ male}^{k} p_i$$

Test 2: Gender differences

Does the effect of positive subjective feedback differ by gender?

- Treatment effect may be higher for women if:

$$\frac{\partial R_{IE}(p)}{\partial p} < 0$$

A supportive environment/positive feedback increases utility more for those with lower self-confidence

  - Harris et al., 2009: self-confidence can buffer the effects of social stressors, e.g. poor group climate

and/or

$$\frac{\partial w_{IE}(p)}{\partial p} < 0$$

The self-evaluation of those with lower confidence is affected more by feedback/environment

  - Ertac, 2011: females update beliefs differently

Test 2: Gender differences

Does the effect of positive subjective feedback differ by gender?

- Compare the treatment effect by gender
  - Gender difference in the difference by treatment

  – if higher for females:

  $\frac{\partial R_{IE}(p)}{\partial p} < 0$ and/or $\frac{\partial w_{IE}(p)}{\partial p} < 0$ holds

  – subjective feedback has a greater effect on females
    - cannot differentiate whether due to R_{IE} or w_{IE}

Test 3: Praise vs. Encouragement

Does the effect of praise differ from that of encouragement?

- I_{EF} (treatment) raises $Prob(e^* = 1)$ more than I_{EP} if:

$$w_{IEF}(p) > w_{IEP}(p)$$

- Potential channels:
  1. **Info about past vs. future performance** weighted differently in E(S)
  2. The magnitude of treatment differs:
     - Praise: **depends on performance**, more treatment for high performers
     - Encouragement: **independent of performance**

- Compare mean differences for control vs. praise and control vs. encouragement cases

Methodology

- **Computer game** on a website:
  - Data collection:
    - selected classrooms in various countries
    - online users
  - simple game, requires concentration and effort

- **Randomized treatment**:
  - Control (Praise): Performance feedback (level)
  - Control (Encour.): Performance feedback (score)
  - Praise: Performance feedback (level) + Praise
  - Encouragement: Performance feedback (score) + Encouragement

- Players receive same feedback if play again within each session, but not between sessions
  - Longer run effects
  - Can track individuals/sessions well: subsample analyses

The Shape Game

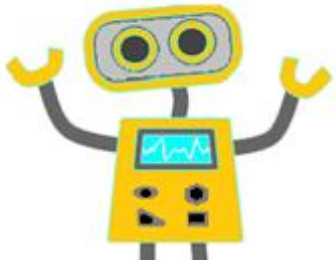
https://experimental-games.herokuapp.com/#12112016

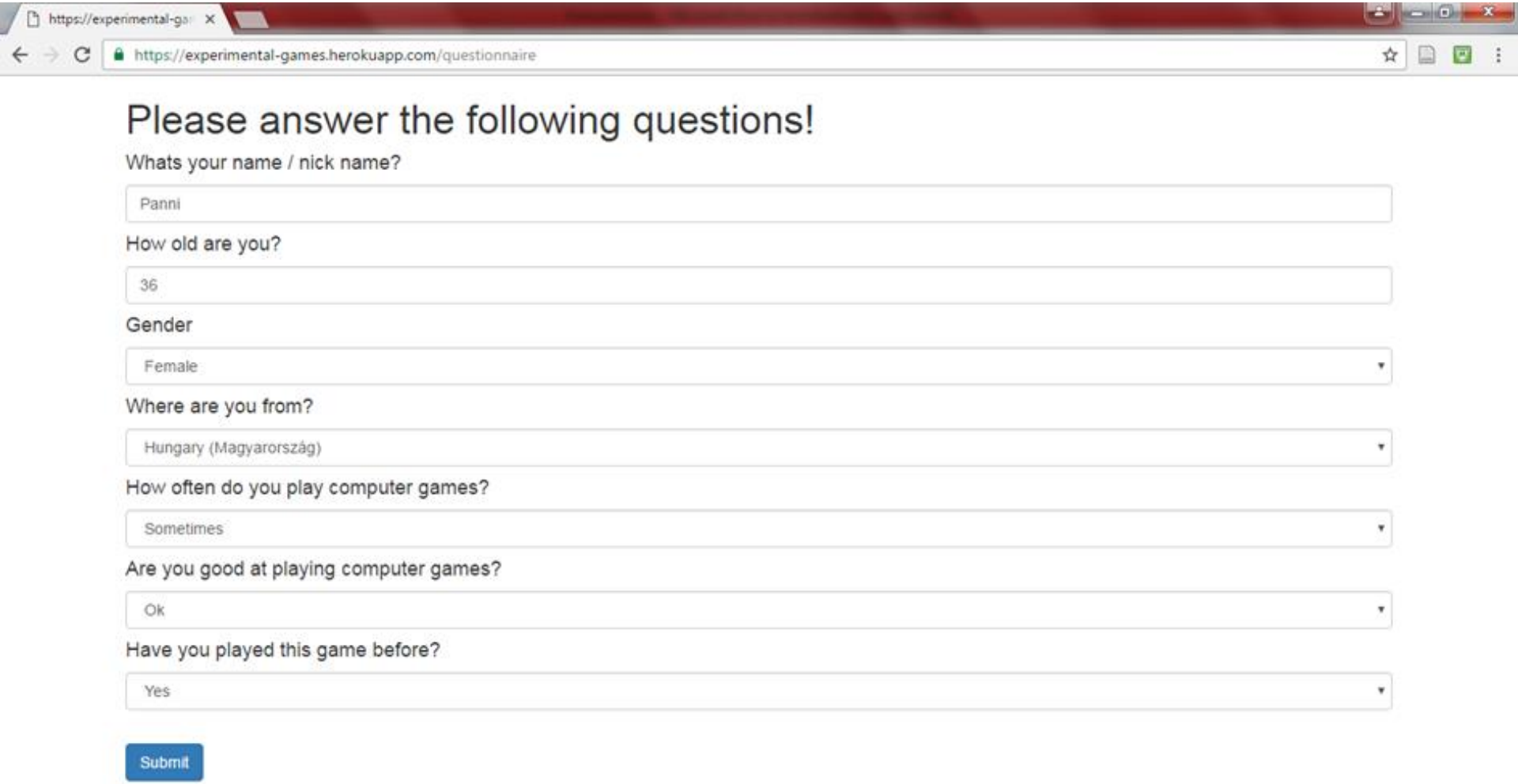
Experimental Games

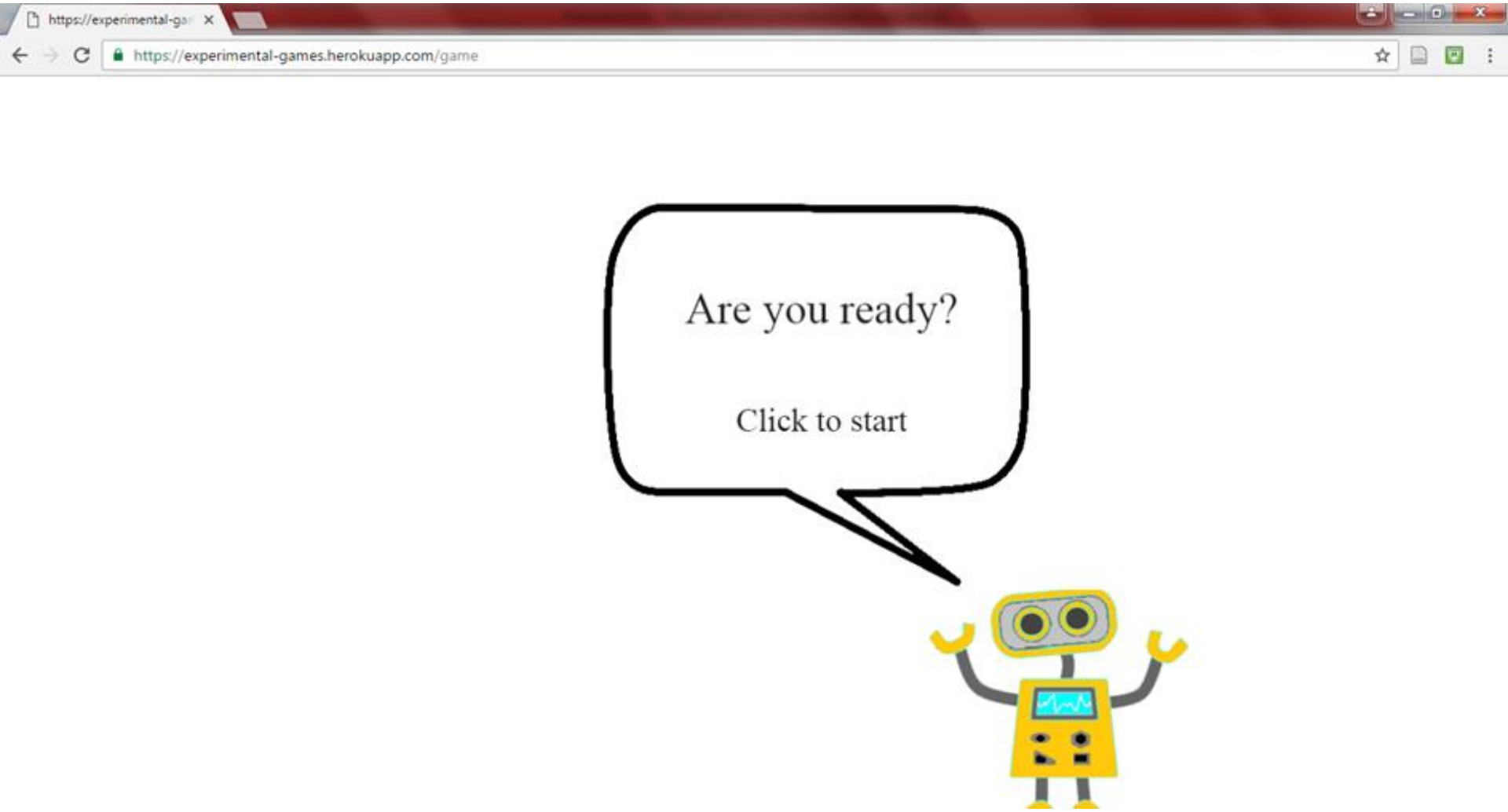
This is a website with free games made by the Virtual Research Collaboration. The games are free. We collect anonymous, simple data for our research on performance in different games. We thank you very much for helping our project, and hope you enjoy the games!

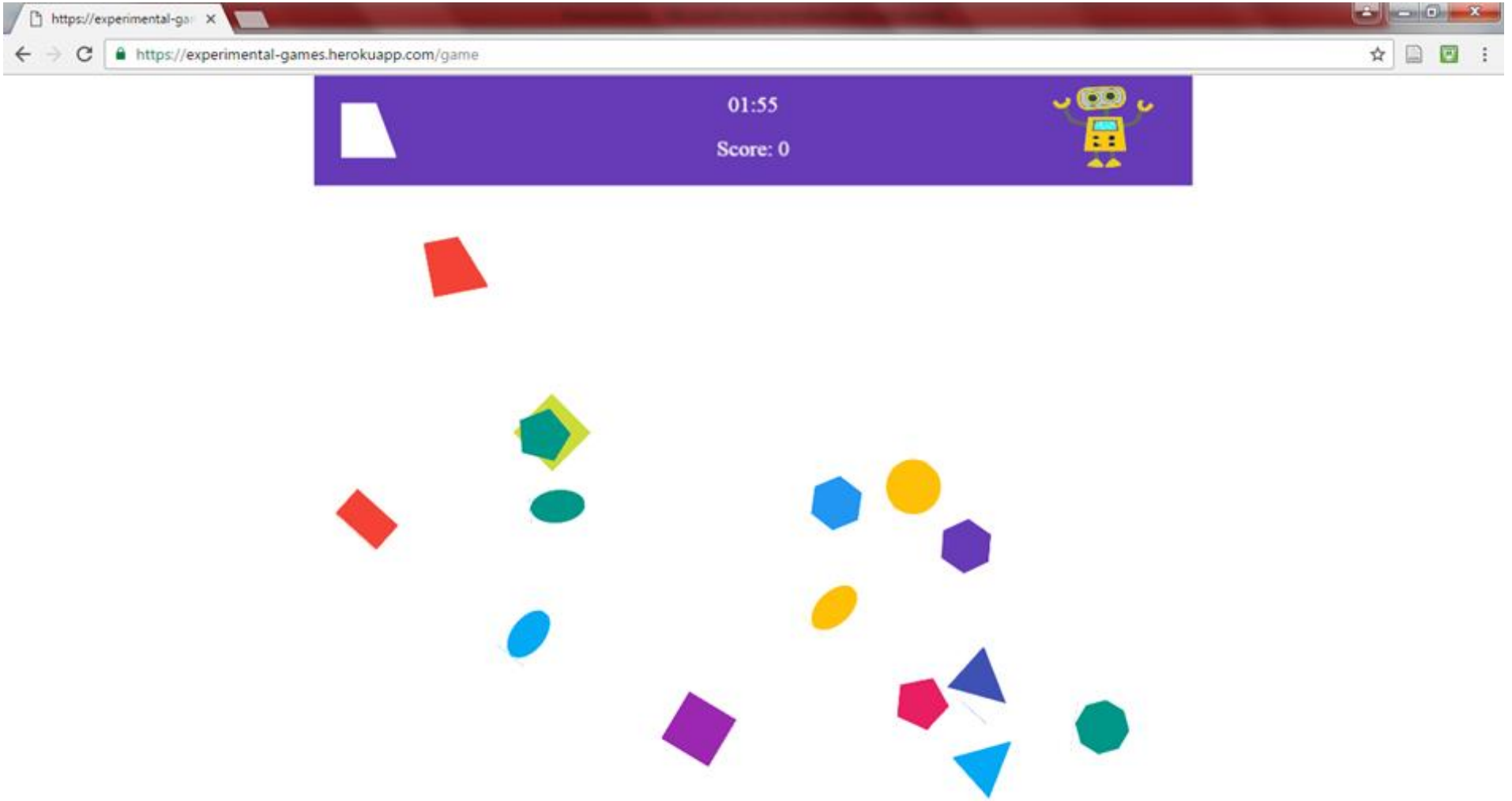
The Shape Game

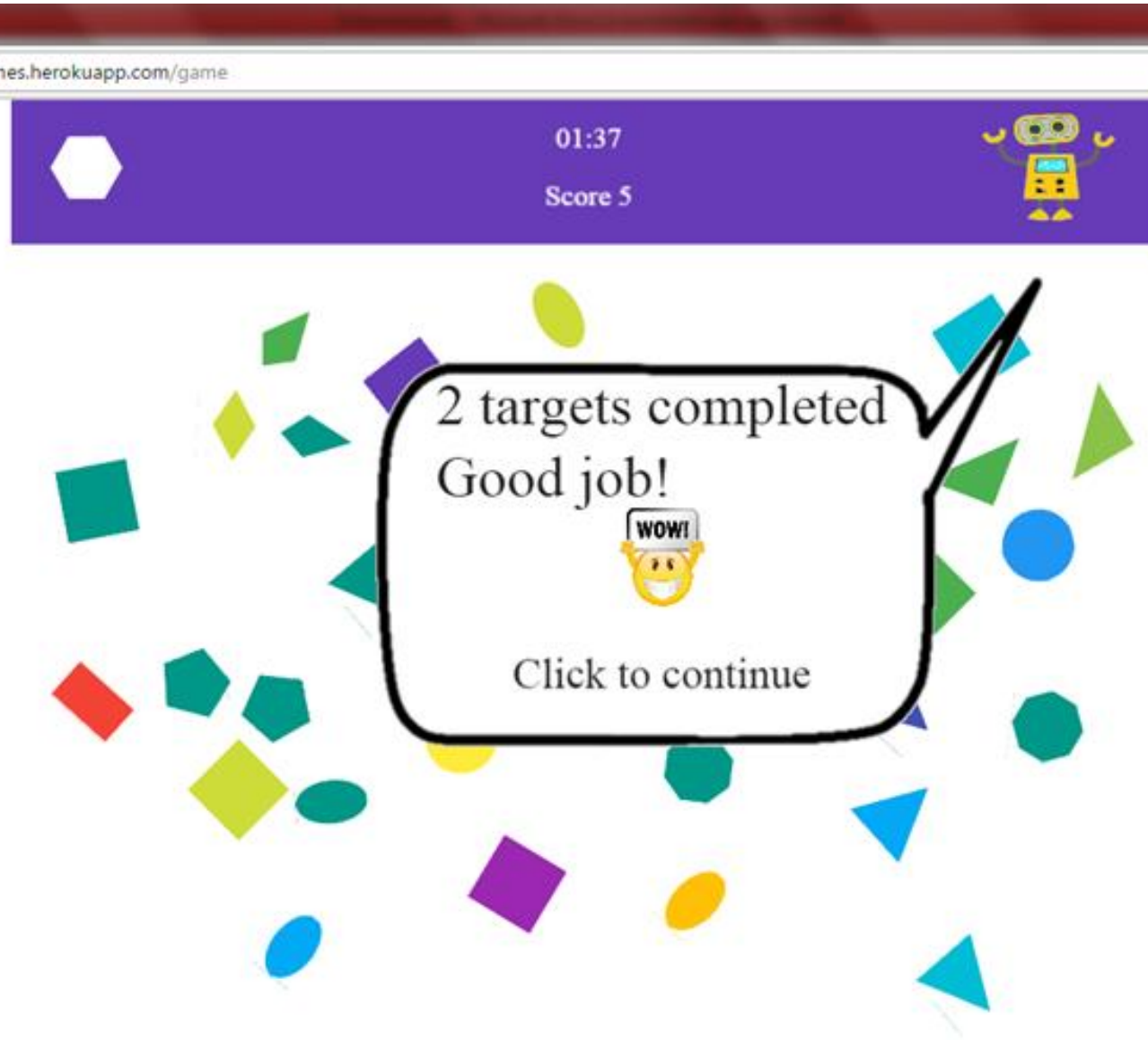
Click the shape shown in the top left corner. Find all of the shape to move on to the next shape. Find as many as you can to score points.




https://experimental-ga
https://experimental-games.herokuapp.com/questionnaire
Please answer the following questions!
Whats your name / nick name?
Panni
How old are you?
36
Gender
Female
Where are you from?
Hungary (Magyarország)
How often do you play computer games?
Sometimes
Are you good at playing computer games?
Ok
Have you played this game before?
Yes
Submit


https://experimental-ga
https://experimental-games.herokuapp.com/game
Are you ready?
Click to start


https://experimental-ga
https://experimental-games.herokuapp.com/game
01:55
Score: 0


https://experimental-ga
https://experimental-games.herokuapp.com/game
01:37
Score 5
2 targets completed
Good job!
WOW!
Click to continue

Feedback Specifications

Control (Praise)	
Trigger	**text**
start screen	Are you ready? "Click"
after 2nd, 5th, 10th, 15th, 20th... shape change	"X targets completed"
END	Score: XX Play again!

Control (Encour.)	
Trigger	**text**
start screen	Are you ready? "Click"
30/60/90 seconds	Score: X
END	Score: XX Play again!

Praise		
Trigger	**Picture**	**text**
start screen	x	Are you ready? "Click"
after 2nd, 5th, 10th, 15th, 20th... shape change		"X targets completed" + 3 texts alternate: "Good job!" or "Well done!" or "You're great!"
END		Congratulations! Score: XX Play again!

Encouragement		
Trigger	**Picture**	**text**
start screen		Are you ready? "Good luck!" "Click"
30		Score: X + "You can do it!"
60		Score: X + "Keep it up!"
90		Score: X + "Almost there!"
END		Score: XX + Play again!

Data

Rich data: every event (click/treatment), exact time (1000th second)

- **Outcome measures:**
  - Effort (number of clicks /whether plays again)
  - Performance (score overall/over time)
- **Identifiers**: track game/session/player
  - Tracking token, IP address, url slug, nickname
- **Survey**:
  - Gender, age, location
  - Whether player has played before
  - Whether player plays games often
  - How good player considers him/herself to be at playing games
  - Automatic: touchscreen or not
- **Samples**:
  - first/subsequent games or sessions
  - classroom vs. online user

Preliminary results: main stats

- Test 1: treatment effect?

Effort: clicks			
feedback	mean	SD	N
control_enc	57.2	17.6	12
control_pr	55.7	12.5	18
encour	51.1	18.9	30
praise	39.8	25.8	6

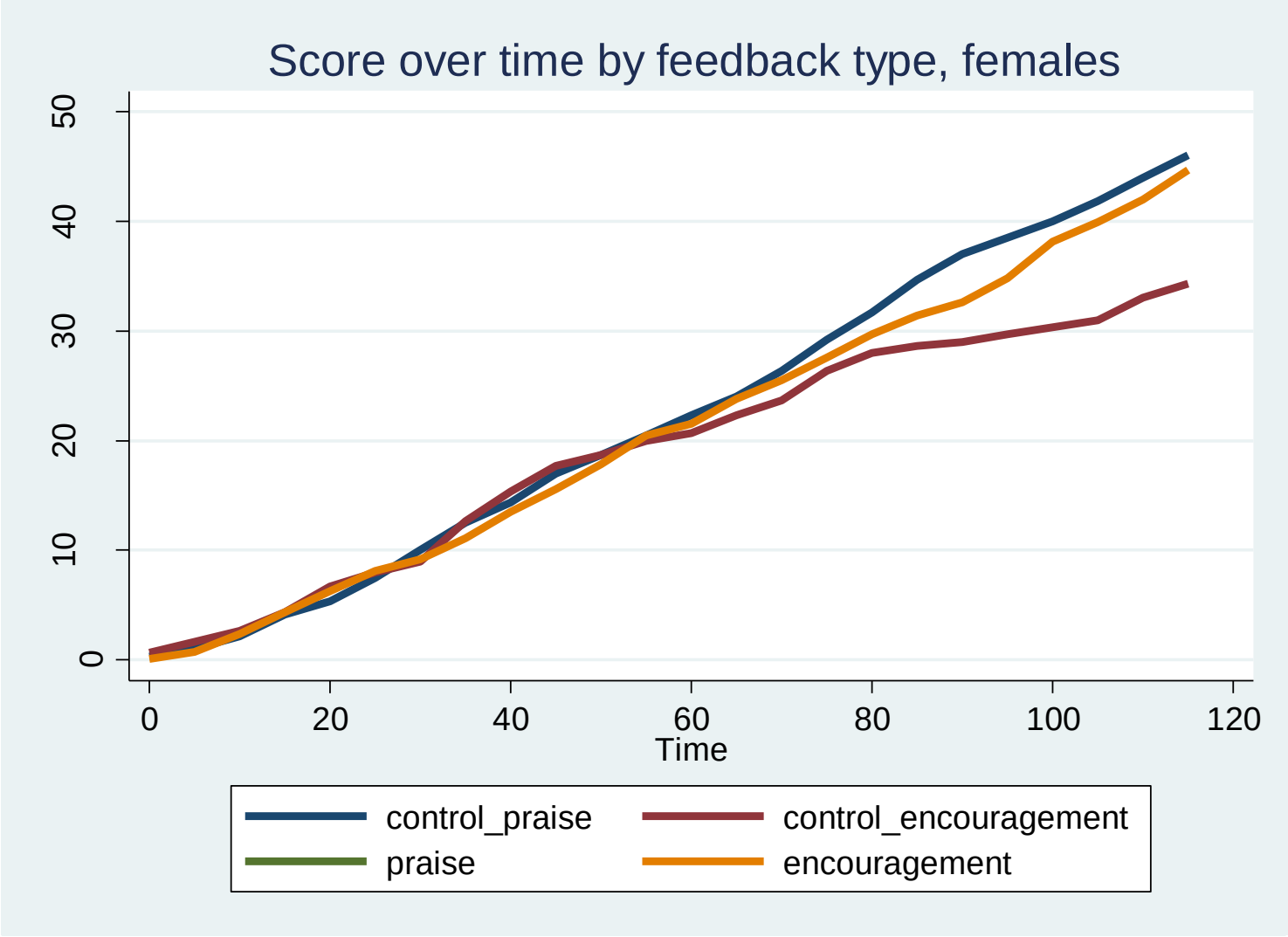
Performance: endscore			
feedback	mean	SD	N
control_enc	41.5	18.2	12
control_pr	41.9	12.1	18
encour	38.4	17.7	30
praise	20	16.8	6

Preliminary results: game-level means

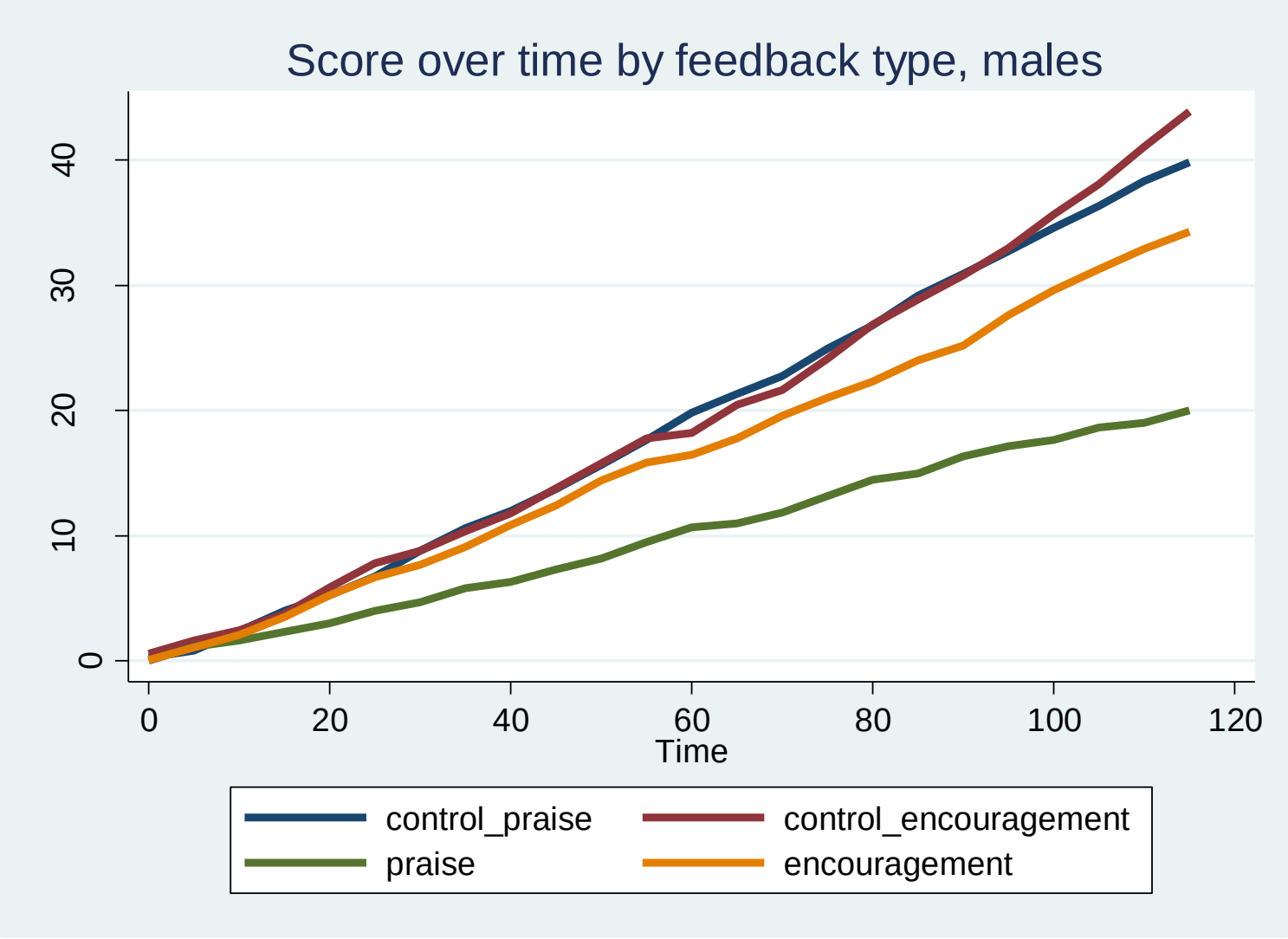
- Test 2: gender difference in feedback effect?

Gender	control_enc	control_pr	encour	praise
Female	35.6	43.7	42.0	45.1
	14.9	7.2	15.2	8.3
	15	13	17	11
T-test:			0.242	0.660
Male	43.4	42.8	36.5	27.7
	18.2	13.7	17.0	22.1
	22	18	22	10
T-test:			0.204	0.033

Preliminary results: performance over time



Preliminary results: performance over time



Conclusion and plans

- Results so far: very few observations, but in the right direction
- More detailed responses from testers:
  - Males/more confident annoyed by feedback
  - Females/less confident like it

TO DO:

- Gather data!
- Results by gender & confidence
- Consult psychologists for relevant literature, personality traits and gender, prev experiments


Thank
You!!!