

Paying Crowd Workers for Collaborative Work

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This Talk

Three main takeaways:

- 1) Collaborative tasks enable **complex, tightly coupled work**
- 2) In group work, **fair pay and motivation** are closely related
- 3) Workers are **perceptive of fair and unfair payments** in groups

Crowdsourcing and Mechanical Turk

Amazon Mechanical Turk

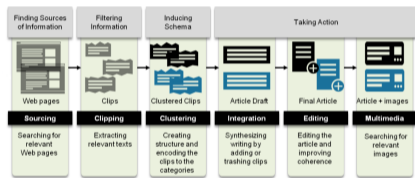
- ▶ Typical work: label images, transcribe audio clips, answer surveys, ...
- ▶ Usually **independent work**

Important to keep workers **motivated**:

- ▶ Primary motivation: money [Kaufmann et al., 2011]
- ▶ Higher pay attracts more workers [Mason and Watts, 2009; Rogstadius et al., 2011]
- ▶ Performance-based pay [Ho et al., 2016]

Collaborative Crowdsourcing Tasks

Some crowdsourced tasks rely on **collaboration** between workers



[Hahn et al., 2016]

Is the following product review sarcastic?

Product: Holy Bible: Stock Car Racing (Paperback)
Review Title: "Gave as a gift to a friend that loves stock car racing."

I bought these bibles to give as gifts to my friends that love stock car racing. They were impressed with the stories of the race drivers they found in the bible. I gave one to my church to help reach young people that might otherwise not pickup a bible. I wish they would make one for motorcycle riders. I am a member of CMA and would use this as an outreach tool. Chris Cline, Overland Park, KS

Deliberate

Initial Votes

New Sarcasm (1) Sarcastic (2)

Honorably Mentioning

The reviewer is mocking the idea of a Bible directed specifically to stock car racers.

Colorful Clones

I agree with honorable mention: This is a nice, nice outreach tool.

[Schaekermann et al., 2018]

[Zhou et al., 2018]

Worker **motivation** not well understood

Features of Collaborative Tasks

Literature review: 114 papers describing collaborative crowdsourcing tasks

Types of information that workers can have:

- ▶ **Aware of others:** Do they know that other workers are involved in the task?
- ▶ **See others' work:** Do they see other workers' output (*same* task or *other* task)?
- ▶ **Identify others' work:** Can they identify which worker did each part of the work?
- ▶ **Freely interact:** Can they have open, free-form conversations with other workers?

Types of Collaborative Tasks

Anonymous shared interfaces

- ▶ ✓ Are aware of others
- ▶ ✓ Can see others' work
- ▶ ✗ Cannot identify others' work
- ▶ ✗ Cannot freely interact

Gives **freedom to coordinate**:

- ▶ Control arbitrary GUIs [Lasecki et al., 2011]
- ▶ Plan travel itineraries [Zhang et al., 2012]
- ▶ Write creative stories [Kim et al., 2017]

Types of Collaborative Tasks

Structured deliberation and shared interfaces

- ▶ ✓ Are aware of others
- ▶ ✓ Can see others' work
- ▶ ✓ Can identify others' work
- ▶ ✗ Cannot freely interact

Gives workers **additional context** to:

- ▶ Create interface mockups [Lasecki et al., 2015]
- ▶ Power a chat bot [Huang et al., 2016]
- ▶ Reason about unclear instructions [Chang et al., 2017]

Types of Collaborative Tasks

Full collaboration

- ▶ ✓ Are aware of others
- ▶ ✓ Can see others' work
- ▶ ✓ Can identify others' work
- ▶ ✓ Can freely interact

Tightly coupled work through Google Documents or Slack channels:

- ▶ Brainstorm company slogans [Lykourantzou et al., 2017]
- ▶ Solve complex cognitive problems [Zhou et al., 2018]
- ▶ Deliberate about ambiguous questions [Schaekermann et al., 2018; Chen et al., 2019]

Existing Payment Systems

Existing tasks: most common to pay all workers **equally**

Alternatives:

- ▶ Paying for participation: difficult to incentivize effort
- ▶ Paying for quality: several ways to measure work quality

Overall, payments are ad-hoc and not well motivated

Fair Payments: Equity Theory

Link between payment and motivation: **equity theory** [Adams, 1965]

People think they are being treated fairly if

$$\frac{O_{self}}{I_{self}} = \frac{O_{other}}{I_{other}} = c$$

where

- ▶ I : input (work quality, effort, time spent, . . .)
- ▶ O : output (rewards or bonuses)
- ▶ c : pay per unit of work

Underrewarded workers **restore equity** by putting in less work [Mowday, 1979]

Fair Payments: Cooperative Game Theory

Alternative fair payment from cooperative game theory

Shapley value [Shapley 1953]: fair reward division

- ▶ Consider all possible orders of players joining the group
- ▶ Give players their average **marginal contribution** over these orders

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1. **Efficiency**: all of the group's reward is allocated

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4. **Additivity**: if group does two tasks together, considering tasks separately or together gives same rewards

Research Questions

How do these theoretically fair payments affect crowd workers?

Specific questions:

1. Do workers think proportional pay and Shapley values are **fairer** than equal pay?
2. Are workers' fairness perceptions **biased** toward themselves?
3. Do workers put in more **effort** when they are paid fairly?

Study 1: HITs

Hired 132 workers

- ▶ 25 minute HIT; base of \$1.75 and typical bonus of \$1

Formed **virtual groups**


- ▶ Picked 2 prior workers as virtual teammates
- ▶ Placed group into one of four bonus conditions

Study 1: Task

Audio transcription task based on Scribe [Lasecki 2012]

- ▶ Real time transcription: no pausing or rewinding
- ▶ 14 audio clips (21 – 31 s each)

Audio playing...



0:09 0:37

every four years soccer team gather to
compete for the sports biggest

Type here

The image shows a simulated audio player interface. At the top, it says "Audio playing...". Below this is a horizontal progress bar. The left portion of the bar is filled with a teal color, and the right portion is light gray. Below the bar, the time "0:09" is displayed on the left and "0:37" on the right. Underneath the progress bar is a text area containing the transcription "every four years soccer team gather to compete for the sports biggest". At the bottom of the interface is a text input field with the placeholder text "Type here".

Study 1: Teams and Payments

After each audio clip, paid group performance-based bonus

Worker 3 (you): words typed: 28/72 (38%), correct: 25/28 (89%)

every four years soccer teams from across the globe *team* gather to compete for the sports biggest trophy the world cup historically the americans have been brilliant winning three of the past seven world cups never finishing worse than third the american women that is the mens national team not so hot the us has *team* never finished higher than eighth except for 1930 the very first world cup when we finished third *eight*

Your team earned **\$0.30** for typing **61** correct words (5c per 10 words).

Individual payments:



Given you and your teammates' performance, how fair do you think your team's payments are?

UNFAIR NEUTRAL FAIR

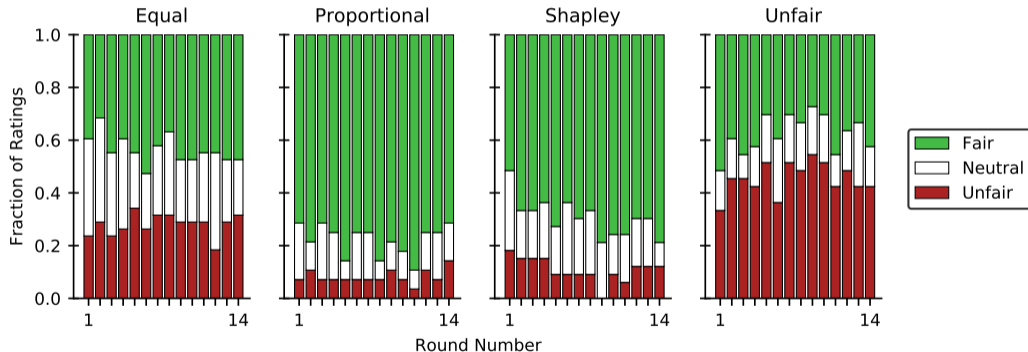
Study 1: Conditions

Split group's bonuses in one of four ways:

- ▶ **EQUAL:** pay one third of the group's bonus
- ▶ **PROPORTIONAL:** pay in proportion to number of correct words
- ▶ **SHAPLEY:** pay Shapley valued bonuses
- ▶ **UNFAIR:** give 50% of bonus to worst worker and 25% to other two

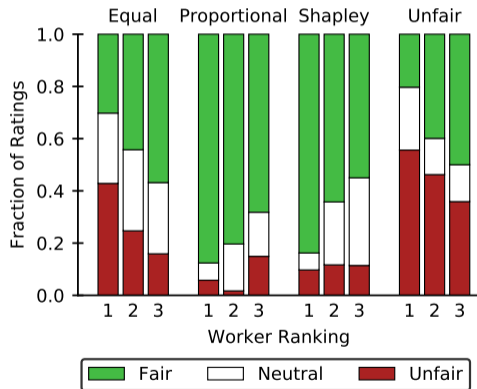
Study 1: Fairness Ratings

Theoretically fair payments considered **more fair** than equal pay



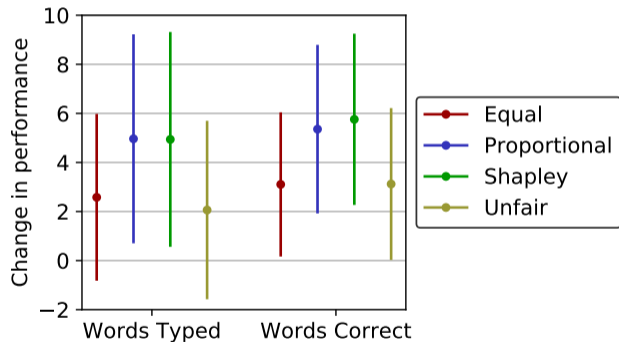
Study 1: Worker Biases

Best and worst workers in each group have **different fairness perceptions**



Study 1: Effort

Measured **effort** by comparing words typed in first and last rounds

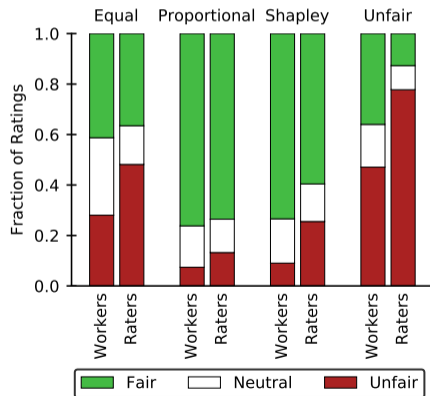


Other tasks better suited for capturing effort

Study 2: External Raters

Follow-up: asked 79 **unbiased workers** to rate bonuses

- ▶ Rated 4 rounds of each payment type



Summary

Three main takeaways:

- 1) Identified types of collaboration and **tasks that require close interaction**
- 2) Grounded **fair payments** in equity theory and cooperative game theory
- 3) Found that workers are biased, but are **perceptive of fair and unfair payments**

Broader Impacts

Median wage on Mechanical Turk is under \$2/hour [Hara et al., 2018]

- ▶ Improving crowdsourced work can attract more low-paying requesters

Fair, transparent group work is beneficial to both workers and requesters

- ▶ Improve trust and reputation with workers
- ▶ Help workers understand how to do high quality work
- ▶ Collaborative tasks: get these benefits without relying on the platform

Future Work

Worker motivation and fair pay in other group tasks

Estimating work quality: agreement scores, subjective ratings

Human-AI teams and worker motivation

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