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Research in the Crowdsourcing Age, a Case Study

How scholars, companies and workers are using Mechanical Turk, a 'gig economy' platform, for tasks computers can't handle

BY *Paul Hitlin*

FOR FURTHER INFORMATION ON THIS REPORT:

Paul Hitlin, Senior Researcher
Dana Page, Senior Communications Manager
Lee Rainie, Director, Internet, Science and Technology Research

202.419.4372

www.pewresearch.org

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Terminology

The marketplace of Mechanical Turk has a language all of its own. Most of the following definitions were created by the designers of the site, while a few terms (such as Turkers and task) have become commonly used phrases adapted by some in the Mechanical Turk community.

HIT: The term HIT (or HITs) stands for Human Intelligence Tasks. Each HIT is an individual assignment that a worker can undertake.

HIT group: HIT groups are a collection of tasks (or HITs). The main pages of Mechanical Turk display HIT groups – rather than individual HITs – so that multiple people can perform the same task. For example, a company may want 10 different people to complete the same survey, so they would post a single HIT group that contained 10 HITs. Once all of the HITs within a HIT group have been taken by workers, the HIT group disappears from the site.

Most of this report will refer to HIT groups (as opposed to singular HITs) since they are the way that requesters post assignments and the clearest way to measure activity on the site.

Task: A commonly used synonym for HIT.

Worker: An individual who works on HITs in order to earn money. Workers must register with Amazon and Mechanical Turk. Workers can collect qualifications in order to gain access to a wider range of HIT groups.

Requester: A person, business or organization that posts HITs on Mechanical Turk. Requesters post assignments and determine how much reward to give for the completion of each task. Requesters also assign requirements necessary for a worker to attempt a task and determine if a task was completed in a satisfactory manner. Requesters pay a commission to Mechanical Turk for use of their site. This commission is a percentage of the reward they pay to workers.

Active requester: A term used by Dr. Panagiotis G. Ipeirotis of the New York University Stern School of Business to measure the amount of requesters on the site who are repeatedly posting tasks over time. An active requester is a requester who had previously posted a HIT and would post another HIT later on. For example, a company would be considered an active requester on May 13 if they had posted a HIT prior to that date, and would again on or after May 13.

Reward: The amount of money paid by the requester to the worker for the completion of a HIT. These range from "free" to $60 or more, although most rewards are less than 10 cents.

Qualification: A qualification is a property of a worker that represents that worker's skill, ability or reputation. Requesters may create qualifications that workers must achieve to work on specific HITs. Workers earn these qualifications by fulfilling requirements, which usually involve the completion of a specific test. There are a variety of qualifications. Some requesters will require that workers have demonstrated a successful history on the site. Some qualifications require workers to live in a particular country. And there are specific qualifications that workers can earn such as the "Adult Content Qualification" or "Confidentiality Qualification."

MTurk: A commonly used abbreviation for the Mechanical Turk site.

Turkers: A commonly used term for the workforce on Mechanical Turk.

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How scholars, companies and workers are using Mechanical Turk, a 'gig economy' platform, for tasks computers can't handle

Digital age platforms are providing researchers the ability to outsource portions of their work – not just to increasingly intelligent machines, but also to a relatively low-cost online labor force comprised of humans. These so-called "online outsourcing" services help employers connect with a global pool of free-agent workers who are willing to complete a variety of specialized or repetitive tasks.

Because it provides access to large numbers of workers at relatively low cost, online outsourcing holds a particular appeal for academics and nonprofit research organizations – many of whom have limited resources compared with corporate America. For instance, Pew Research Center has experimented with using these services to perform tasks such as classifying documents and collecting website URLs. And a Google search of scholarly academic literature shows that
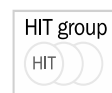
How Mechanical Turk Works

Mechanical Turk is a website marketplace run by Amazon that connects requesters who have discrete, repetitive tasks (known as Human Intelligence Tasks or HITs) with workers from around the world who complete these tasks. HITs are accepted and completed by workers on a first-come, first-serve basis.
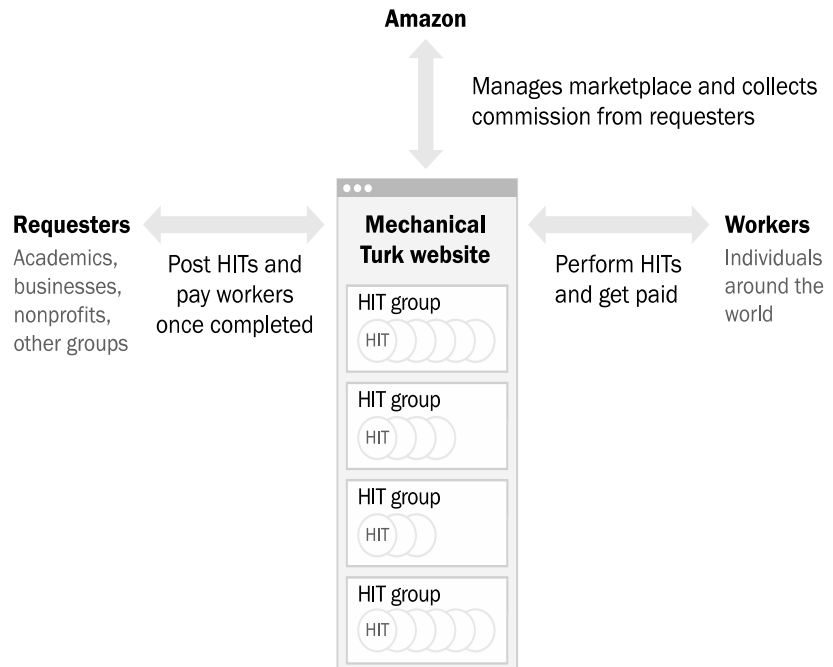
HIT — **Human Intelligence Tasks**
These tasks are individual assignments that can easily be completed by a person but are difficult for computers. Common types of HITs include surveys or the transcription of items from a photo of a receipt.

HIT group — **HIT group**
HITs are displayed in HIT groups. Within each group, there can be any number of related tasks to be done.

Amazon

Manages marketplace and collects commission from requesters

Requesters
Academics, businesses, nonprofits, other groups

Post HITs and pay workers once completed

Mechanical Turk website

HIT group

HIT group

HIT group

HIT group

Perform HITs and get paid

Workers
Individuals around the world

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more than 800 studies – ranging from medical research to social science – were published using data from one such platform, Amazon's Mechanical Turk, in 2015 alone.[1]

The rise of these platforms has also generated considerable commentary about the so-called "gig economy" and the possible impact it will have on traditional notions about the nature of work, the structure of compensation and the "social contract" between firms and workers. Pew Research Center recently explored some of the policy and employment implications of these new platforms in a national survey of Americans.

Proponents say this technology-driven innovation can offer employers – whether companies or academics – the ability to control costs by relying on a global workforce that is available 24 hours a day to perform relatively inexpensive tasks. They also argue that these arrangements offer workers the flexibility to work when and where they want to. On the other hand, some critics worry this type of arrangement does not give employees the same type of protections offered in more traditional work environments – while others have raised concerns about the quality and consistency of data collected in this manner.

A recent report from the World Bank found that the online outsourcing industry generated roughly $2 billion in 2013 and involved 48 million registered workers (though only 10% of them were considered "active"). By 2020, the report predicted, the industry will generate between $15 billion and $25 billion.

Amazon's Mechanical Turk is one of the largest outsourcing platforms in the United States and has become particularly popular in the social science research community as a way to conduct inexpensive surveys and experiments. The platform has also become an emblem of the way that the internet enables new businesses and social structures to arise.

In light of its widespread use by the research community and overall prominence within the emerging world of online outsourcing, Pew Research Center conducted a detailed case study examining the Mechanical Turk platform in late 2015 and early 2016. The study utilizes three different research methodologies to examine various aspects of the Mechanical Turk ecosystem. These include human content analysis of the platform, a canvassing of Mechanical Turk workers and an analysis of third party data.

The first goal of this research was to understand who uses the Mechanical Turk platform for research or business purposes, why they use it and who completes the work assignments posted

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[1] Pew Research Center arrived at this number by searching for the term "Mechanical Turk" on the Google Scholar search engine and verifying that studies utilized data from MTurk. The date range included all of 2015 and results excluded patents and citations.

there. To evaluate these issues, Pew Research Center performed a content analysis of the tasks posted on the site during the week of Dec. 7-11, 2015.

A second goal was to examine the demographics and experiences of the workers who complete the tasks appearing on the site. This is relevant not just to fellow researchers that might be interested in using the platform, but as a snapshot of one set of "gig economy" workers. To address these questions, Pew Research Center administered a nonprobability online survey of Turkers from Feb. 9-25, 2016, by posting a task on Mechanical Turk that rewarded workers for answering questions about their demographics and work habits. The sample of 3,370 workers contains any number of interesting findings, but it has its limits. This canvassing emerges from an opt-in sample of those who were active on MTurk during this particular period, who saw our survey and who had the time and interest to respond. It does not represent all active Turkers in this period or, more broadly, all workers on MTurk.

Finally, this report uses data collected by the online tool mturk-tracker, which is run by Dr. Panagiotis G. Ipeirotis of the New York University Stern School of Business, to examine the amount of activity occurring on the site. The mturk-tracker data are publically available online, though the insights presented here have not been previously published elsewhere.

Workers and their use of the site

Among the key findings of our February 2016 opt-in canvassing of Mechanical Turk workers:

- *The U.S.-based workers who responded to our canvassing are younger and more educated than U.S. workers in general:* 51% of these respondents have a college degree, compared with 36% of working U.S. adults over the age of 18. And 88% of these Turkers are under 50 years old, compared with 66% of employed adults.

- *These Turkers generally report earning less than minimum wage.[2]* While the federal minimum wage is $7.25 per hour (and is even higher in some jurisdictions), about half of workers (52%) in our sample who were asked about their incomes report earning a rate of less than $5 an hour. Making $4.99 per hour, a worker who performs tasks for 40 hours a week and does not take a vacation for an entire year would earn $10,379.20 (before taxes). Only 8% say they earn $8 per hour or more.[3]

- *Turkers in this sample say they frequently visit the site to complete work, rather than checking in on sporadic occasions.* Almost two-thirds of these workers (63%) say they perform tasks on the site "every day."

- *Most of these Turkers in the Pew Research Center sample use the site to supplement other income sources, though a sizable minority relies on the site for the majority of their incomes.* More than half (53%) say that "very little" of their incomes come from Mechanical Turk. By contrast, Turkers who earn "all" or "most" of their incomes there make up 25% of workers.

- *Older workers in this canvassing tend to earn lower wages, and fewer of them rely exclusively on the site for income.* Of the Turkers asked about their incomes, almost three-

Many Mechanical Turk workers report making less than $5 an hour

% of Mechanical Turk workers in Pew Research Center's canvassing who say they make each hourly wage
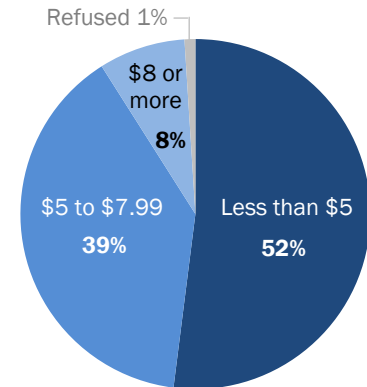
Source: Nonprobability survey of U.S.-based workers on Mechanical Turk conducted Feb. 9-25, 2016.
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[2] For this study, the rewards offered by the Center differed for groups of respondents, ranging from 5 cents to $2. All respondents were asked about their demographics. Only those Turkers who received a reward of more than 5 cents, a total of 2,884 respondents, were asked additional questions such as their hourly wage and work habits.

[3] Mechanical Turk pays its workers by the task completed and not by the hour, therefore it is not required to follow federal wage laws. The specific payments are determined by the requesters and not the site itself. This report does not explore how Mechanical Turk sets prices or pays workers.

quarters of those ages 50 or older make less than $5 per hour. By comparison, about half of Turkers under 50 in the sample fall into this category.

▪ *The demographics of Turkers in this study who earn "all" or "most" of their incomes on the site differ from those who use the site to earn a portion of their incomes.* Those who use Mechanical Turk for "all" or "most" of their incomes tend to be younger, less educated and live in households with lower incomes compared with those who use the site to supplement other pay. Some 49% of Turkers who get the majority of their incomes from MTurk are 18 to 29 years old, compared with 38% of those the same age with other significant income sources. Around one-third (32%) of those who use the site as their primary incomes have college degrees, compared with 58% of those with college degrees who supplement other incomes. And 61% live in households earning less than $40,000 in 2015, compared with 37% who are in the same income bracket and use the site to supplement other income sources.

The requesters and tasks they post on the site

Our analysis of the tasks posted on Mechanical Turk during the week of Dec. 7-11, 2015, finds that:

▪ *Mechanical Turk was used by a mix of companies and academics.* During the week of our analysis of content on the site, academics were responsible for slightly more of the HIT groups posted (36%) than businesses (31%). The remaining tasks were sought by requesters who could not be identified.

▪ *The majority of tasks on the site during this period (61%) were short, repetitive "microtasks" that paid 10 cents or less and could be completed in a few minutes.* Employers used Turkers to perform tasks that are easy for humans and difficult for computers. In the week of our analysis, the most popular request (37% of the HIT groups) involved having workers identify information seen in pictures – often sales receipts. These are easy assignments for humans, but still challenging for computers to read and decipher. The second largest task (26%) involved transcription of audio or video files. The classification of images or other information was third at 13% of the total. These tasks included requests for Turkers to determine if a picture contained a particular

Most Mechanical Turk tasks paid 10 cents or less

% of HIT (task) groups with rewards in each price range during the week of Dec. 7-11, 2015
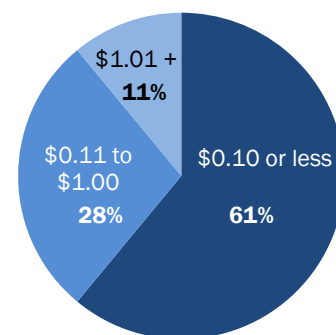
Source: Content analysis of tasks appearing on Mechanical Turk. "Research in the Crowdsourcing Age, A Case Study"

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person or object, or if an audio recording met standards for quality. Surveys comprised a fourth group, also at 13% of the total. Many of these tasks asked Turkers information about themselves and their opinions – similar to the Pew Research Center survey discussed above.

▪ *During the week studied, several companies used the site frequently and made up a large portion of the overall activity.* In fact, the top five most active requesters, all businesses, accounted for more than half of all the HIT group postings on the site (53%). Those businesses posted similar HIT groups multiple times throughout the week that were made up of simple, repetitive tasks. The single most active business accounted for 19% of the total HIT groups – almost all of which asked Turkers to record information contained in pictures of sales receipts.

▪ *While more HIT requests came from academics than businesses, these academics were less likely to post more than once during the week reviewed.* And nearly all of their requests (89%) consisted of surveys. During the week studied, 107 different academic groups used the site for research. Of those, 70% only posted a single request during that time. By contrast, of the 91 businesses who posted jobs, 58% did so more than once.

The emergence of online outsourcing sheds insights into other dimensions of new tech-enabled, world-spanning labor pools. As is often the case when strangers try to work together, issues of trust and reliability quickly enter the picture. On Mechanical Turk, workers have devised rating systems for evaluating requesters and formed active online communities to share stories, tips and warnings about performing in these new environments. Many requesters have contributed to a growing body of literature with suggestions for how to ensure quality work from large numbers of workers.

The economic factors at play in the Mechanical Turk community are similar to other markets utilizing the "gig economy" model. On the one hand, workers' wages must be low enough that employers can save money using the sites. On the other hand, wages must be high enough that workers will want to participate. And issues of data quality and reliability will be paramount for researchers using the sites.

This report will cover these issues and explain how the Mechanical Turk marketplace represents emerging labor markets unrestrained by geographic boundaries and physical limitations.
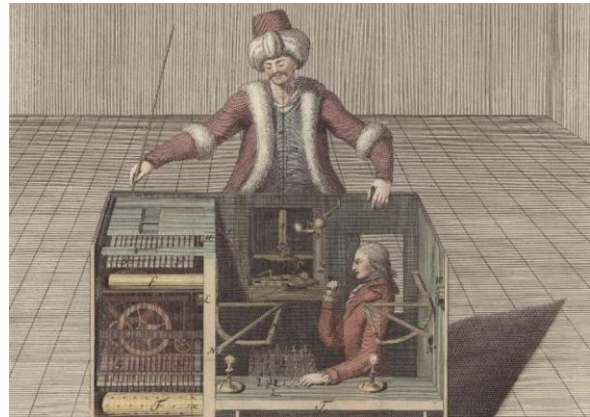
1. What is Mechanical Turk?

Mechanical Turk is a website owned and operated by Amazon since its creation in 2005. The name comes from an 18th century chess-playing device commissioned by Austrian Empress Maria Theresa. Challengers competed against the Turk, believing they were competing against an automated machine. However, the Turk was an illusion. Challengers were led to believe they were playing a mechanized device, when in fact they were competing against a person hidden inside.

The Mechanical Turk website was the idea of Amazon chief executive Jeff Bezos, who believed a platform could be created to exploit the fact that humans can easily perform certain tasks that were difficult for computers. He predicted there was a business to be built around connecting those who wanted research done with those who were willing to do it. By creating the Mechanical Turk marketplace, Bezos tried to create a phenomenon he called "artificial artificial intelligence."

An 18th century engraving by Joseph Racknitz showing how he believed the original Mechanical Turk machine was constructed. Photo: Joseph Racknitz/Public Domain.
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"Normally, a human makes a request of a computer, and the computer does the computation of the task," Bezos told The New York Times in 2007. "But artificial artificial intelligences like Mechanical Turk invert all that. The computer has a task that is easy for a human but extraordinarily hard for the computer. So instead of calling a computer service to perform the function, it calls a human."

In the past decade, researchers from many different fields have come to use the site as a way to get tasks completed in an efficient and inexpensive manner. Pew Research Center decided to conduct research about Mechanical Turk because it is one of the largest such operations and because it has become a common source of research in both the academic and business worlds.
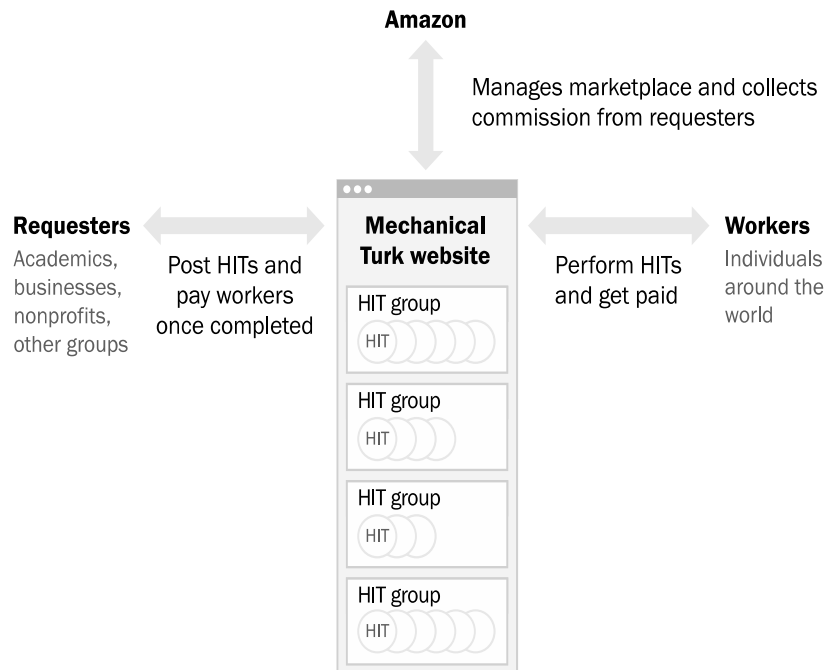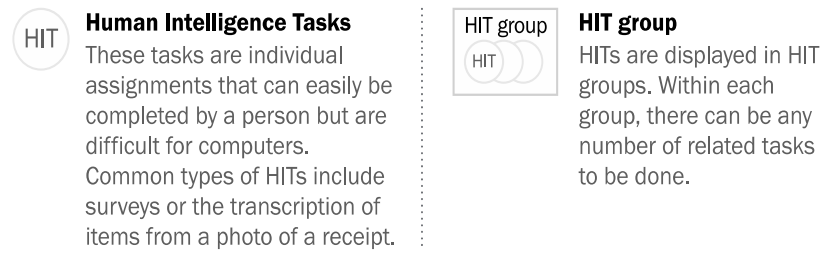
How the marketplace works

The structure of Mechanical Turk is designed to make it easy to access and use. An organization, company or person conceives a task – often a repetitive one that could be described as a "microtask" – for a person to perform. That group or individual becomes a requester by posting the task on MTurk as a HIT (Human Intelligence Task). On the post, the requester includes directions for how to complete the task, the amount of reward they are offering and the qualifications needed for workers to participate. In addition to paying those who complete the tasks, requesters pay an additional percentage as a commission to Amazon.

The level of reward a Turker earns varies depending on specifics of the assignment. Payments for individual tasks can range from free to as much $60. However, Pew Research Center's study of a typical week of work revealed that the majority of tasks (61%) paid $10 cents or less each.

How Mechanical Turk Works

Mechanical Turk is a website marketplace run by Amazon that connects requesters who have discrete, repetitive tasks (known as Human Intelligence Tasks or HITs) with workers from around the world who complete these tasks. HITs are accepted and completed by workers on a first-come, first-serve basis.

HIT

Human Intelligence Tasks
These tasks are individual assignments that can easily be completed by a person but are difficult for computers. Common types of HITs include surveys or the transcription of items from a photo of a receipt.

HIT group

HIT group
HITs are displayed in HIT groups. Within each group, there can be any number of related tasks to be done.

Amazon

Manages marketplace and collects commission from requesters

Requesters
Academics, businesses, nonprofits, other groups

Post HITs and pay workers once completed

Mechanical Turk website

HIT group
HIT group
HIT group
HIT group

Perform HITs and get paid

Workers
Individuals around the world

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HITs are displayed on the site in *HIT groups*. Within each HIT group, there can be any number of related HITs to be completed. For example, a company might want humans to record the contents listed on a picture of a receipt from a retail store. If they have 200 receipts, they can create a single HIT group that contains 200 HITs. The MTurk search screen will show only one HIT group, although it will also list the number of HITs available in that group. Any number of people can click on the group and perform the tasks. That HIT group might be completed by 50 or 100 people, each working on several different receipts.

HITs are accepted by workers on a first-come, first-serve basis. Popular tasks are completed in hours, while other tasks may stay on the site for months. Experienced Turkers have developed a number of ways to identify quickly the best paying tasks.

To become a worker on the site, a person must register with Amazon. That person immediately becomes eligible to "accept" HITs and earn money.

The types of tasks on the site vary greatly. Among other things, Turkers are asked to participate in surveys, transcribe movies and copy text from images.

The Center's investigation of the tasks posted in December 2015 showed that the most common task consisted of workers recording information appearing in an image – often a sales receipt. More than a third of HIT groups (37%) fell into this category. The second largest assignment, at 26%, involved the transcription of audio or video files.

For a new worker, it is difficult to know how long any particular task will take. Each HIT group has the reward posted and the amount of time the worker is given to complete the task. However, the time allotted is often much longer than the time needed.

Over time, workers can earn qualifications that enable them to participate in a wider variety of assignments. Workers earn these qualifications by fulfilling requirements, which usually involve the completion of a specific test or a characteristic of the worker's location or age.

Extracting information from pictures and transcription made up almost two-thirds of Mechanical Turk requests

# of HIT groups in each category during the week of Dec. 7-11, 2015

	# of HIT groups	% of total HIT groups
Collect info from pictures	787	37%
Transcription	562	26
Content classification or matching	274	13
Survey (academic or business)	269	13
Collect info from around the web	145	7
Provide keywords/titles for images	25	1
Website testing	18	1
Other	43	2

Source: Content analysis of tasks appearing on Mechanical Turk. "Research in the Crowdsourcing Age, A Case Study"

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Like in many online marketplaces in the sharing economy, Turkers have developed their own, independent ways to evaluate tasks and requesters. Online forums such as Turkopticon and mturk forum allow users to share their experiences. Workers can rate requesters on how quickly they paid and how complicated the tasks were. There are even sites like turkalert that send emails to users whenever their favorite requesters post a new assignment.

2. The size of the Mechanical Turk marketplace

How many people and organizations use Mechanical Turk? The answer is difficult to determine precisely because key information about the users is proprietary. However, the size of each group can be inferred from a collection of different data sources.

How many people are working specifically on Mechanical Turk?

A 2015 World Bank report estimated Amazon's Mechanical Turk marketplace has about 500,000 registered workers worldwide, although not all of them are active.

According to Alexa.com – a web tracking company also owned by Amazon – Mechanical Turk had about 750,000 unique visitors worldwide in December 2015 alone.

Of course not all of those visitors participated in the marketplace. Some may have visited to see how the site works. However, the Alexa data give at least circumstantial evidence that many were there to earn money. The average user visited the site almost eight times each in December and spent more than 33 minutes per day there.

How many requesters are posting jobs?

During the period (Dec. 7-11, 2015) examined by Pew Research Center, there were 294 distinct requesters who posted at least once, which translates to an average of about 59 requesters per day. But that is only one way to measure the number of people and groups that are using the site on a regular basis.

According to data collected by Professor Ipeirotis' mturk-tracker tool, there was an average of 1,278 active requesters per day in 2015. An active requester is defined as a person or group who posted a job on the site before and after the time captured – meaning they had used the site and would continue to do so. In other words, at any given point in 2015, there was an average of 1,278 requesters who had already posted a task on MTurk and would post another in the future.

The high point of use of MTurk by requesters was March 11 when there were 1,634 active requesters.

3. The requesters: a mix of academics and businesses

In order to gain a fuller understanding of what types of researchers are using Mechanical Turk, Pew Research Center conducted a detailed content analysis of HIT groups posted during the week of Dec. 7-11, 2015. The Center captured and analyzed the most recently posted HIT groups three times a day for each of those five days. In all, 2,123 different HIT groups from 294 different requesters were analyzed. (See the Methodology for a detailed explanation of the capture and coding process.)

Because the only public information about requesters is the screen name of the person or group posting a HIT group, categorization of these requesters is challenging. For this project, Pew Research Center placed requesters into categories based on as much contextual information that was available. For some requesters, the categorization was simple because their screen names clearly revealed their identity.

When a requester's name was not as clear, the Center used other clues to make determinations, including Google searches and the keywords offered by the requester in the task description. Many academics can be located through their personal websites, and keywords such as "research" or "psychology" gave further context. (All of these categorizations were based on the assumption that those who post tasks to MTurk are being truthful when identifying themselves. There is no independent way to confirm whether this was true.)

The requesters were categorized into four distinct groups: "academic," "business," "nonprofit" and "can't tell." Even when using all the contextual information available along with web searches, about a third of the requesters (32%) had generic names that could not be identified. These included names such as "HCTEST," "Roseanna," and "Heather."

Of the requesters who could be identified, slightly more academics than companies used the site

During the week studied, Pew Research Center found that 36% of the unique requesters were either academic groups, professors or graduate students. That was slightly more than the 31% which were businesses. Identifiable nonprofits were barely represented at 1%.

Slightly more academics than businesses used Mechanical Turk

% of unique requesters in each category during the week studied (Dec. 7-11, 2015)
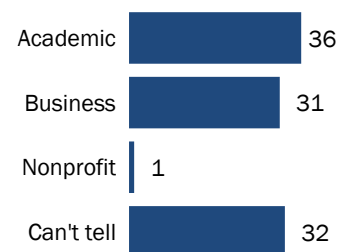
Category	Value
Academic	36
Business	31
Nonprofit	1
Can't tell	32

Source: Content analysis of tasks appearing on Mechanical Turk. "Research in the Crowdsourcing Age, A Case Study"

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While the total number of academics and businesses were fairly close, the details of how each type of group used the site were very different.

A few companies made up the majority of business on MTurk during the week of Pew Research Center's study

The businesses that use MTurk tend to be comparatively active. Even though they made up a smaller proportion of the requesters during the December period of analysis, the amount of work they posted was much greater. Businesses accounted for one-third of the requesters posting tasks (31%), but their work accounted for 83% of the HIT groups posted, compared with only 9% for academics.

The distribution of work from the business community was very top heavy. In fact, just a small number of companies made up the majority of the work posted on the site. The top five most active requesters, which were all businesses, accounted for more than half of all the HIT groups posted for the week (53%).

For these companies, Turkers may have become part of their regular workforce and the use of Mechanical Turk may be an important part of their business model. These companies posted identical tasks on a daily basis.

The most active requester was the CEO of a company that specializes in producing real-time sales data. That firm accounted for 19% of the total HIT groups during the period of our analysis with an average of 79 new HIT groups posted per day. This company provides data based on the behaviors of their research panel. One major component of the company's process is to have shoppers take a picture of their sales receipts and then have Turkers transcribe the purchases listed on those receipts in a standardized format.

Small number of businesses made up majority of tasks on Mechanical Turk

% of tasks requesters posted on Mechanical Turk during the week studied (Dec. 7-11, 2015)

Top 5 businesses combined 53%

All others requesters 47%
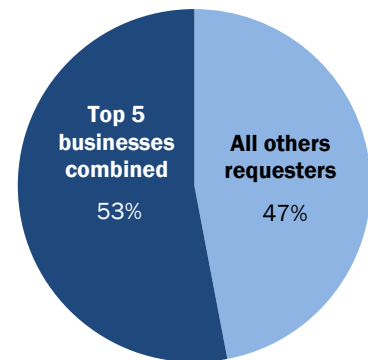
Source: Content analysis of tasks appearing on Mechanical Turk from Dec. 7-11, 2015.
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Virtually all of the HITs posted by this firm during the study were a version of this transcription process. For example, on Dec. 10, the company posted 78 HIT groups, nearly all of which had virtually the same title and description.

The next two largest requesters were both transcription services for audio or video files. Together they accounted for 22% of all the HIT groups in the December study timeframe.

These requests were often for transcription of lengthy audio or video files. For example, a Dec. 14 request asked for a Turker to transcribe an audio file that was 44.5 minutes long. The assignment was to be completed in less than six hours for a payment of $16.

While most transcription requests asked Turkers to transcribe files themselves, some of these services asked Turkers to "approve" or "edit" written transcripts that had already been produced. In this way, they were using the site to double-check the accuracy of other transcribers.

Beyond those top five businesses, there were 86 other businesses that posted on the site, which accounted for 42% of the overall HIT groups that week. These businesses used MTurk for transcriptions along with a wide variety of other types of tasks. One voice talent service, for example, asked Turkers to check whether audio samples submitted by actors met a set of defined criteria. Another business asked Turkers

Transcription service tasks especially popular among a small number of highly active firms

% of HIT groups posted by businesses during the week studied (Dec. 7-11, 2015)

	Five most active businesses	All other businesses	Total
Collect info from pictures	44%	39%	43%
Transcription	42	13	32
Content classification or matching	12	18	14
Collect info from around the web	<1	18	7
Survey	0	6	2
Provide keywords or titles for images	0	2	1
Website testing	0	1	<1
Other	<1	2	1

Source: Content analysis of tasks appearing on Mechanical Turk from Dec. 7-11, 2015. Numbers do not add up to 100 because of rounding.
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to "grade and correct" tasks completed by others. Specifically, workers were asked to verify URLs for businesses that had been found by other Turkers.

Not all of the businesses that used MTurk did so regularly throughout the week. About half of the businesses (53 of them) posted only one or two HIT groups, suggesting they saw MTurk as a place for help with occasional tasks rather than as part of their regular workforce. But those companies combined to make up only a small portion of the overall activity in this period (3%).

In the period studied, academics used MTurk as a survey tool for nonrepresentative samples; those who did typically had one project to complete

These findings indicate that researchers and academics use the site differently from businesses: In general, members of the academic community use Mechanical Turk as a way to conduct inexpensive surveys or recruit study participants, even if those surveys are nonrandom samples.

During this time period, there were 107 different groups and individuals that could be identified as being from the academic community. More than two-thirds of those academic requesters (70%) only posted a single task during the week. On the other hand, 7% posted five times or more. In addition, the vast majority of tasks posted by academics in this period were surveys (89%). Compared with traditional methods of surveys and panel experiments, MTurk is much cheaper and sometimes easier to use.

For academics who used MTurk for something other than a survey, their HIT groups were generally part of other types of experiments. Some researchers asked Turkers to search for a term on Google and report how many ads they saw on the page, while others asked Turkers to conduct visual experiments.

Surveys represent majority of tasks from academics on Mechanical Turk

% of HIT groups posted by academic requesters during the week studied (Dec. 7-11, 2015)

Survey	89%
Provide keywords or titles for images	4
Collect info from around the web	4
Content classification or matching	3
Other	1

Source: Content analysis of tasks appearing on Mechanical Turk. Numbers do not add up to 100 because of rounding.
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4. Turkers in this canvassing: young, well-educated and frequent users

For academics who are unable to conduct large, representative surveys of the American public because of cost, Mechanical Turk offers an alternative. However, the research community is actively debating the validity of surveys and experiments posted on the site.

A number of academic studies have compared the composition of Mechanical Turk survey respondents to the general U.S. population. And while clear differences exist, recent research suggests that many of those differences can be controlled for with proper sampling and weighting techniques – along with the correct amount of caution.

Susan Fiske, a professor of psychology at Princeton University, told PBS in 2015 that compared with the frequent use of undergraduates as study participants, "[Mechanical Turk is] way more representative of American people." She added, "From my point of view as a social psychologist, this is so much better than running [studies on] college students."

While the representativeness of these surveys is one concern, others also worry about the over-exposure of Turkers to academic surveys. David Rand published a 2014 study that found Turkers have become highly experienced with academic studies. According to a survey conducted of 291 workers, the median respondent reported participating in 300 academic studies through MTurk, 20 of which occurred during the past week. Some worry that having this much exposure to surveys and experiments could condition the workers to certain types of answers or have them become overly familiar with the types of questions they will be asked.

Turkers in the Pew Research Center sample are relatively young and well educated

Our nonprobability survey of Turkers in November suggests that they are not representative of Americans overall – or even of working adults.

There is no practical method to directly sample from the list of all Turkers, since their contact information is confidential. However, a number of researchers have studied the characteristics of Turkers by posting a HIT group where workers get paid to answer questions about their demographics and how they use the site. While this method is not as representative as a random sample would be, this process is the best known method possible for understanding the demographics and patterns of people who complete surveys on the site to earn money.

For this study, Pew Research Center conducted its own nonprobability canvassing of 3,370 Turkers living in the U.S. The amount of reward differed for groups of respondents and ranged from 5 cents to as much as $2. A total of 3,370 Turkers answered the survey.[4]

Most workers on Mechanical Turk live in the U.S., although people from around the world are able to use the site. (The site is only available in English.) According to surveys conducted as part of Ipeirotis' mturk-tracker tool during the first two months of 2016, 80% of the workers who responded live in the U.S. Another 16% live in India, while 4% live in other countries.

How Turkers in the Pew Research Center study compare with all working adults

% of U.S. adults in each category

	All working adults	Workers on Mechanical Turk
Male	53%	51%
Female	47	49
Household income		
Under $10K	2	6
$10K to $40K	18	36
$40K to 75K	27	32
$75K to $100K	15	12
$100K or more	39	13
Age		
18-29	23	41
30-49	43	47
50-64	28	10
65+	6	1
Race and ethnicity		
White, non-Hispanic	65	77
Black, non-Hispanic	11	6
Hispanic	16	6
Other	8	11
Educational attainment		
High school graduate or less	35	12
Some college	29	36
College degree or more	36	51

Source: Data for all U.S. workers come from Pew Research Center tabulations of the 2015 Current Population Survey Annual Social and Economic Supplement. The nonprobability survey of U.S.-based Turkers was conducted through tasks posted on Mechanical Turk from Feb. 9-25, 2016. Numbers may not add to 100 due to rounding.
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[4] The amount of the reward varied as part of an experiment on how reward levels affected demographic composition of respondents. However the difference in the demographics by reward level was minor and the experimental groups are combined in this report.

The requirement that Turkers live in the U.S. to work on a specific HIT is common. During the week of MTurk activity studied for this project, 19% of HIT groups had a requirement that workers could only accept the task if they lived within the U.S. More of the HIT groups posted by academic requesters included this stipulation (39%) than those posted by businesses (16%).

In general, the demographic results here are in line with findings made by Ipeirotis and other researchers.

The Center's study of Turkers in the U.S. suggests that Mechanical Turk has become a place for younger, educated people looking to supplement other incomes. Even though the majority of these Turkers said they earn less than $5 per hour, the flexibility creates value for them.

By comparing this survey of Turkers to the composition of the overall adult working population taken from 2015 Census data, the differences in education and age become apparent.

Turkers who answered the Center's online survey are more educated than working adults in general. More than half of Turkers (51%) report they have at least college degrees – much higher than the 36% of adult workers. Only 12% of Turkers report they have high school degrees or less.

At the same time, almost three-quarters of Turkers (74%) surveyed say they live in households earning $75,000 a year or less, compared with 47% of adult workers.

On MTurk, 88% of workers questioned say they are 49 years old or younger, compared with 66% of employed adults.

Workers also tend to include fewer racial and ethnic minorities. Fully 77% of Turkers in the Pew Research Center survey indicate they are white, while 23% self-identify as another race or ethnicity. That is less diverse than the general working population – where 65% are white and 35% are of another race or ethnicity.

In terms of gender, the two groups are not far apart. There is a nearly even split between the number of men and women who use Mechanical Turk in the Center's sample, while the working population has slightly more men (53%) than women (47%).

There are patterns to the ways that Turkers use the site

In order to get a better understanding of the habits of Turkers, Pew Research Center's surveys included several questions focused on workers' interactions with the site. These questions were only asked of workers who were rewarded with 25 cents or more since these surveys required extra time to complete. In all, 2,884 Turkers answered these additional questions.

The results reveal a portrait of Turkers as people who use the site on a frequent basis. At the same time, the money they earn there is often not their primary sources of income, and for many Turkers their reported rate of pay is relatively low.

Turkers in this sample use the site frequently – although the total amount of time they spend there each week varies widely

Many of the Turkers who responded to this survey are frequent users of the site. Fully 95% say they perform tasks on Mechanical Turk more than once a week, and almost two-thirds (63%) say they usually perform tasks every day.

Most Turkers perform tasks every day

% of Turkers in Pew Research Center canvassing who work on Mechanical Turk …
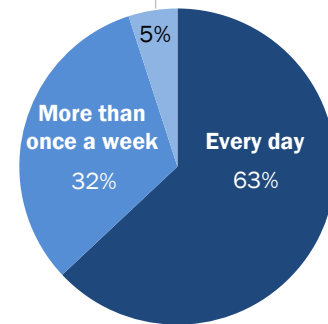
Source: Nonprobability survey of U.S.-based workers on Mechanical Turk conducted Feb. 9-25, 2016.
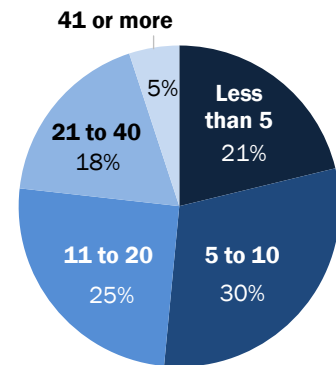"Research in the Crowdsourcing Age, A Case Study"

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But although most of these Turkers do work regularly, the amount of time they spend on the site in total each week varies quite a bit. Almost a quarter (21%) say they typically spend less than five hours a week, while another 30% work between five and 10 hours a week. Only 24% of Turkers indicate that they average 21 hours or more per week.

In addition, for many workers the numbers of hours worked varies from week to week. One of the benefits for Turkers is the flexibility to work when they want to. More than half of Turkers (55%) in this sample report that their hours fluctuate quite a bit from week to week, while 44% say they keep fairly consistent hours over time.

Time per week that Turkers spend on the site varies greatly

% of Turkers in Pew Research Center canvassing who spend … hours a week working on the site

41 or more
5%

21 to 40
18%

Less than 5
21%

11 to 20
25%

5 to 10
30%

Source: Nonprobability survey of U.S.-based workers on Mechanical Turk conducted Feb. 9 - 25, 2016.
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Activity on the site also varies in intensity throughout the day. An analysis of data from mturk-tracker finds that throughout 2015, the number of HIT groups completed by Turkers is highest at 2:00 p.m. EST with an average of 102 HIT groups an hour. That level of activity stays fairly constant until it starts dropping at 9:00 p.m. EST. The lowest rate of activity typically occurs from 5:00 a.m. EST until 11:00 a.m. EST.

This pattern suggests the highest rates of activity occur during the afternoon and evening hours on the East Coast. However, since Mechanical Turk is a service used around the world, the times of day are different for other parts of the U.S. and India, which is either 9.5 or 10.5 hours ahead of the East Coast.

Most Turker activity occurs during evening hours

Average number of HIT groups posted and completed by hour

HIT groups completed per hour

HIT groups posted per hour
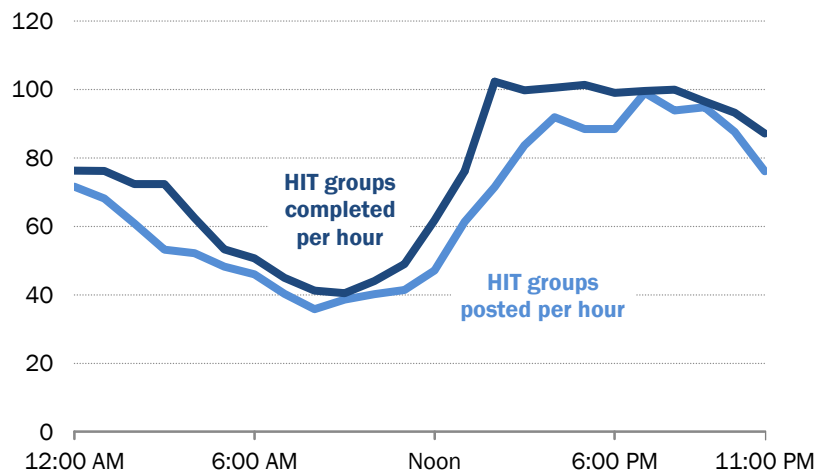
Note: Times are Eastern Standard Time.
Source: www.mturk-tracker.com data from Jan. 1 - Dec. 31, 2015.
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Many Turkers in this sample say they get relatively low hourly wages that they supplement with other outside income

Mechanical Turk pays its workers by the task completed and not by an hourly rate, meaning it is not required to follow federal wage laws. At the same time, the variable pay means workers can earn money based on their skills and speed, rather than constant wages.

To gain an understanding of the typical income for those working on the site, Pew Research Center asked these Turkers to share the amount of money they typically earn per hour.[5]

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[5] Mechanical Turk provides workers with data regarding the money they have earned, but does not provide workers with data regarding their total amount of time working on the site. Data shown here regarding hourly wages are based on self-reported numbers.

Many Turkers report making a relatively low hourly rate, especially when compared to the current federal minimum wage of $7.25 per hour. In the Center's survey, more than half (52%) reported making an hourly rate of $4.99 or less.

At $4.99 per hour, a worker who performed tasks for 40 hours in a week would make $199.60. For an entire year at that rate, a worker who took no time off would earn an income of $10,379.20 (before taxes) and not have any benefits.

At the same time, only 8% of Turkers questioned say they earn $8 per hour or more. At that rate, a worker would earn $16,640 in a year (before taxes) if they worked 40 hours every week.

Roughly half of Mechanical Turk workers make less than $5 an hour

% of Turkers in Pew Research Center's canvassing who self-report making ... per hour on the site
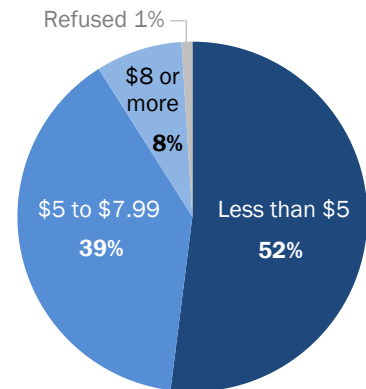
Refused 1%

$8 or more **8%**

$5 to $7.99 **39%**

Less than $5 **52%**

Source: Nonprobability survey of U.S.-based workers on Mechanical Turk conducted Feb. 9 - 25, 2016.
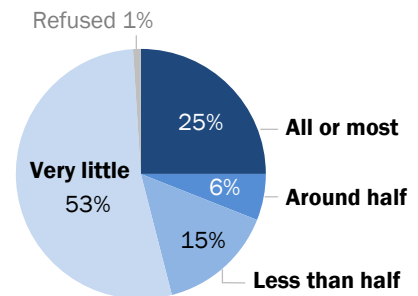"Research in the Crowdsourcing Age, A Case Study"

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For a quarter of these Turkers, their incomes from the site make up most, if not all, of their incomes.

The majority of Turkers canvassed here use the site to supplement other sources of income. Of those surveyed, just over half (53%) say their rewards make up "very little" of their total incomes, while 15% say they make up less than half.

On the other hand, 25% of these Turkers get "all" or "most" of their incomes from the site. For this group of workers, Mechanical Turk is essentially their full-time job.

Mechanical Turk is a primary income source for 25% of Turkers

% of Turkers in Pew Research Center's canvassing who report making … of their incomes from Mechanical Turk

Source: Nonprobability survey of U.S.-based workers on Mechanical Turk conducted Feb. 9 - 25, 2016.
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Turkers in this canvassing who rely almost exclusively on the site for their incomes tend to be younger, less educated and live in households with lower incomes

According to the results of the Pew Research Center survey, the characteristics of Turkers who earn "all" or "most" of their incomes from MTurk are noticeably different from those who use it to supplement other incomes.

In particular, Turkers who make the majority of their incomes from the site tend to be younger and less educated compared with those who use the site to supplement other major sources of income. About one-third of those who rely almost exclusively on the site for income (32%) have college degrees, compared with 58% of those with college degrees and other significant income sources.

In addition, nearly half of the workers in this survey who make all or most of their incomes there (49%) were 18 to 29 years old, compared with 38% of those with considerable incomes from other places. And these Turkers live in households that earn less overall income. The majority of Turkers who claim that Mechanical Turk work is their primary income source (61%) live in households with annual incomes of less than $40,000 in 2015, compared with 37% of other Turkers.

At the same time, the hourly wages for these two groups do not differ by much. Half of Turkers in this canvassing who make most of their incomes there report earning $4.99 an hour or less, compared with 54% of those who have a number of other income avenues.

And even though these Turkers who get almost all of their incomes from the site report lower education levels compared with other Turkers, they are still more educated than the adult working

Turkers who earn all or most of their incomes from MTurk, differ from those who use it to supplement other incomes

Demographic characteristics of Turkers in Pew Research Center's canvassing, based on % of income earned using Mechanical Turk

	Earn all or most of income from MTurk	Earn half or less of income from MTurk
Household income		
Under $10K	16	3
$10K to $40K	46	34
$40K to 75K	24	35
$75K to $100K	7	14
$100K or more	8	14
Refused	*	*
Age		
18-29	49	38
30-49	42	49
50-64	8	11
65+	*	2
Educational attainment		
High school graduate or less	19	10
Some college	49	33
College degree or more	32	58

Source: Nonprobability survey of U.S.-based workers on Mechanical Turk conducted Feb. 9 - 25, 2016.
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population in general. Fully 81% of Turkers without other large income sources have at least some education beyond high school, compared with 65% of employed adults in general.

### Turkers of different ages use the site in different ways

For the most part, Turkers in the Pew Research Center sample tend to use the site in similar ways regardless of their gender or race. However, younger and older users do have different habits, as do Turkers with different levels of educational attainment.

Men and women in the Center's canvassing tend to use the site in similar ways, although women have lower hourly wages on average

The use of the site does not differ much when Turkers are broken out by gender or by race – with one notable exception. Overall, women in this sample report making a lower pay rate than men. Fully 59% of women say they earn less than $5 an hour, compared with 47% of men. This gender difference remains even when factoring in other demographic factors such as race, age, household income and hours worked on the site.

Male Turkers have slightly higher hourly earnings than women

% of Turkers in Pew Research Center's canvassing who make each hourly wage
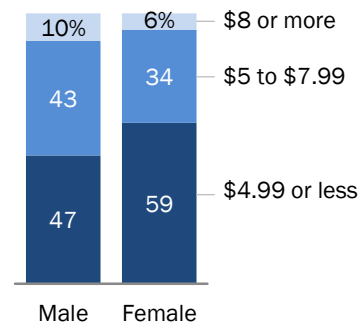
Note: Refused, at 1% each, is not shown.
Source: Nonprobability survey of U.S.-based workers on Mechanical Turk conducted Feb. 9-25, 2016.
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Older workers in this sample make less money on an hourly basis, and fewer of them rely on Mechanical Turk as their primary sources of income

The Pew Research Center canvassing also suggests that older and younger workers tend to interact with the site differently. In particular, older users make less money per hour than younger users – either because these older Turkers work at a slower pace or because they choose tasks that pay less. Fully 73% of Turkers over the age of 50 make less than $5 per hour, compared with 52% of workers ages 30 to 49, and 46% of those 29 years old or younger.

Along with making more money on an hourly basis, younger workers in the Center's sample are also more likely to rely on the site as their primary sources of income. Some 30% of workers ages 18 to 29 indicate that the site makes up most or all their incomes, compared with 22% of those ages 30 to 49 and 17% of those 50 and over.

*Turkers in the Pew Research Center sample with less education use the site more often, but earn lower wages*

Turkers have a range of educational backgrounds, but those with college diplomas tend to use the site less often and are also less likely to rely on their earnings as primary sources of income.

Of the Turkers surveyed with college degrees, 59% use the site every day and 60% work 10 hours a week or less. By contrast, two-thirds of those with less than college degrees (67%) use it every day, while 42% work 10 hours a week or fewer.

Similarly, just 15% of college graduates earn most or all of their incomes from Mechanical Turk, compared with 35% of those without college degrees.

Younger Turkers have higher hourly earnings than older Turkers

% of Turkers in Pew Research Center's canvassing who make each hourly wage
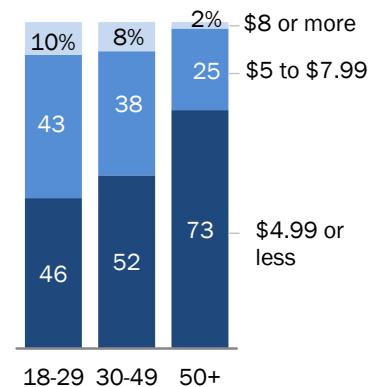
Note: Refused to answer responses, at 1% each, are not shown.
Source: Nonprobability survey of U.S.-based workers on Mechanical Turk conducted Feb. 9 - 25, 2016.
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Acknowledgments

Methodology

This study includes data from four primary sources collected using different methodologies.

Content Analysis

The detailed analysis of the tasks posted on Mechanical Turk consisted of human coding of content that appeared from Dec. 7-11, 2015.

Capture

The most recent 10 pages of HIT groups posted on Mechanical Turk were automatically gathered using a Python scraping tool at three points on each of the five days studied. Each page consists of 20 HIT groups. The times collected were 10 a.m., 3 p.m. and 8 p.m. EST. All the data gathered from the site were publically available.

Because HIT groups are posted so quickly, some of the tasks listed on the 10 pages moved down the list while the scraping tool was running and therefore appeared on more than one of the saved pages. Therefore, the HIT groups collected included a number of duplicates each time. Duplicates were removed after the scraping was complete.

In total, 2,123 different HIT groups were archived during the five-day period.

Human Coding

The unit of measure for the project was the HIT group. No weighting was used in the analysis.

Each HIT group was coded by an experienced researcher for three variables: type of HIT, whether a bonus was mentioned and whether the HIT group explicitly stated that the worker must be at least 18 years old.

Intercoder Testing

To test the validity of the coding scheme, two researchers each coded the same 139 HIT groups that were a subsample of the overall content. The percent of agreement for the three variables were as follows:

> HIT Type: 95%
> Bonus mentioned: 94%
> Adults only: 99%

Additional Classification

After the coding was completed, researchers classified the HIT groups in two more ways. First, HIT groups that explicitly asked for Turkers who lived in the U.S. were identified.

Second, the requesters for each HIT group were categorized by the type of organization or person. The categories were: business, academic, nonprofit or can't tell. Because the only information about requesters that is public is their screen name, researchers placed requesters into groups based on any contextual information that was available. This included words that might have appeared in the title or description of the HIT group such as "psychology" or "experiment" (which suggested the requester was likely an academic). Additional Google searches were conducted to try to gain additional information about the requesters when possible. Because some of this information was derived through contextual information, there is the possibility of some error.

All of this categorization is based on the assumption that those who post tasks to MTurk are being truthful when identifying themselves. There is no independent way to confirm whether this is true.

Pew Research Center survey

Data about the demographics and habits of workers come from a nonprobability survey conducted using the Mechanical Turk site. There is no ideal way to get a random sample of workers since their information is private, so the best option is to post HIT groups on the site and get the largest sample of Turkers possible.

Pew Research Center posted surveys only open to people living in the United States between Feb. 9-25, 2016. Workers were paid variable amounts in order to determine if there were differences in the types of people who respond to different levels of rewards. Workers who were paid 5 cents were only asked questions about their demographics, while those paid 25 cents, 75 cents or $2 were also asked about their use of the site. (The results suggest that there are minor differences in the makeup of workers who responded to the survey with each of the various rewards and will be explored in more detail in a separate report.) In total, 3,370 unique workers responded to the surveys, with 2,884 of those answering the extended set of questions.

Survey estimates presented in this report are not weighted, in part because there are no reliable benchmarks for the population of workers active on Mechanical Turk. No margins of error are reported because this was a nonprobability sample, and we lack data to validate the assumption of approximate unbiasedness.

Data from the U.S. Census

Data regarding the demographics of working adults in the U.S. over the age of 18 came from a Pew Research Center tabulation of the 2015 Current Population Survey Annual Social and Economic Supplement published by the U.S. Census Bureau.

Data from mturk-tracker.com

This report also uses data from the automated data collection site www.mturk-tracker.com, which is run by Dr. Panagiotis G. Ipeirotis of the NYU Stern School of Business. For a full description of the tool written by Ipeirotis, read his paper entitled "Analyzing the Amazon Mechanical Turk Marketplace."

Pew Research Center collected data from the public mturk-tracker API, which has been gathering and posting data about Mechanical Turk for several years. This report includes data from two of the tracker's functions.

First, Ipeirotis has been running a regular survey task for Turkers that includes five questions. Each worker who completes the five question survey is paid 5 cents. The Center compiled survey results from 5,918 respondents from Jan. 1, 2016, to Feb. 29, 2016, in order to determine the percent of workers who were located in the U.S.

Second, mturk-tracker has been collecting data on how many HIT groups and HITs have been posted and completed each hour since May 2014. The data are collected by an automated algorithm 24 times each day. Pew Research Center compiled and analyzed the raw data provided by mturk-tracker's API. (Note: Two days did not have any values in the dataset, Feb. 19 and 20, 2015.)

Topline questionnaire

Q0011 How often do you USUALLY do tasks on Mechanical Turk?

Based on respondents who received $0.25 or more for taking the survey [N=2884]

	CURRENT	
%	63	Every day
	32	More than once a week but not every day
	3	Once a week
	1	Once a month
	1	Less than once a month
	*	Refused

Q0012 How many hours per week do you typically spend doing tasks on Mechanical Turk??

Based on respondents who received $0.25 or more for taking the survey [N=2884]

	CURRENT	
%	21	Less than 5 hours per week
	30	5-10 hours per week
	25	11-20 hours per week
	12	21-30 hours per week
	7	31-40 hours per week
	3	41-50 hours per week
	2	51-60 hours per week
	1	Over 60 hours per week
	*	Refused

Q0013 Would you say that the number of hours you spend working on Mechanical Turk is fairly consistent from week to week, or do your hours tend to be quite a bit higher some weeks and quite a bit lower other weeks?

Based on respondents who received $0.25 or more for taking the survey [N=2884]

	CURRENT	
%	44	My hours are fairly consistent
	55	My hours fluctuate quite a bit
	1	Refused

Q0014 About how much money do you earn per hour doing tasks on Mechanical Turk?

Based on respondents who received $0.25 or more for taking the survey [N=2884]

CURRENT

%		
	52	$4.99 per hour or less
	20	$5 to $5.99 per hour
	11	$6 to $6.99 per hour
	7	$7 to $7.99 per hour
	4	$8 to $8.99 per hour
	3	$10 to $11.99 per hour
	1	More than $12 per hour
	1	Refused

Q0015 Think now about your TOTAL personal income last week. How much of your PERSONAL income did you earn from doing tasks on Mechanical Turk?

Based on respondents who received $0.25 or more for taking the survey [N=2884]

CURRENT

%		
	17	All, or almost all, of your income
	8	Most of your income
	6	Around half of your income
	15	Less than half of your income
	53	Very little of your income
	1	Refused