Let's Read!

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The trigger point of our project is...

CS492: Crowdsourcing | Home | Reading Response | Topic Presentation

Reading Response

You'll **READ** and **CRITIQUE** influential research papers and articles in crowdsourcing.

1	9/6	Introduction to crowdsourcing and human computation (PDF) Discussion by Juho (PDF)	(1) Howe, Jeff. "The rise of crowdsourcing." Wired magazine 14.6 (2006): 1-4. (2) Quinn, Alexander J., and Bederson, Benjamin B. "Human computation: a survey and taxonomy of a growing field." CHI 2011.	
2	9/8	Crowdsourcing platforms (PDF) Discussion by Oisin (PDF)	(1) response Ipeirotis, Panagiotis G. "Analyzing the amazon mechanical turk marketplace." XRDS: Crossroads 17.2 (2010): 16-21. (2) response Geiger, David, et al. "Managing the Crowd: Towards a Taxonomy of Crowdsourcing Processes." AMCIS. 2011. (3) Vakharia, Donna, and Matthew Lease. "Beyond AMT: An analysis of crowd work platforms." arXiv preprint arXiv:1310.1672 (2013).	
2	9/13	Worker Issues in Crowdsourcing (PDF) Discussion by Sang-gyun (PDF)	(1) response Irani, Lilly C., and M. Silberman. "Turkopticon: [illegible] (2) (3) (4) CS	Assignment 1: [illegible]
3	9/15	No class (Chuseok)		
3	9/20	Technique: programming paradigms part 1 (PDF) Discussion by Youngbo (PDF)	(1) response Little, Greg, [illegible] algorithms on mechanica (2) Little, Greg, et al. "Expl computation processes." workshop on human com (3) Barowy, Daniel W., et a human-based and digital [illegible] 47.10 (2012): 639-654.	
4	9/22	Technique: programming paradigms part 2 (PDF) Discussion by Juho (slides in the main material)	(1) response Bernstein, Michael S., et al. "Soylent: a word processor with a crowd inside." UIST 2010. (2) response Kittur, Aniket, et al. "Crowdforge: Crowdsourcing complex work." UIST 2011. (3) Ahmad, Salman, et al. "The jabberwocky programming environment for structured social computing." UIST 2011.	Project 0: Team Formation
4	9/27	Technique: quality control part 1(PDF) Discussion by Junsoo (PDF)	(1) response Harris, Mark. "How a lone hacker shredded the myth of crowdsourcing." (2) response Snow, Rion, et al. "Cheap and fast---but is it good?: evaluating non-expert annotations for natural language tasks." EMNLP 2008. (3) Zaidan, Omar F., and Chris Callison-Burch. "Crowdsourcing translation: Professional quality from non-professionals." ACL 2011.	
13	11/29	Application: civic engagement (PDF) Discussion by Paul (PDF)	response : choose TWO from (1)-(3) (1) Haklay, Mordechai, and Patrick Weber. "Openstreetmap: User-generated street maps." IEEE Pervasive Computing 7.4 (2008): 12-18. (2) Kim, Nam Wook, et al. "Budgetmap: Engaging taxpayers in the issue-driven classification of a government budget." CSCW 2016. (3) Heimerl, Kurtis, et al. "CommunitySourcing: engaging local crowds to perform expert work via physical kiosks." CHI 2012.	
14	12/1	Application: citizen science and participatory sensing (PDF) Discussion by Noé (PDF)	response : choose one from (1)-(3) (1) Bonney, Rick, et al. "Citizen science: a developing tool for expanding science knowledge and scientific literacy." BioScience 59.11 (2009): 977-984. (2) Sullivan, Brian L., et al. "eBird: A citizen-based bird observation network in the biological sciences." Biological [illegible]patory Sensing: A citizen-[illegible]the patterns that shape our [illegible]ject, White Paper (2009).	
			[illegible]vidence for a collective [illegible]ractor in the performance of human groups." [illegible].6004 (2010) [illegible]Daniela, et al. "Expert crowdsourcing with flash [illegible] 2014. [illegible]iloufar, et al. "Huddler: Convening Stable and [illegible]wd Teams Despite Unpredictable Availability." CSCW	Project 6: Hi-Fi Prototype
15	12/8	Application: accessibility (PDF) Discussion by Young-Min (PDF)	response : choose one from (1)-(2) (1) Guo, Anhong, et al. "VizLens: A Robust and Interactive Screen Reader for Interfaces in the Real World." UIST 2016. (2) Hara, Kotaro, et al. "Tohme: detecting curb ramps in google street view using crowdsourcing, computer vision, and machine learning." UIST 2014.	
15	12/13	The future of crowd work (PDF) Discussion by Sungjae (PDF)	(1) response Kittur, Aniket, et al. "The future of crowd work." CSCW 2013. (2) Licklider, Joseph CR. "Man-computer symbiosis." IRE transactions on human factors in electronics 1 (1960): 4-11. (3) Humans Need Not Apply (15-min video)	
16	12/15	Final Project Presentations		Project 7: Final Presentations
16	12/20	No class (Finals week)		

32 reading responses out of 66 paper

Submission status

Submission status	No attempt
	This assignment is not accepting submissions
Grading status	Not graded
Due date	Wednesday, 28 September 2016, 11:59 PM
Time remaining	Assignment is overdue by: 76 days 9 hours

We are novice researchers

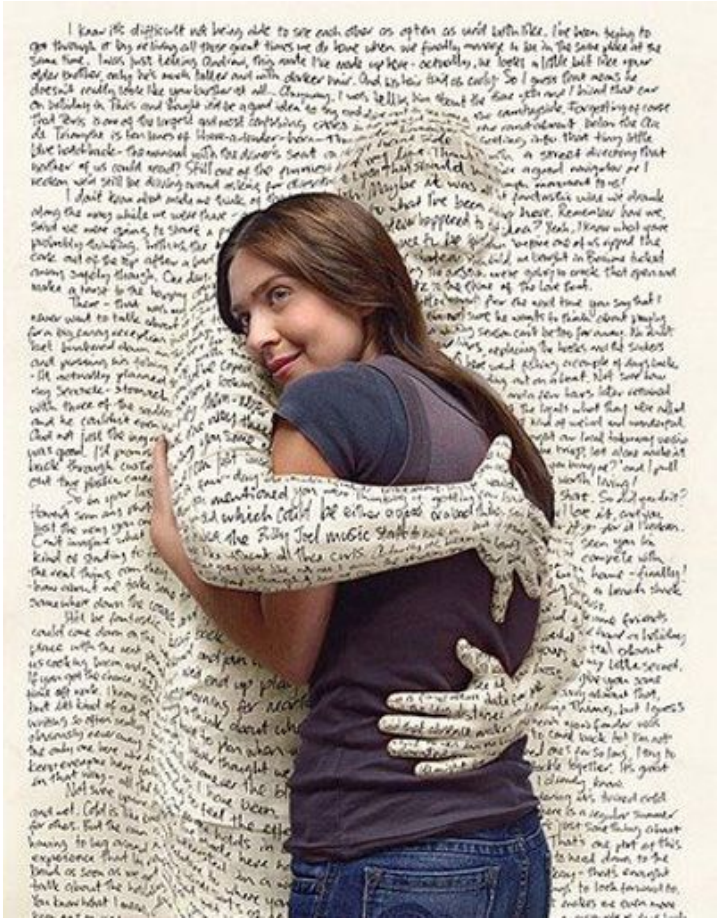
- Unfamiliar with the discipline
- Little background knowledge

It causes...

1. Poor time-efficiency

It causes...

1. Poor time-efficiency
2. Difficulty in having a critical view on a paper



Problem statement

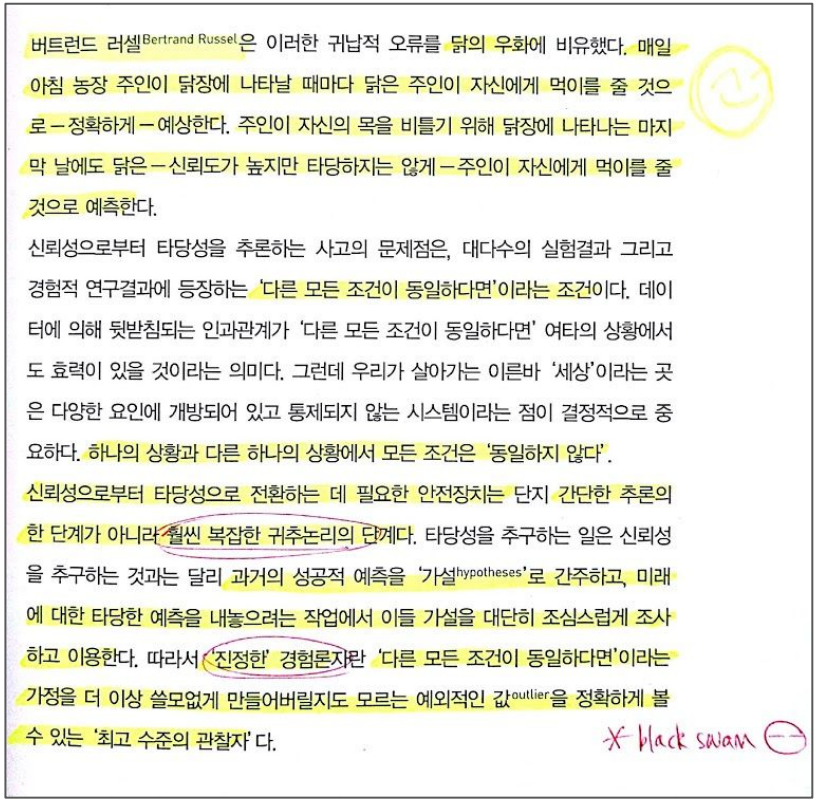
Novice researchers, who are unfamiliar with a discipline and have little background knowledge, commonly face **1) poor time-efficiency** and **2) difficulty in having a critical view on a paper.**

Existing solution: a paper with professor's annotation

- Helpful visual cues made by an expert (professor)

  → At a glance, I can figure out which parts is important

  → I can see which part he likes or dislikes (critical view)



버트런드 러셀Bertrand Russel은 이러한 귀납적 오류를 닭의 우화에 비유했다. 매일 아침 농장 주인이 닭장에 나타날 때마다 닭은 주인이 자신에게 먹이를 줄 것으로—정확하게—예상한다. 주인이 자신의 목을 비틀기 위해 닭장에 나타나는 마지막 날에도 닭은—신뢰도가 높지만 타당하지는 않게—주인이 자신에게 먹이를 줄 것으로 예측한다.

신뢰성으로부터 타당성을 추론하는 사고의 문제점은, 대다수의 실험결과 그리고 경험적 연구결과에 등장하는 '다른 모든 조건이 동일하다면'이라는 조건이다. 데이터에 의해 뒷받침되는 인과관계가 '다른 모든 조건이 동일하다면' 여타의 상황에서도 효력이 있을 것이라는 의미다. 그런데 우리가 살아가는 이른바 '세상'이라는 곳은 다양한 요인에 개방되어 있고 통제되지 않는 시스템이라는 점이 결정적으로 중요하다. 하나의 상황과 다른 하나의 상황에서 모든 조건은 '동일하지 않다'.

신뢰성으로부터 타당성으로 전환하는 데 필요한 안전장치는 단지 간단한 추론의 한 단계가 아니라 훨씬 복잡한 귀추논리의 단계다. 타당성을 추구하는 일은 신뢰성을 추구하는 것과는 달리 과거의 성공적 예측을 '가설hypotheses'로 간주하고, 미래에 대한 타당한 예측을 내놓으려는 작업에서 이들 가설을 대단히 조심스럽게 조사하고 이용한다. 따라서 '진정한' 경험론자란 '다른 모든 조건이 동일하다면'이라는 가정을 더 이상 쓸모없게 만들어버릴지도 모르는 예외적인 값outlier을 정확하게 볼 수 있는 '최고 수준의 관찰자'다.

X black swan

Limitation of existing solution

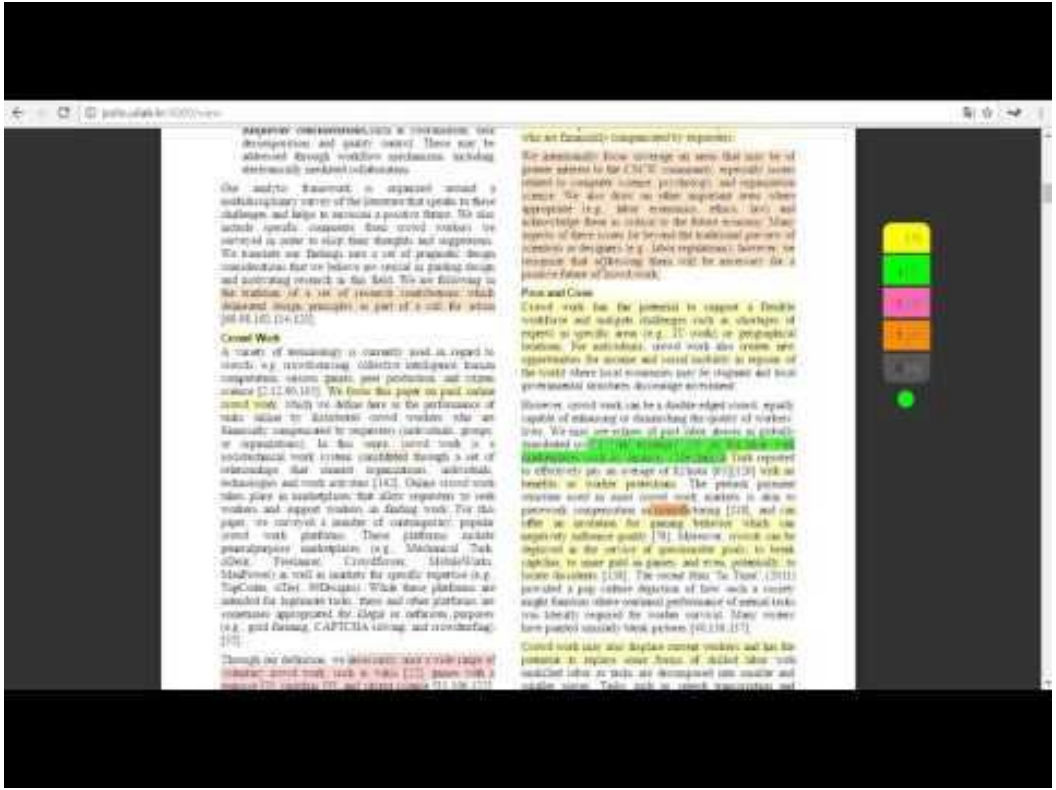
- **Expert** is rare and expensive, and has less motivation.
- Hard-copy paper lacks scalability.

Let's read

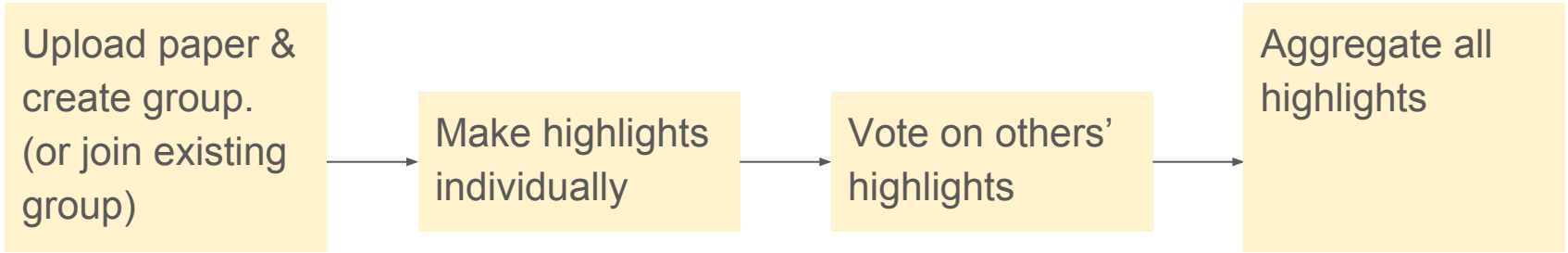
Online paper-reading platform
where a group of **novice researchers** read a paper together
with **helpful visual cues** naturally generated by themselves.

System design

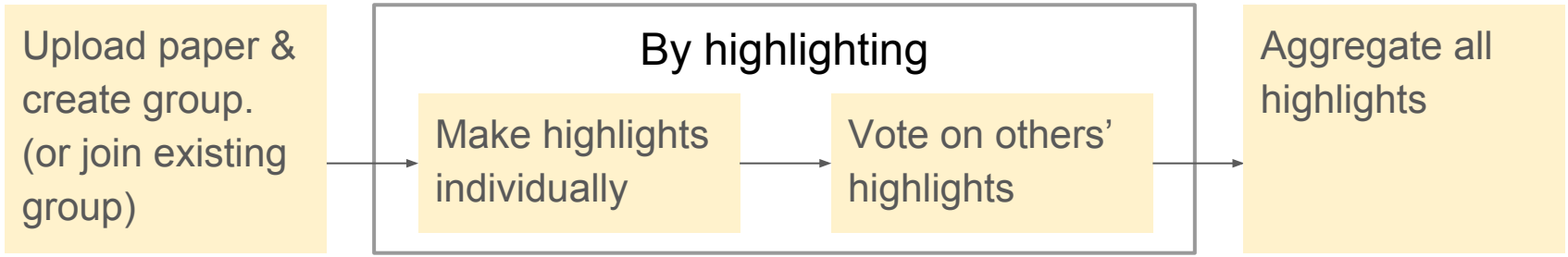
Interface walk-through video



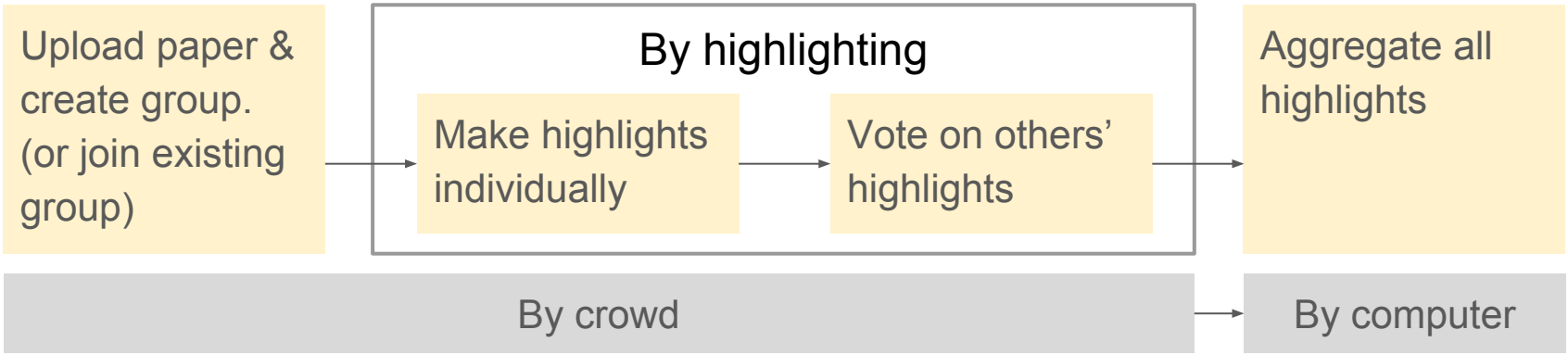
Workflow


Upload paper & create group. (or join existing group)
Make highlights individually
Vote on others' highlights
Aggregate all highlights

Workflow


Upload paper & create group. (or join existing group)
By highlighting
Make highlights individually
Vote on others' highlights
Aggregate all highlights

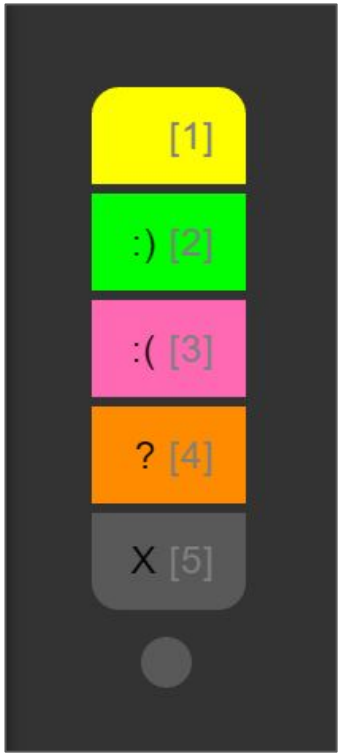
Workflow


Upload paper & create group. (or join existing group)
By highlighting
Make highlights individually
Vote on others' highlights
Aggregate all highlights
By crowd
By computer

Design consideration

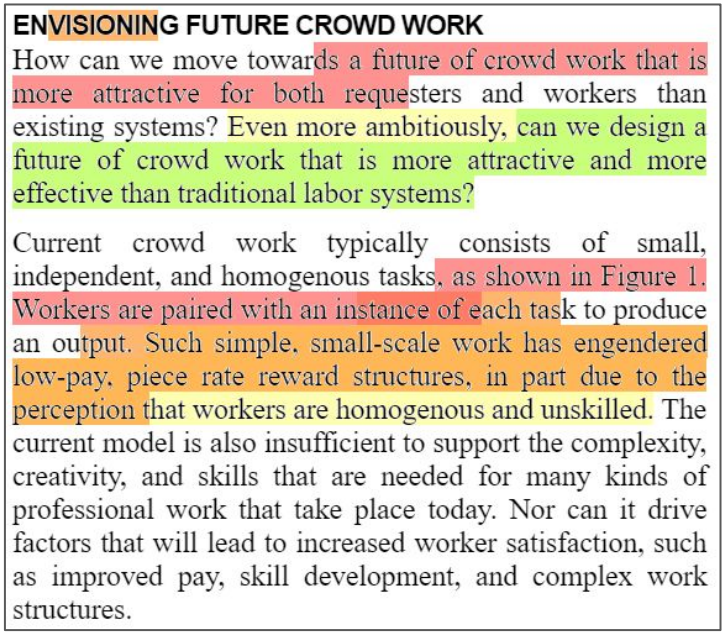
4-color highlighter

- Each color corresponds to
  - (normal highlight)
  - **:)** (like)
  - **:(** (dislike)
  - **?** (I don’t know)
- Based on
  - Guideline for reading response (critical review)
    - summary/likes/dislikes
  - Interview from pilot study
    - P3: “I need ‘I don’t know’ color”



Quality control issue

- P2, P3: “Some highlights seem irrelevant”



ENVISIONING FUTURE CROWD WORK

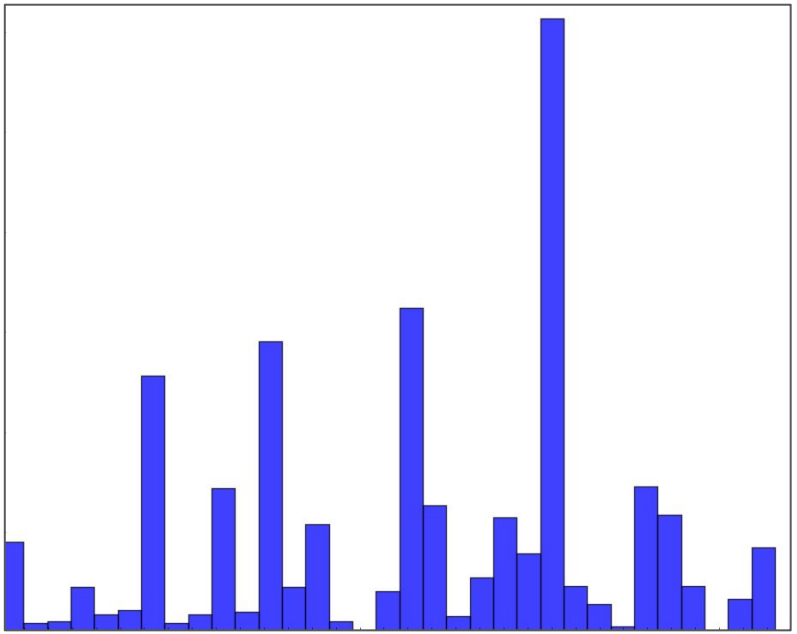
How can we move towards a future of crowd work that is more attractive for both requesters and workers than existing systems? Even more ambitiously, can we design a future of crowd work that is more attractive and more effective than traditional labor systems?

Current crowd work typically consists of small, independent, and homogenous tasks, as shown in Figure 1. Workers are paired with an instance of each task to produce an output. Such simple, small-scale work has engendered low-pay, piece rate reward structures, in part due to the perception that workers are homogenous and unskilled. The current model is also insufficient to support the complexity, creativity, and skills that are needed for many kinds of professional work that take place today. Nor can it drive factors that will lead to increased worker satisfaction, such as improved pay, skill development, and complex work structures.

Quality control issue

- P2, P3: “Some highlights seem irrelevant”

(# of vote)



(word)

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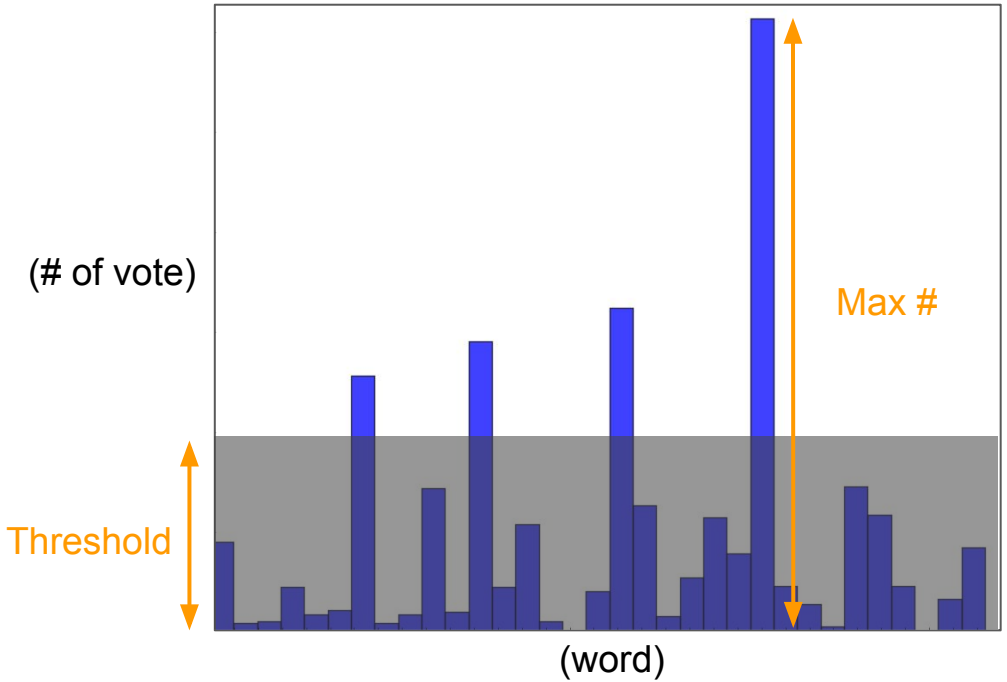

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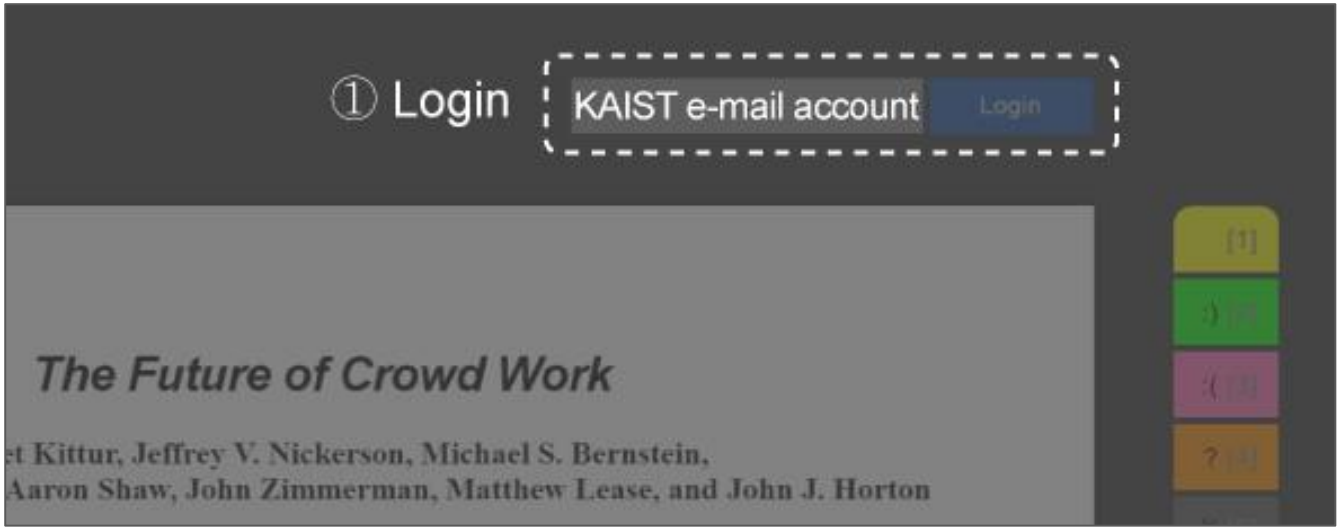
Quality control issue

- Concern about sabotage
  → we require KAIST E-mail account

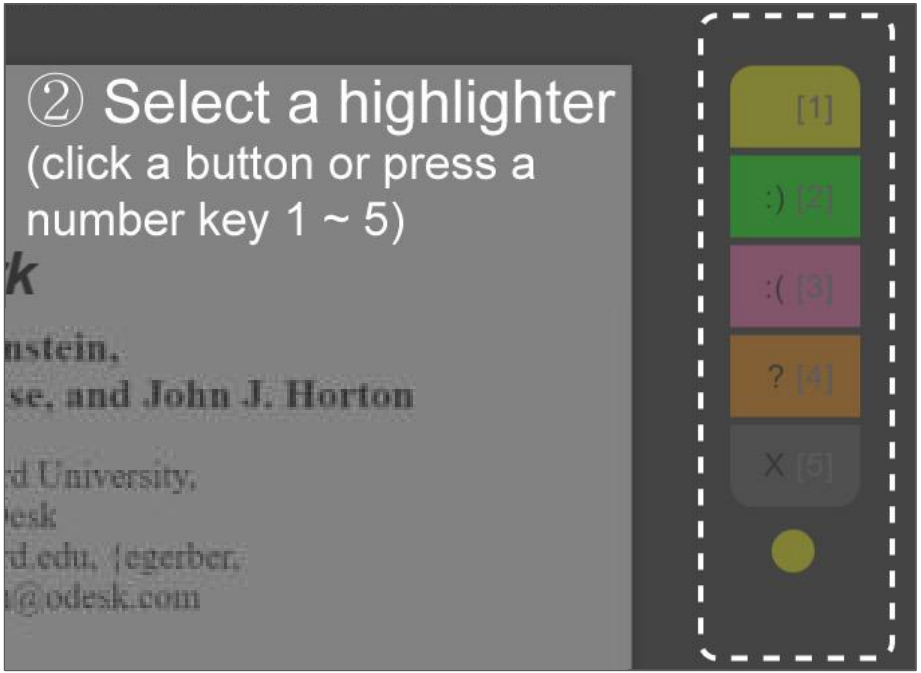


Usability issue

- P2: *“Long distance of mouse travel hinder me from changing color”*

Usability issue

- P2: *“Long distance of mouse travel hinder me from changing color”*



Deployment & result

[75,77,152,153].

This displacement is coupled to a new form of Taylorism [88,141], in which organizations optimize cognitive efficiency [157] at the expense of education and skill development. Taylorism yielded to more enlightened job design after several decades (and protracted struggles by workers), but given the short time commitment between crowd worker and requester, it is easy to imagine heightened exploitation and dehumanization.

As scientists, engineers, and designers, we can propose and evaluate new structures for crowd work and help imagine and bring about more positive futures. We can do so both through the intentional creation of desirable work environments as well as the cultivation of increased demand for work and workers. In particular, we suggest a role for researchers in conceptualizing and prototyping new forms of crowd work that go beyond the simple, independent, and deskilled tasks that are common today, with the goal of blazing a trail for organizations and platforms that will form the foundation of future crowd work.

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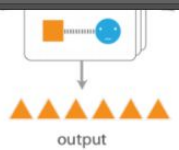


Figure 1: Current crowd work processes.

crowdsourced labor markets can be viewed as large distributed systems in which each person, such as a worker on Mechanical Turk, is analogous to a processor that can solve a task requiring human intelligence. In this way a crowdsourcing market could be seen as a loosely coupled distributed computing system [9]. Fleshing out this analogy, we develop here the beginnings of a framework for the future of crowd work that integrates the human aspects of organizational behavior with the automation and scalability of the distributed computing literature.

Both distributed organizations and computing systems face many common fundamental challenges in accomplishing complex work. Key challenges in distributed computing include partitioning computations into tasks that can be done in parallel, mapping tasks to processors, and distributing data to and between processors [9,25,96,132]. Many of these challenges map to coordination dependencies identified by Malone & Crowston [89] that also apply to human organizations. Below we discuss two categories of overlap between coordination dependencies discussed in organizational science, their analogs in distributed computing, and their implications for the beginnings of a framework for the future of crowd work.

Managing shared resources

Whenever a limited resource needs to be shared, coordinating how that resource is allocated becomes important. Allocating a fixed pool of workers to multiple tasks that must be completed under a deadline is a classic example of managing shared resources. Malone & Crowston [89] suggest a number of examples of task allocation mechanisms, ranging from first come/first serve, to markets, to managerial decisions. In distributed computing systems, managing shared resources is of

[1]
:) [2]
:([3]
? [4]
X [5]

Our analytic framework is organized around a multidisciplinary survey of the literature that speaks to these challenges and helps to envision a positive future. We also include specific comments from crowd workers we surveyed in order to elicit their thoughts and suggestions. We translate our findings into a set of pragmatic design considerations that we believe are crucial in guiding design and motivating research in this field. We are following in the tradition of a set of research contributions which delineated design principles as part of a call for action [69,98,102,114,123].

Crowd Work

A variety of terminology is currently used in regard to crowds, e.g. crowdsourcing, collective intelligence, human computation, serious games, peer production, and citizen science [2,12,90,105]. We focus this paper on paid, online crowd work, which we define here as the performance of tasks online by distributed crowd workers who are financially compensated by requesters (individuals, groups, or organizations). In this sense, crowd work is a sociotechnical work system constituted through a set of relationships that connect organizations, individuals, technologies and work activities [142]. Online crowd work takes place in marketplaces that allow requesters to seek workers and support workers in finding work. For this paper, we surveyed a number of contemporary, popular crowd work platforms. These platforms include generalpurpose marketplaces (e.g., Mechanical Turk, oDesk, Freelancer, Crowdflower, MobileWorks, ManPower) as well as markets for specific expertise (e.g., TopCoder, uTest, 99Designs). While these platforms are intended for legitimate tasks, these and other platforms are sometimes appropriated for illegal or nefarious purposes (e.g., gold farming, CAPTCHA solving, and crowdturfing) [35].

Through our definition, we necessarily omit a wide range of voluntary crowd work, such as wikis [22], games with a purpose [2], captchas [3], and citizen science [31,106,122]. Much has already been written about these systems (e.g.,

We intentionally focus coverage on areas that may be of greater interest to the CSCW community, especially issues related to computer science, psychology, and organization science. We also draw on other important areas where appropriate (e.g., labor economics, ethics, law) and acknowledge these as critical to the future economy. Many aspects of these issues lie beyond the traditional purview of scientists or designers (e.g., labor regulations); however, we recognize that addressing them will be necessary for a positive future of crowd work.

Pros and Cons

Crowd work has the potential to support a flexible workforce and mitigate challenges such as shortages of experts in specific areas (e.g., IT work) or geographical locations. For individuals, crowd work also creates new opportunities for income and social mobility in regions of the world where local economies may be stagnant and local governmental structures discourage investment.

However, crowd work can be a double-edged sword, equally capable of enhancing or diminishing the quality of workers' lives. We may see echoes of past labor abuses in globally distributed crowd work: extremely low pay for labor, with marketplaces such as Amazon's Mechanical Turk reported to effectively pay an average of $2/hour [65] [126] with no benefits or worker protections. The pertask payment structure used in most crowd work markets is akin to piecework compensation in manufacturing [118], and can offer an invitation for gaming behavior which can negatively influence quality [78]. Moreover, crowds can be deployed in the service of questionable goals: to break captchas, to mine gold in games, and even, potentially, to locate dissidents [158]. The recent film "In Time" (2011) provided a pop culture depiction of how such a society might function where continual performance of menial tasks was literally required for worker survival. Many writers have painted similarly bleak pictures [40,136,137].

Crowd work may also displace current workers and has the potential to replace some forms of skilled labor with unskilled labor as tasks are decomposed into smaller and

[1]
:) [2]
:([3]
? [4]
X [5]

Deployment for Reading Response

- Target users: CS492 Crowdsourcing Classmates
- Target task: reading response for “The Future of Crowd Work” (due Dec12 midnight)
- Advertised on Piazza on Dec12 early morning.
- 7 users visited (including 3 of us)
- Unfortunately...
- ...None of them were students from our class. (except us)
- It was difficult to measure the impact of our platform in reading responses.

How much users got involved?

- In 3 days of service, a total of 13 human users registered (excluding test & troll accounts)
- Total of 127 highlight blocks
  - 77 **(!)** , 25 **:)** , 9 **:(** , 16 **(?)**
- However...
- 99 of highlights contributed by the 3 of us…
  - Avg. 33 highlights for a 12 page paper
- Remaining 10 users did 28 highlights
  - Many of them just trying to see if highlight works

Qualitative survey

How much time did you save?

- Slight increase in paper reading time
  - 103min → 110min

- Significantly reduced reading response writing time
  - 42min → 27min

How well did you understand the paper?

- 4.0 / 5 → 4.0 / 5

How helpful was highlighting when reading paper?

- 3.0 / 5

How helpful was highlighting for writing reading response?

- 4.6 / 5

Qualitative survey

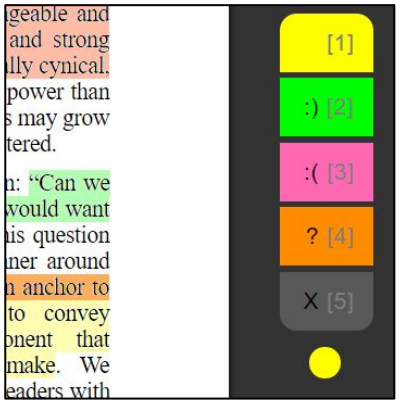
How was the experience of Multi-Color Highlighting?

Pros

- Really helpful for writing a reading response
- I can easily recall the parts which I like or dislike
- I became more eager to semantically differentiate highlighting

Cons

- It might disturb natural reading flow.
- ambiguous points make hard to decide which color to use



Qualitative survey

How was the experience of seeing other people’s highlights?

Pros

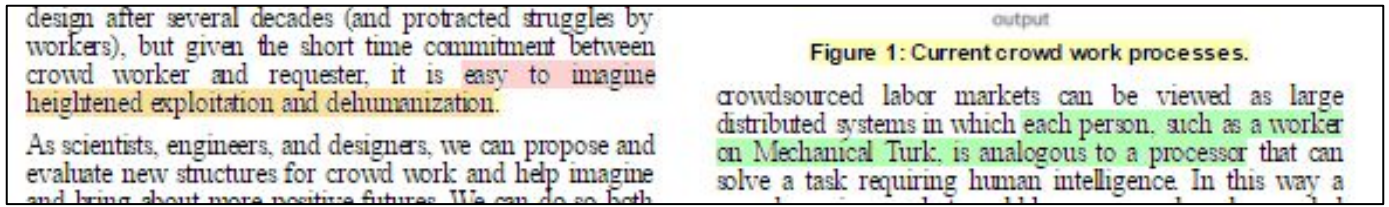
- trying to understand other's highlighting helped me thinking about the issue deeply.
- I tended to follow others' highlight
- I noticed a good point I would have missed otherwise

Cons

- I tended to follow others' highlight unconsciously

Suggestions

- Providing a (statistical) reason to trust others' highlight


design after several decades (and protracted struggles by workers), but given the short time commitment between crowd worker and requester, it is easy to imagine heightened exploitation and dehumanization.

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output

Figure 1: Current crowd work processes.

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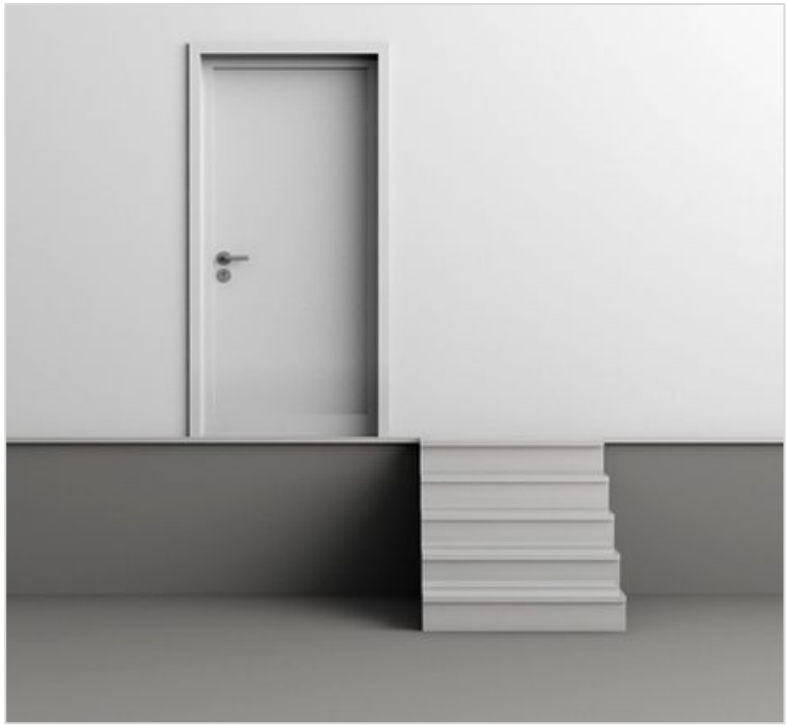
Discussion

Limitations & Implications

- User study: why failed?
  - Recruitment
  - Usability issues



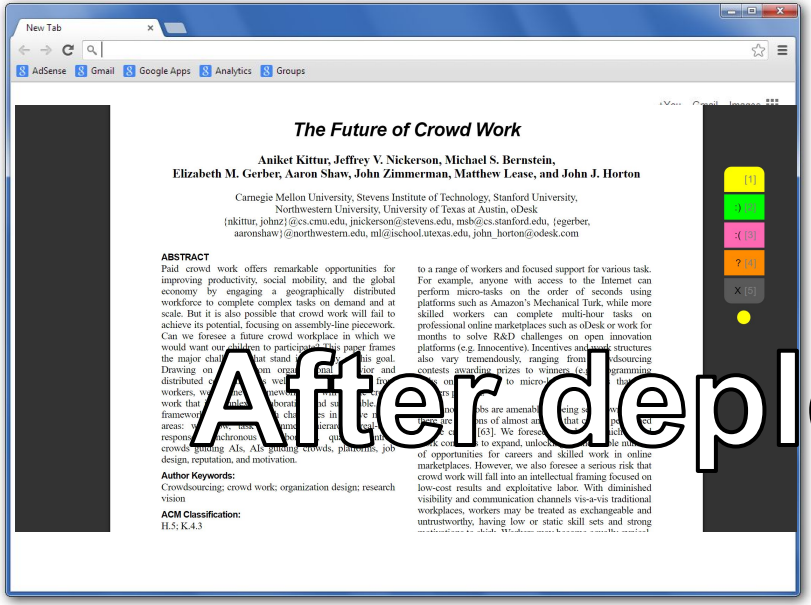
Difficulty of recruitment

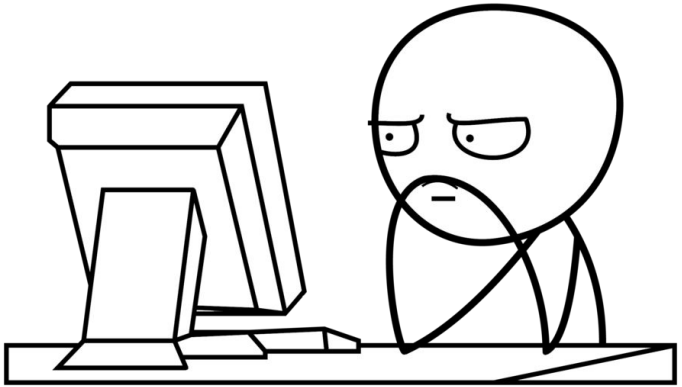
- Need a full step process for evaluation
  - Fully highlighted paper by various users
- Hard to find motivated readers
  - Limited crowd pool

What we expected

Difficulty of recruitment

- Need a full step process for evaluation
  - Fully highlighted paper by various users
- Hard to find motivated readers





After deployment

Usability Issues

- Loading forever
  - Due to Flask issues

Usability Issues

- Browser compatibility

- Minor bugs
  - Highlight not working sometimes
  - Couldn’t type numbers(1~5) in ID entry
  - etc.

Limitations & Implications

- Quality Control
  - ‘Quality’ varies by individuals

scale. But it is also possible that crowd work will fail to achieve its potential, focusing on assembly-line piecework. Can we foresee a future crowd workplace in which we would want our children to participate? This paper frames the major challenges that stand in the way of this goal. Drawing on theory from organizational behavior and distributed computing, as well as direct feedback from workers, we outline a framework that will enable crowd work that is complex, collaborative, and sustainable. The framework lays out research challenges in twelve major areas: workflow, task assignment, hierarchy, real-time

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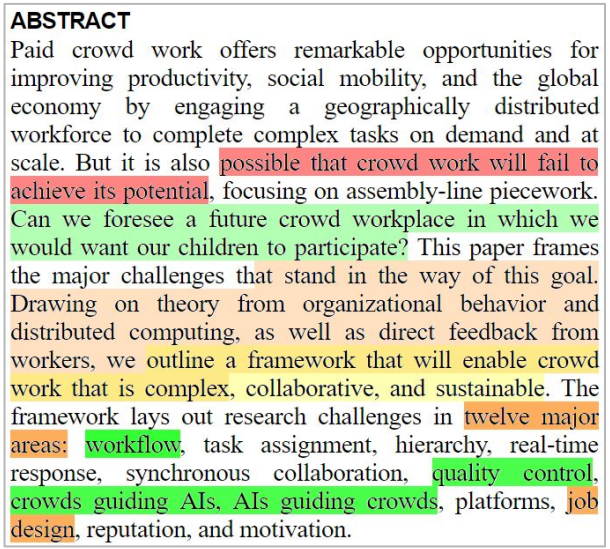
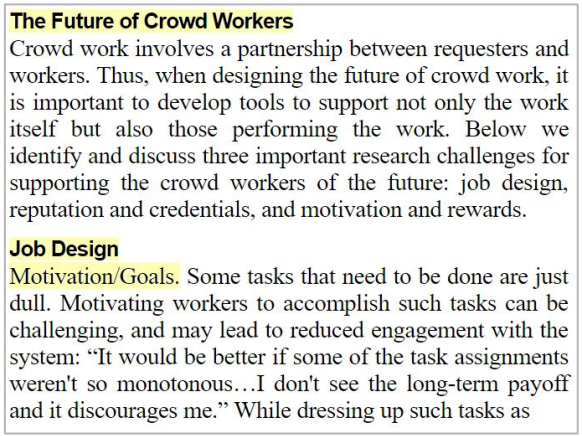
Limitations & Implications

- Quality Control
  - ‘Quality’ varies by individuals
  - Highlight density varies
    - Introduction, Abstract > Conclusion > Implementation, Discussion...



ABSTRACT

Paid crowd work offers remarkable opportunities for improving productivity, social mobility, and the global economy by engaging a geographically distributed workforce to complete complex tasks on demand and at scale. But it is also possible that crowd work will fail to achieve its potential, focusing on assembly-line piecework. Can we foresee a future crowd workplace in which we would want our children to participate? This paper frames the major challenges that stand in the way of this goal. Drawing on theory from organizational behavior and distributed computing, as well as direct feedback from workers, we outline a framework that will enable crowd work that is complex, collaborative, and sustainable. The framework lays out research challenges in twelve major areas: workflow, task assignment, hierarchy, real-time response, synchronous collaboration, quality control, crowds guiding AIs, AIs guiding crowds, platforms, job design, reputation, and motivation.



The Future of Crowd Workers

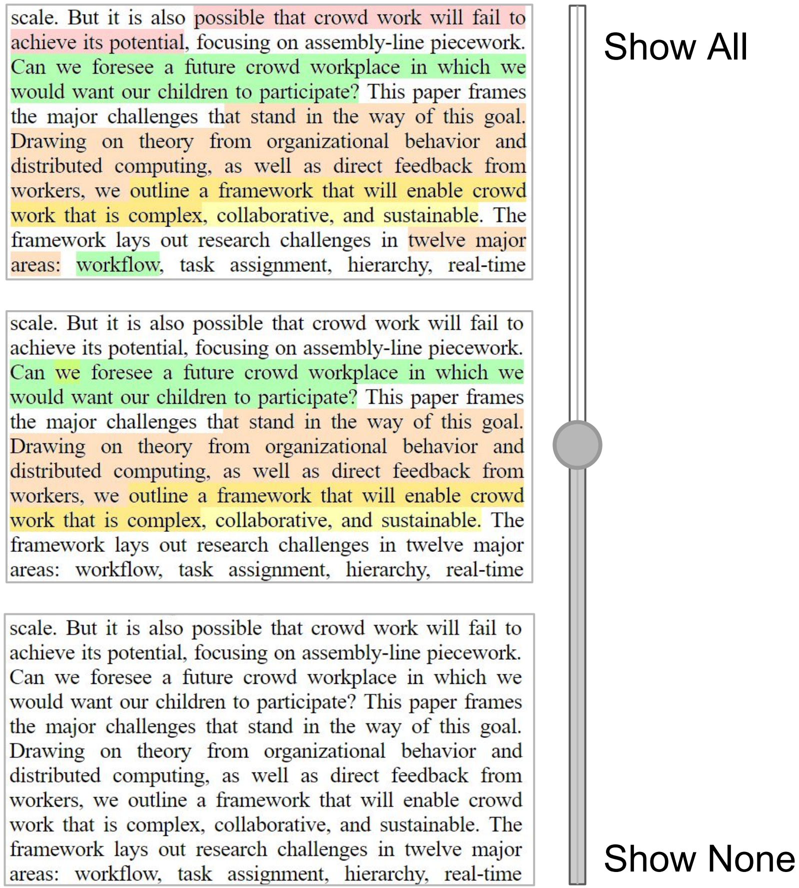
Crowd work involves a partnership between requesters and workers. Thus, when designing the future of crowd work, it is important to develop tools to support not only the work itself but also those performing the work. Below we identify and discuss three important research challenges for supporting the crowd workers of the future: job design, reputation and credentials, and motivation and rewards.

Job Design

Motivation/Goals. Some tasks that need to be done are just dull. Motivating workers to accomplish such tasks can be challenging, and may lead to reduced engagement with the system: “It would be better if some of the task assignments weren't so monotonous…I don't see the long-term payoff and it discourages me.” While dressing up such tasks as

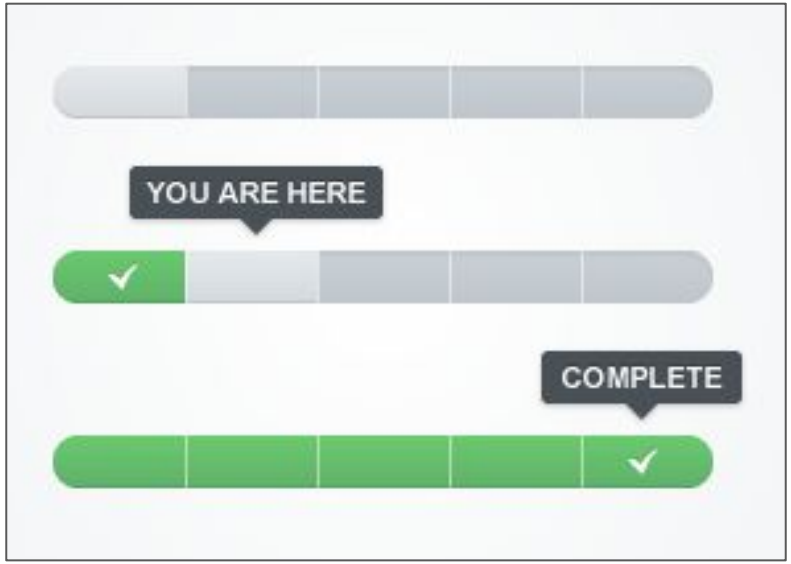
Possible improvements

- Highlight slider
  - Control the group highlight appearance
  - By adjusting threshold
  - Could serve user preferences
  - Enforce sparse highlighted parts



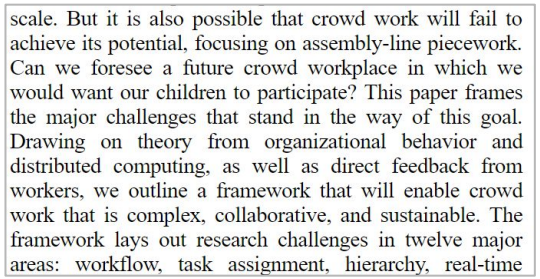
Possible improvements

- Reading progress
  - Show paper reading progress based on final highlighted paragraph
  - Gamification property
  - Light up goal visibility



Intrinsic problems

- Early user disadvantage
  - Early users of the service couldn't benefit much from group highlights.
  - Intrinsic problem of system
  - Motivate them by providing interactive assets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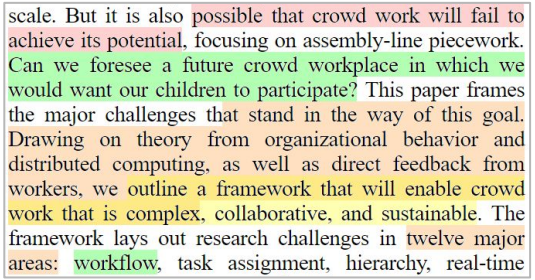
Early user view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Later user view

Intrinsic problems

- Do user really read on the computer screen?
  - P3: Though I normally read articles in printed papers, if all systems are like this, I would try to read in this platform.

Our analytic framework is organized around a multidisciplinary survey of the literature that speaks to these challenges and helps to envision a positive future. We also include specific comments from crowd workers we surveyed in order to elicit their thoughts and suggestions. We translate our findings into a set of pragmatic design considerations that we believe are crucial in guiding design and motivating research in this field. We are following in the tradition of a set of research contributions which delineated design principles as part of a call for action [69,98,102,114,123].

Crowd Work

A variety of terminology is currently used in regard to crowds, e.g. crowdsourcing, collective intelligence, human computation, serious g
science [2,12,90,105].
crowd work, which w
tasks online by dist
financially compensate
or organizations). In
sociotechnical work s
relationships that c
technologies and work activities [142]. Online crowd work takes place in marketplaces that allow requesters to seek workers and support workers in finding work. For this paper, we surveyed a number of contemporary, popular crowd work platforms. These platforms include generalpurpose marketplaces (e.g., Mechanical Turk, oDesk, Freelancer, Crowdflower, MobileWorks, ManPower) as well as markets for specific expertise (e.g., TopCoder, uTest, 99Designs). While these platforms are intended for legitimate tasks, these and other platforms are sometimes appropriated for illegal or nefarious purposes (e.g., gold farming, CAPTCHA solving, and crowdturfing) [35].

Through our definition, we necessarily omit a wide range of voluntary crowd work, such as wikis [22], games with a purpose [2], captchas [3], and citizen science [31,106,122]. Much has already been written about these systems (e.g.,

We intentionally focus coverage on areas that may be of greater interest to the CSCW community, especially issues related to computer science, psychology, and organization science. We also draw on other important areas where appropriate (e.g., labor economics, ethics, law) and acknowledge these as critical to the future economy. Many aspects of these issues lie beyond the traditional purview of scientists or designers (e.g., labor regulations); however, we recognize that addressing them will be necessary for a positive future of crowd work.

Pros and Cons

Crowd work has the potential to support a flexible workforce and mitigate challenges such as shortages of experts in specific areas (e.g., IT work) or geographical locations. For individuals, crowd work also creates new
ons of
l local
word,
lity of
ses in
y for
labor, with marketplaces such as Amazon's Mechanical Turk reported to effectively pay an average of $2/hour [65] [126] with no benefits or worker protections. The pertask payment structure used in most crowd work markets is akin to piecework compensation in manufacturing [118], and can offer an invitation for gaming behavior which can negatively influence quality [78]. Moreover, crowds can be deployed in the service of questionable goals: to break captchas, to mine gold in games, and even, potentially, to locate dissidents [158]. The recent film "In Time" (2011) provided a pop culture depiction of how such a society might function where continual performance of menial tasks was literally required for worker survival. Many writers have painted similarly bleak pictures [40,136,137].

Crowd work may also displace current workers and has the potential to replace some forms of skilled labor with unskilled labor as tasks are decomposed into smaller and smaller pieces. Tasks such as speech transcription and

Let's Read!

[1]
:) [2]
:([3]
? [4]
X [5]

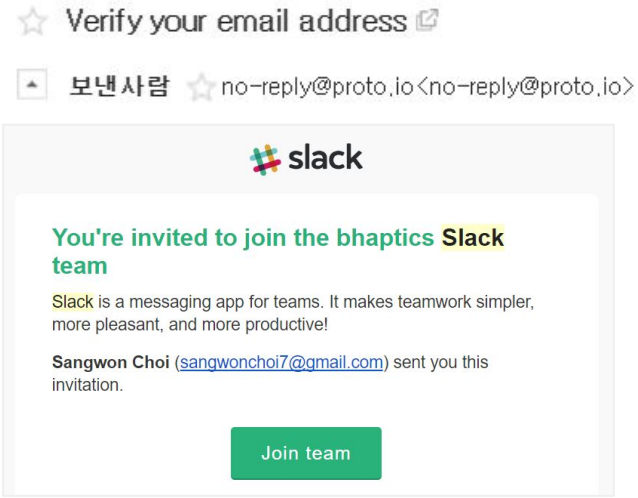
Thank you for listening…

Q&A

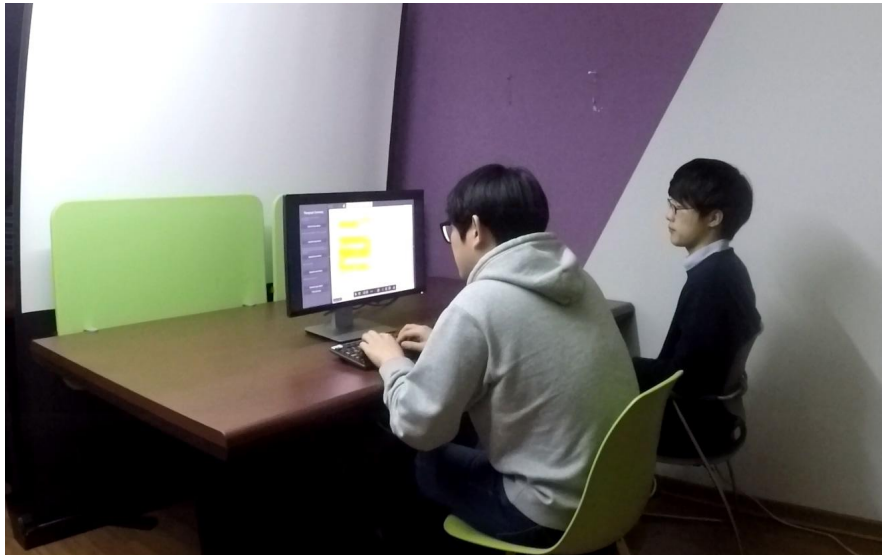
Appendix

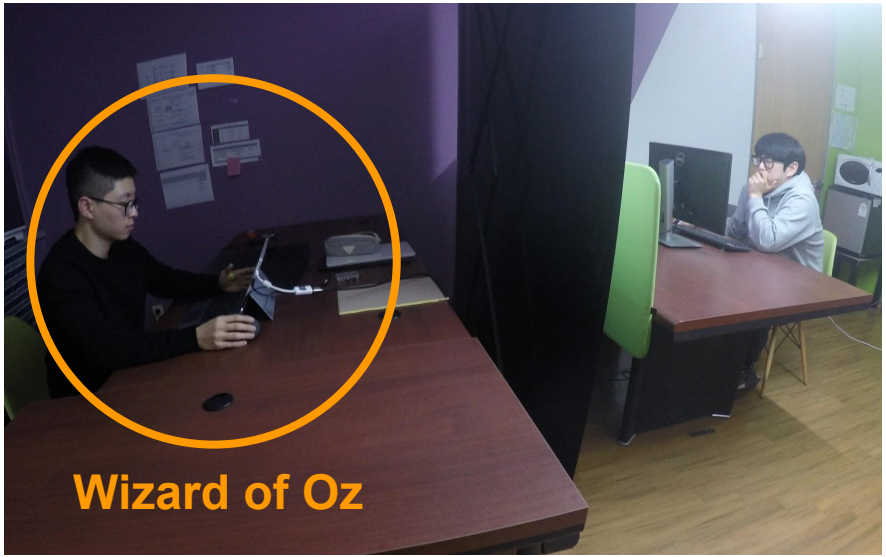
Possible improvements

- User verification
  - E-mail verification
  - Group leader invitation
  - Could enhance quality control & recruitment

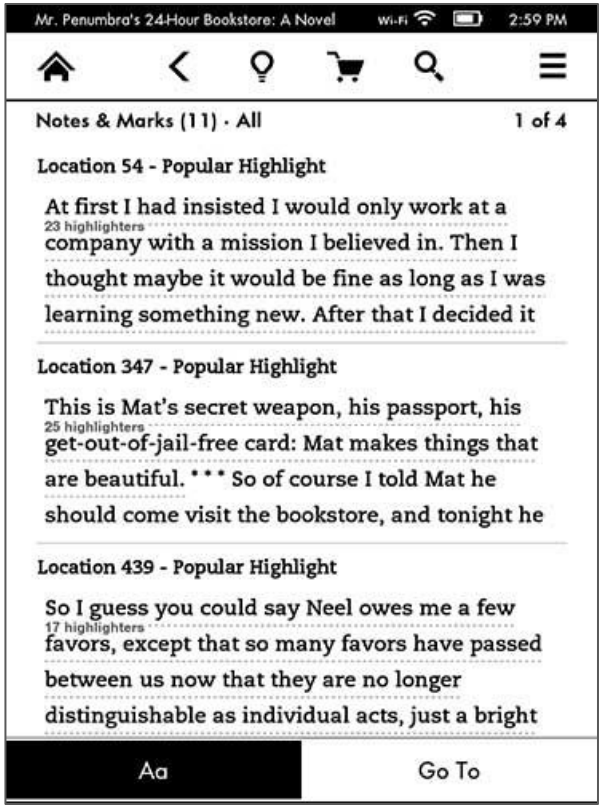


Quality control issue

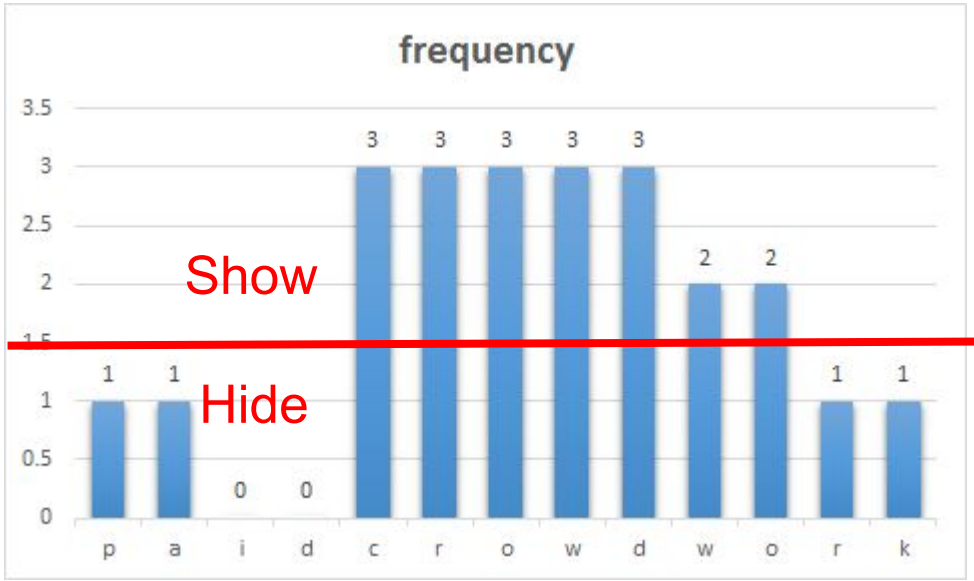




Related work: Amazon kindle



Analyzing Highlights



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Paid crowd work offers remarkable opportunities for improving productivity, social mobility, and the global economy by engaging a geographically distributed workforce to complete complex tasks on demand and at scale. But it is also possible that crowd work will fail to achieve its potential, focusing on assembly-line piecework. Can we foresee a future crowd workplace in which we would want our children to participate? This paper frames the major challenges that stand in the way of this goal. Drawing on theory from organizational behavior and distributed computing, as well as direct feedback from workers, we outline a framework that will enable crowd work that is complex, collaborative, and sustainable. The framework lays out research challenges in twelve major areas: workflow, task assignment, hierarchy, real-time response, synchronous collaboration, quality control, crowds guiding AIs, AIs guiding crowds, platforms, job design, reputation, and motivation.

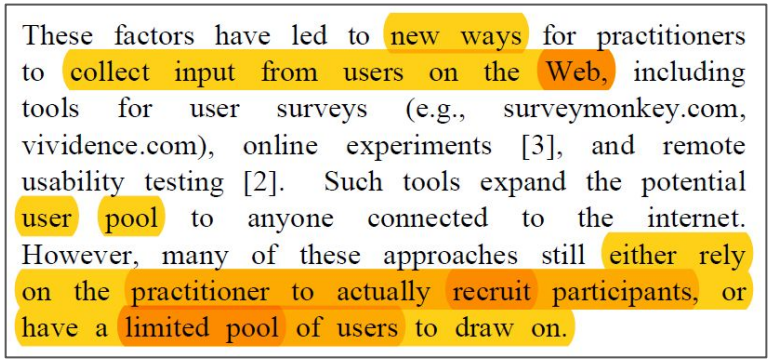
Author Keywords:

Crowdsourcing; crowd work; organization design; research vision

Quality control issue

These factors have led to new ways for practitioners to collect input from users on the Web, including tools for user surveys (e.g., surveymonkey.com, vividence.com), online experiments [3], and remote usability testing [2]. Such tools expand the potential user pool to anyone connected to the internet. However, many of these approaches still either rely on the practitioner to actually recruit participants, or have a limited pool of users to draw on.

Quality control issue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→ Opacity weighted by # of votes

Current status of crowd work

Pros
- Provision of flexible workforce
- Buffer for the shortages of experts
- Social mobility

Cons
- Low pay
- Crowdsourcing for something bad
- Displacement of skilled workers to unskilled