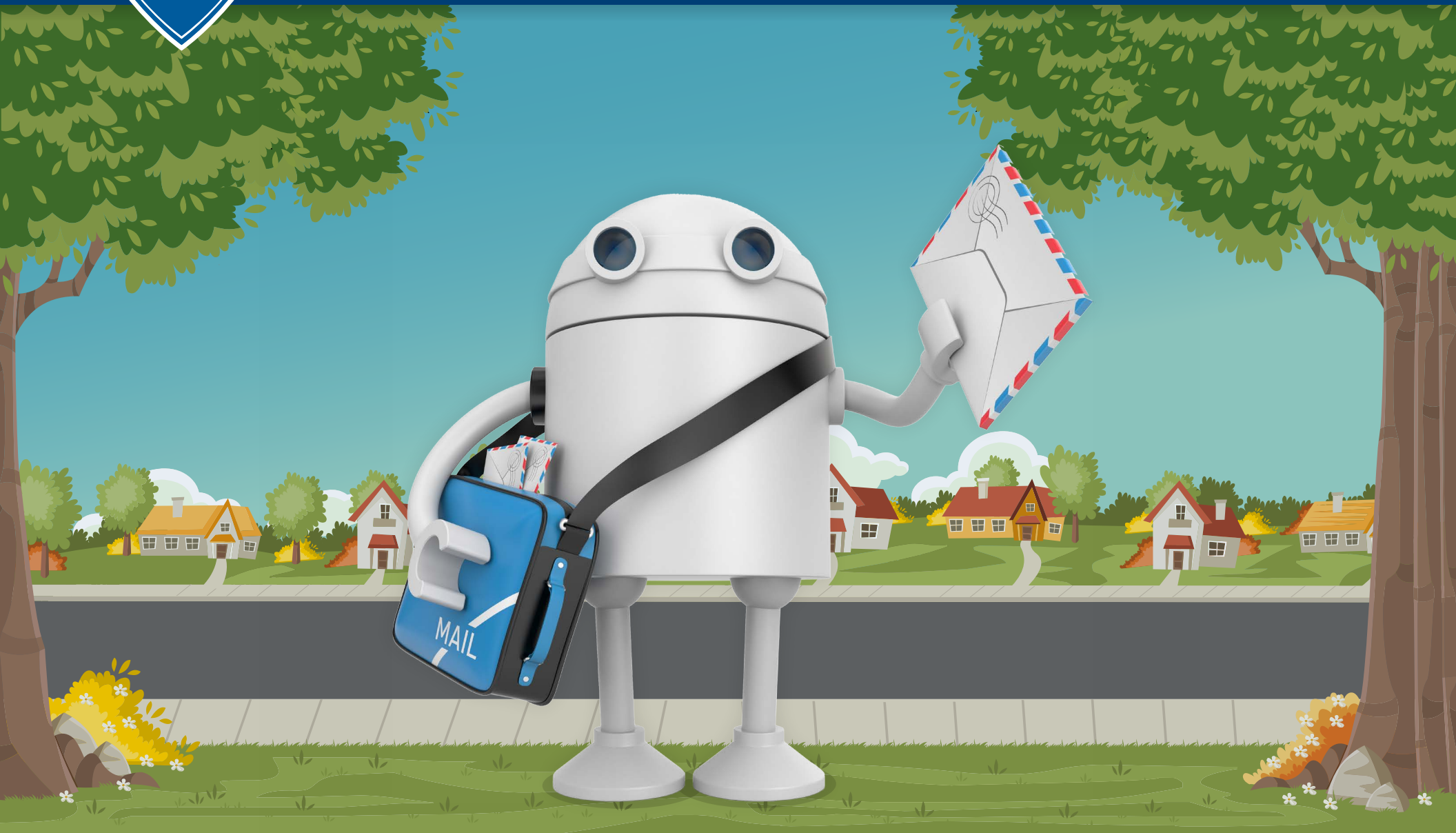
Office of Inspector General | United States Postal Service

RARC Report

# Summary Report: Public Perception of Delivery Robots in the United States

Report Number RARC-WP-18-005 | April 9, 2018



# EXECUTIVE SUMMARY: OVERVIEW

Delivery robots may seem futuristic, but this next wave of logistics technology can be already found on sidewalks throughout the world. More pragmatic than flying drones and less potentially dangerous than driverless vehicles, self-guided delivery robots are already being tested in neighborhoods from Washington, D.C. to the German spa town Bad Hersfeld and the Swiss capital Bern.

Delivery robots have quietly made technical leaps that will make them practicable surprisingly soon. Major retailers and logistics operators are funding research that banks on the technology's promise to lower costs and increase operational efficiency while improving labor conditions for delivery people.

With delivery robots on the cusp of operational feasibility, however, the question remains: how will the public react to this nascent technology? Will people be comfortable sharing their sidewalks with self-guided robots? Will they trust locked robots to securely transport their valuable cargo? Will they miss the nuances of human interactions with delivery people? Those experimenting with these technologies may want to know the answers to these questions in advance in order to address how the public would react prior to a rollout. Otherwise, the result could be damage to organizations' brand image, or the introduction of regulations that limit delivery robots' implementation.

In order to understand how the public might react to self-guided delivery robots, the U.S. Postal Service Office of Inspector General (OIG) administered an online survey targeting a nationally representative sample of 18-75 year-old residents in all 50 states and the District of Columbia in November-December 2017. The goal of the survey was to gauge public perception of delivery robot technology for two different applications:

1. "Independent Delivery" robots that would transport mail and packages from senders to recipients on their own, without any human accompaniment.
2. "Helper Robots" that would follow delivery people as they completed their work, freeing them from having to carry as many items at a given time, or from having to go back to their delivery truck as often to retrieve additional items.

The survey tested the overall appeal of the technology, opinions about its potential benefits, the public's expected timeframe for implementation, and their potential concerns. The survey also asked participants who they most trust to implement the technology among four key players: USPS, FedEX, UPS, or Amazon.

# EXECUTIVE SUMMARY: KEY FINDINGS

Analysis of the OIG survey's results yielded several key findings, including:

- **Lower awareness:** While many respondents reported knowing something about drones or self-driving vehicles, far fewer have seen or heard about delivery robots.
- **Rapid rollout:** After learning about the idea, a large majority of survey participants say that they believe delivery robots will be in use within the next 5 years.
- **A positive reaction — and a potential winner for the USPS brand:** Many more report liking the delivery robot concepts than disliking them. The Helper Robot concept was exceptionally well received, providing large boosts to USPS' brand positivity and its image as an innovative organization if implemented.
- **Flexible delivery and improved working conditions are robots' best perceived benefits:** The ability to receive deliveries when and where recipients choose is viewed as Independent Delivery's greatest benefit, while Helper Robots' ability to improve working conditions and reduce injuries for delivery people are perceived as that concept's best benefits.
- **Open to receive and willing to pay:** Three in four of those surveyed are open to — or would always prefer — receiving delivery from a robot. Many also report that they would be willing to pay slightly more to receive the touted benefits of robot delivery.
- **Limited concerns:** The public has some concerns about the safety of delivery robots, but their primary concern is with potential job losses for delivery people.
- **Different groups, different perspectives:** Millennials and urban residents like the idea of delivery robots more than their older or more rural counterparts.

Given their potential benefits, the Postal Service may someday consider incorporating delivery robots into its operations and, if so, would want to perform the usual feasibility assessments that would come along with such an idea. Since the American Public is the Postal Service's customer base, however, it would be advisable for the organization to keep a close eye on how public opinion regarding this new technology evolves over time.

# HOW TO READ THIS REPORT

The U.S. Postal Service Office of Inspector General's (OIG) public opinion research projects are different from other OIG products in that they are designed to be useful to a general audience while also meeting the technical disclosure standards required by the field of survey research.

The content of this survey's reporting is divided across three separate products, each of which is available through the OIG's document library.* Each product has been designed to be readable as a stand-alone report:

- Those with interest in national findings on the research topic should focus on the Summary Report.
- Those with interest in in-depth reporting for several relevant subgroups should also review the Detailed Subgroup Findings Report.
- Those interested in the technical details surrounding the collection of the data used for this project should review the Methodology Report.

*The USPS OIG Document Library can be accessed through the web at: https://www.uspsoig.gov/document-library.

Most of the slides in the reporting for this survey are designed so that they can be consumed on their own. This way, if someone takes out one slide and shares it, they can understand the findings presented without needing to see the entire report. For that reason, the footnotes found on each slide include important details that might be different from what a general audience is used to seeing, such as notes about any statistical testing that was performed, or the full text of any question whose results are reported on the slide.

General audience members will be most interested in the findings presented at the top of each page of a report. As you move down any given slide, the information presented gets more detailed and technical.

***Please see Appendix A for additional guidance on interpreting the detailed data visualizations that are presented throughout this report.***

*Note:* Throughout this report, Amazon.com, UPS, and FedEx are used to identify companies about which survey data was collected. Amazon.com is the registered trademark of Amazon.com, Inc. UPS is the registered trademark of United Parcel Service of America, Inc. FedEx is the registered trademark of Federal Express Corporation. These trademarks and their respective logos are used for identification purposes only and their use is not meant to imply in any way that the registered holders of the trademarks sponsor or endorse this report or the services of the U.S. Postal Service.

# METHODOLOGY

The U.S. Postal Service Office of Inspector General (OIG) fielded a confidential online survey targeting a nationally representative sample of 18-75 year-old residents of the 50 United States and the District of Columbia. Respondents were selected from an opt-in Internet panel, solicited by email, and incentivized to complete the survey on the OIG's online survey platform by the sampling services provider SSI, per their standard sampling procedures. The survey was conducted in English and Spanish.

Quota sampling procedures were employed during the survey field period in order to improve the representativeness of the data collected. Quotas were employed on age, gender, nativity within ethnicity, race, education, geographic subregion, and ecommerce participation.

With the exception of ecommerce participation, data were weighted prior to analysis according to U.S. Bureau of the Census population estimates on all quota variables, as well as on income and employment status. Ecommerce participation was weighted to reflect the proportion of Americans that had purchased something online in the previous month*. All data and sample sizes in this research's reports are weighted.

Field Dates: November 13 – December 6, 2017

Total Respondents: 2,942

Median Interview Length: 18 minutes 34 seconds

95% confidence interval (National Sample): +/- 1.8%**

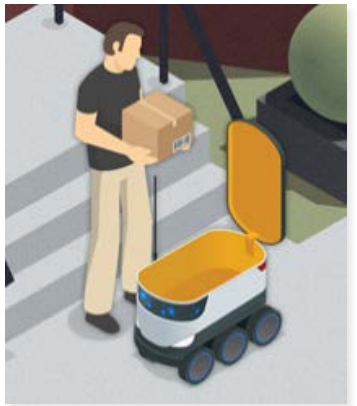
***Please see the Methodology Report for this project for detailed information regarding the methodology employed for this research.***

*Benchmark per the results of a national general population probability telephone survey. | **This interval is being provided as a benchmark. +/- 1.8% is the size of the confidence interval that would be calculated from a probability sample of n=2,942. Like most online research, this study uses a non-probability sample. The actual interval is likely to be somewhat larger, as other sources of error may also impact findings.

# TWO DELIVERY MODELS PRESENTED TO RESPONDENTS

*Model 1:*

## Independent Delivery



In the “Independent Delivery” model, self-guided robots would deliver items on their own, without a carrier accompanying them. The robots would be on wheels, would be about 3 feet tall, and would have a locked compartment where items to be delivered would be secured.

Independent delivery robots would use onboard cameras and sensors to help them safely avoid people and objects as they navigate from the sender of an item to the person receiving it. They would travel on sidewalks at about the same speed as a person walking, using crosswalks when necessary to cross streets. Their cameras, locked compartments, and other design features would also help prevent people from tampering with the robot or its contents as it completed deliveries.

When ordering an item to be delivered by a self-guided robot, the recipient would choose the time when they wanted the item to be delivered, which could be in as little as 15-30 minutes, depending on how far the robot would need to travel and on what kinds of items were being delivered. When placing an order, recipients would also choose the place of delivery — which could be their address, or another location of the recipient’s choice.

Fifteen to thirty minutes before an item was scheduled to arrive, the recipient would be sent an email, text, or phone app notification to let them know that the robot, with the items to be delivered locked inside, was on its way. Once the robot arrived at the delivery location, it would send another message stating that it was waiting outside and would let the recipient know how many minutes they had to retrieve their item before the robot would return to the sender. That message would also include a 4 digit code that the recipient would use to unlock the robot’s compartment in order to retrieve their item.

After delivery, the robot would use its onboard cameras and sensors to help it safely avoid people and objects as it navigates back to the sender’s location.

# TWO DELIVERY MODELS PRESENTED TO RESPONDENTS

*Model 2:*

## Helper Robots

In the “Helper Robots” model, a delivery person would load their items for delivery into the robot. The self-guided robot would then follow the carrier as they walked between homes and businesses and would help them complete their work. The robots would be on wheels, would be about 4 feet tall, and would have a locked compartment where items for delivery would be secured.

Helper robots would use sensors and cameras to help them stay close to, and travel at about the same speed as, the delivery person that they were helping. The robots would also use their sensors and cameras to help them safely avoid people and objects as they navigate between delivery points, and to help prevent other people from tampering with the robot or its contents.

Using self-guided robots would free delivery people from having to personally carry as many items at a given time while they did their work. It would also free them from having to go back to their delivery truck as often to retrieve the additional items that they needed to deliver. This would allow the delivery person to cover a larger area in less time.

For recipients, the experience of receiving an item delivered by a carrier being helped by a self-guided robot would be about the same as it is now. When a delivery person reached an address that required a signature for delivery, the delivery person would take that item from the robot and bring it to the door. The person receiving the item would then sign for and receive the item in the same way that they would if the delivery person was not being helped by a self-guided robot.

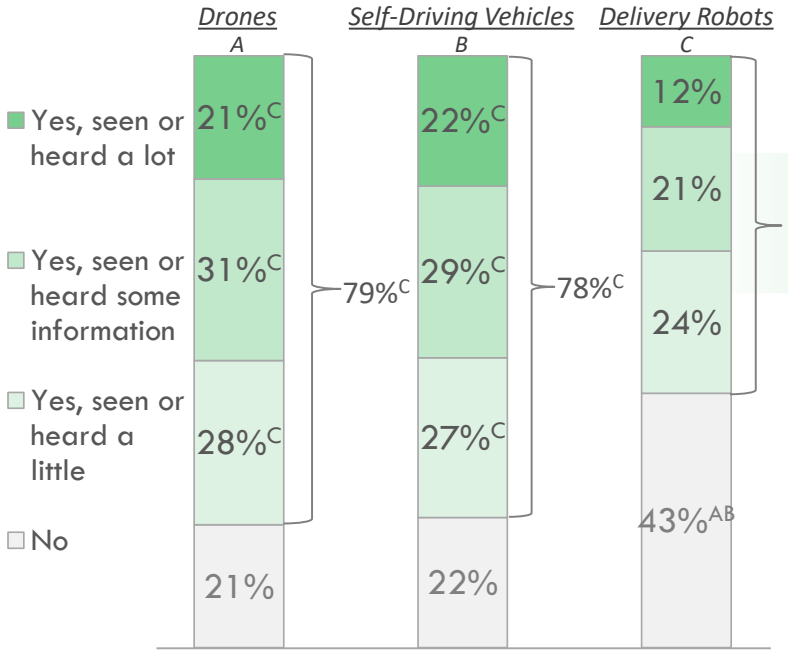
When a delivery person made a delivery that did not require a signature, then that carrier would take the item to be delivered out of the robot and would leave it in the same way, and in the same place, as they would now.

# National Sample Findings

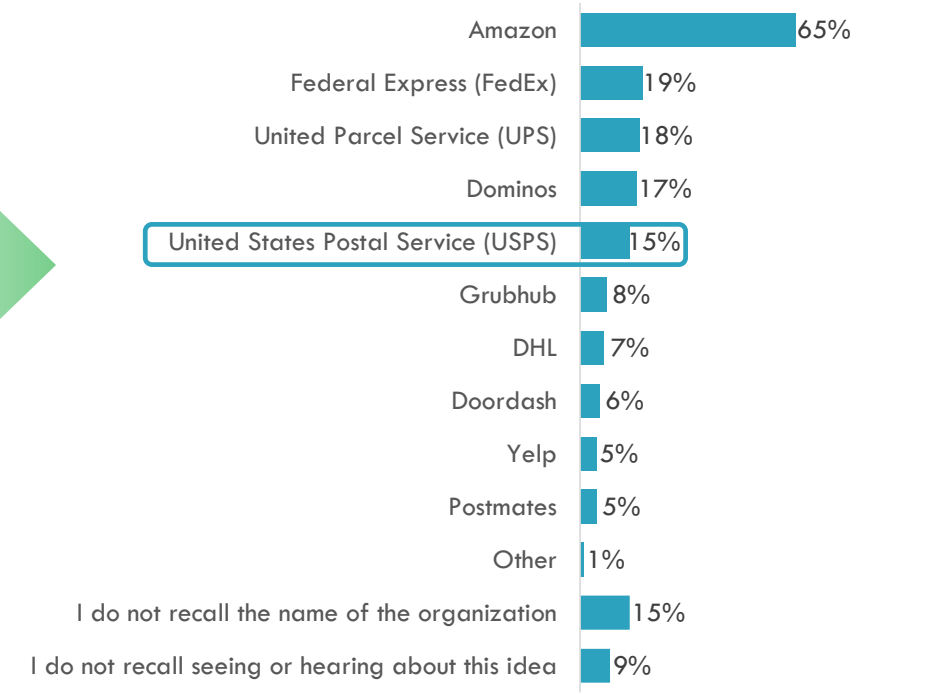
# Lower awareness: far fewer respondents report having seen or heard about delivery robots than about delivery by drone or self-driving vehicles.

- Among those who have previously seen or heard about the idea, Amazon is most strongly associated with the concept. About as many cite USPS as a brand considering the concept as cite FedEx, UPS, and Dominos.

*Seen or heard about organizations developing the following technologies for delivery?*
*(Among National Sample, n=2,942)*

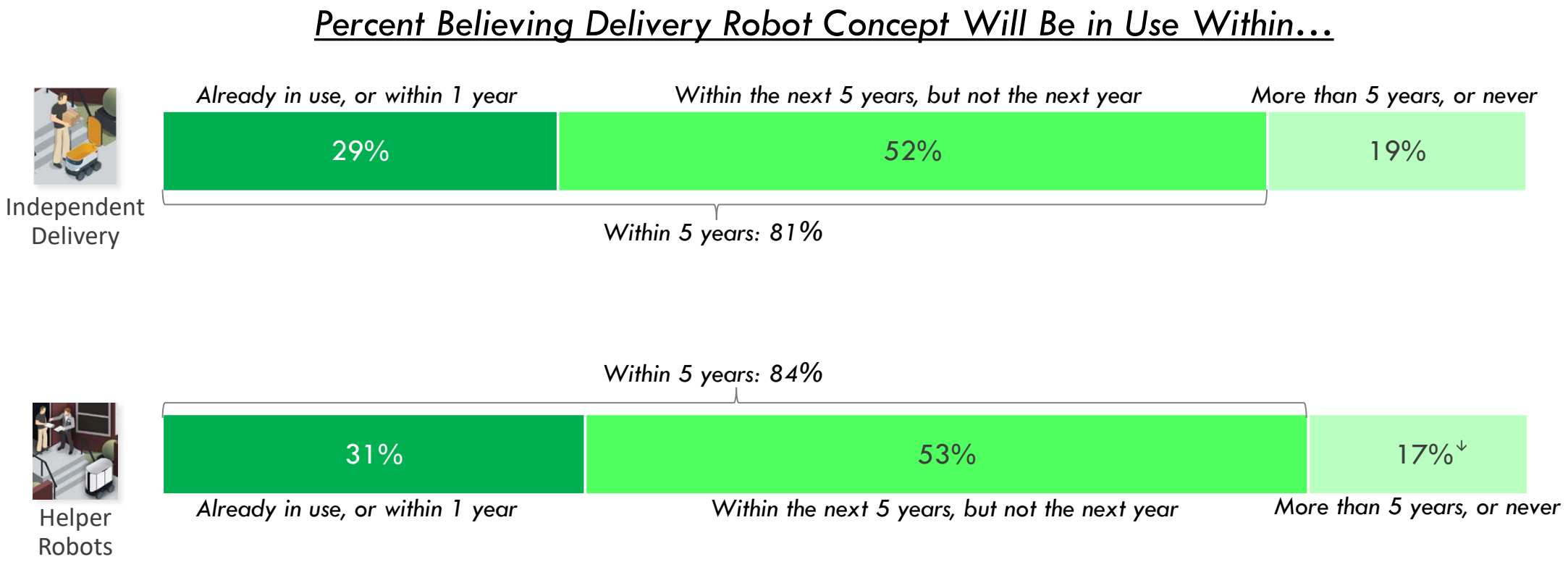



*Brand Associated with Delivery Robot Concept**
*(Among aware of Concept, n=1,666)*




*Findings presented based on those who reported having heard of the delivery robot concept at Q5. | All questions asked prior to exposure to descriptions of Independent Delivery and Helper Robot concepts. | Q5. Have you seen or heard anything about organizations developing the following technologies for the delivery of food, mail, priority documents, or packages? | Q7. According to what you have seen or heard, which, if any, of the following organizations are considering the use of self-guided robots for the delivery of food, mail, priority documents, or packages in the future? | 95% confidence interval (National Sample): +/- 1.8%. | A,B,C: Significantly higher than corresponding group.

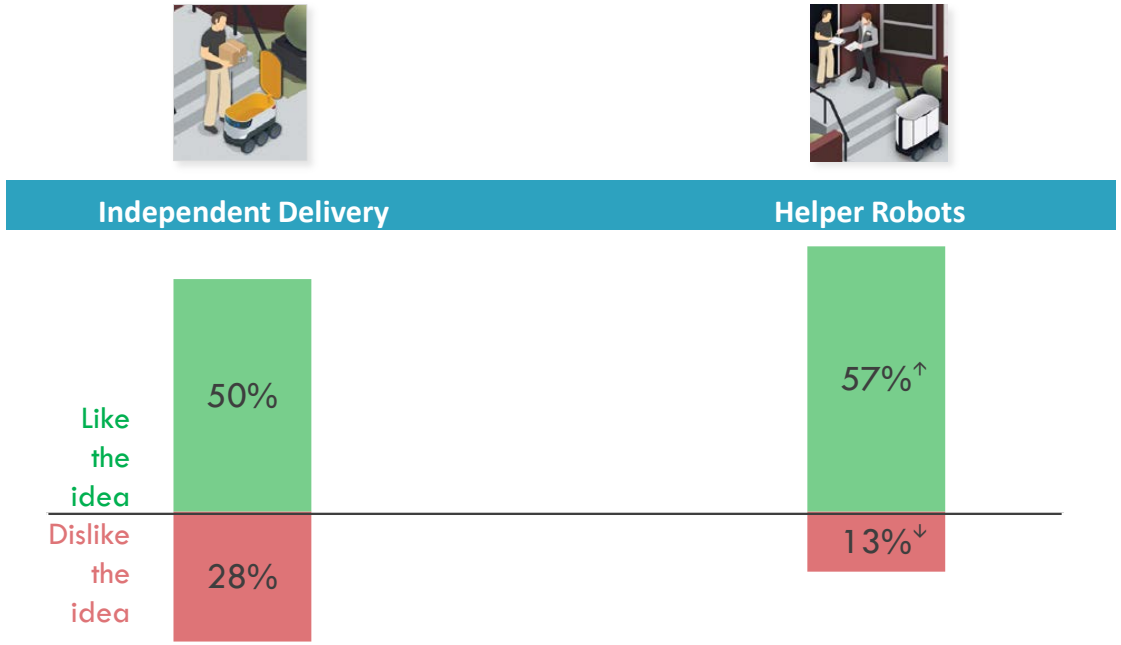
# Rapid rollout: after learning about the idea, a large majority of survey participants say they believe delivery robots will be in use within the next 5 years.




Findings presented are based on the National Sample (n=2,942). The data shown combines scale points for clarity of presentation. | All questions asked following exposure to descriptions of Independent Delivery/Helper Robots concepts. | A7/B6. When, if ever, do you expect that companies might start to use self-guided robots [as we just described for the delivery of food, mail, priority documents, or packages/to help delivery people complete their work, as we just described]? (Scale: Within the next year; Within the next 3 years, but not the next year; Within the next 5 years, but not the next 3 years; Within the next 10 years, but not the next 5 years; More than 20 years; Never). | Question missing the following response option when presented to respondents due to a programming error: Within the next 20 years, but not the next 10 years. | 95% confidence interval (National Sample): +/- 1.8%. | ↑ / ↓: Significantly higher/lower than Independent Delivery measure at 95% c.l.

# Overall, the public likes the idea of delivery robots, particularly when they are put to use in helping delivery people complete their work.

## *Overall Concept Liking*




Findings presented are based on the National Sample (n=2,942). The data shown combines scale points for clarity of presentation. | All questions asked following exposure to descriptions of Independent Delivery/Helper Robots concepts. | A/B4. Overall, how much do you like or dislike the idea of receiving deliveries from [self-guided robots/delivery people being helped by self-guided robots] as just described? (Scale: I like the idea very much; I like the idea somewhat; I neither dislike nor like the idea (omitted from graph); I dislike the idea somewhat; I dislike the idea very much). | 95% confidence interval (National Sample): +/- 1.8%. | ↑ / ↓: Significantly higher/lower than assessment of Independent Delivery.

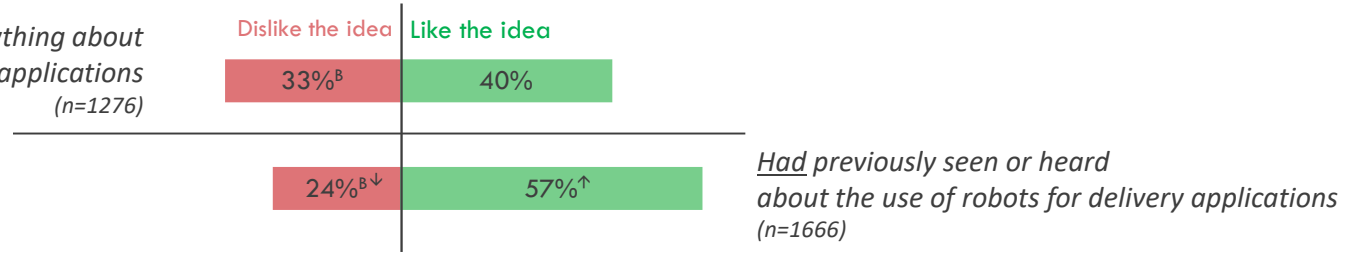
# Increased exposure leads to increased acceptance: those who had previously seen or heard about delivery robots like the idea more than those who had not.

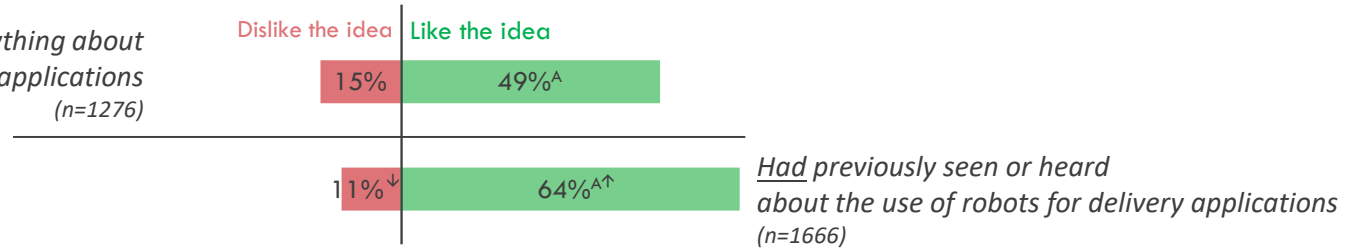
- Those without prior knowledge of the technology are much warmer to the idea of "Helper Robots" than "Independent Delivery" robots.

***Concept Liking by Previous Exposure to the Idea of Delivery Robots***

Independent Delivery
A

Helper Robots
B




The data shown combines scale points for clarity of presentation. | Findings based on those who reported having, or not having, previously seen or heard anything about the use of at Q5. Have you seen or heard anything about organizations developing the following technologies for the delivery of food, mail, priority documents, or packages? | Q5 asked prior to exposure to descriptions of Independent Delivery/Helper Robot concepts, A/B4 asked following concept exposure. | A/B4. Overall, how much do you like or dislike the idea of receiving deliveries from [self-guided robots/delivery people being helped by self-guided robots as just described]? (Scale: I like the idea very much; I like the idea somewhat; I neither dislike nor like the idea (omitted from graph); I dislike the idea somewhat; I dislike the idea very much; Not sure/Don't know enough to say). | A,B: Significantly higher than corresponding group. | ↑ / ↓: Significantly higher/lower than "had not previously seen or heard of the concept" at 95% c.l.

# Different groups, different perspectives: millennials and urban residents like the idea of delivery robots more than their older or more rural counterparts.

## *Concept Liking Among Subgroups*

| | | National Sample (n=2942) | Generations | | | Rurality | | |
|---|---|---|---|---|---|---|---|---|
| | | | Millennials (n=981) A | Generation X (n=777) B | Baby Boomers (n=1184) C | Urban (n=1027) D | Suburban or Small Town (n=1500) E | Rural or Remote (n=414) F |
| Independent Delivery | Like the idea | 50% | 64%$^{BC}$ | 53%$^{C}$ | 36% | 57%$^{EF}$ | 48%$^{F}$ | 41% |
| | Dislike the idea | 28% | 20% | 23% | 38%$^{AB}$ | 23% | 30%$^{D}$ | 35%$^{DE}$ |
| Helper Robots | Like the idea | 57%↑ | 65%$^{BC}$ | 59%$^{C}$↑ | 49%↑ | 61%$^{EF}$ | 56%↑ | 52%↑ |
| | Dislike the idea | 13%↓ | 11%↓ | 12%↓ | 15%$^{A}$↓ | 11%↓ | 12%↓ | 17%$^{DE}$↓ |

The data shown combines scale points for clarity of presentation. | Generations defined based on responses to the question "S5. What is your age in years?" Millennials were defined as being aged 18-34, Generation X as being aged 35-49, Baby Boomers as being aged 50-75. | Rurality based on responses to the question "S3. Which of the following best describes the area where you live?" Respondents classified as Urban answered "A city or urban area." Respondents classified as Suburban answered "A town or suburban area" or "A small town." Respondents classified as Rural answered "A rural area" or "A remote area with few other nearby residents." | A/B4 asked following exposure to descriptions of Independent Delivery/Helper Robots concepts. | A/B4. Overall, how much do you like or dislike the idea of receiving deliveries from [self-guided robots/delivery people being helped by self-guided robots] as just described? (Scale: I like the idea very much; I like the idea somewhat; I neither dislike nor like the idea (omitted from graph); I dislike the idea somewhat; I dislike the idea very much). | 95% confidence interval (National Sample): +/- 1.8%. | A,B,C,D,E,F: Significantly higher than corresponding subgroup within group. | ↑ / ↓: Significantly higher/lower than assessment of Independent Delivery.

# In general, those surveyed believe that the Helper Robot concept would be slightly more likely to work than the Independent Delivery model. Urbanites are the most likely to feel that the concepts would work in the area where they live.

## *Concept Feasibility "In Your Area"*

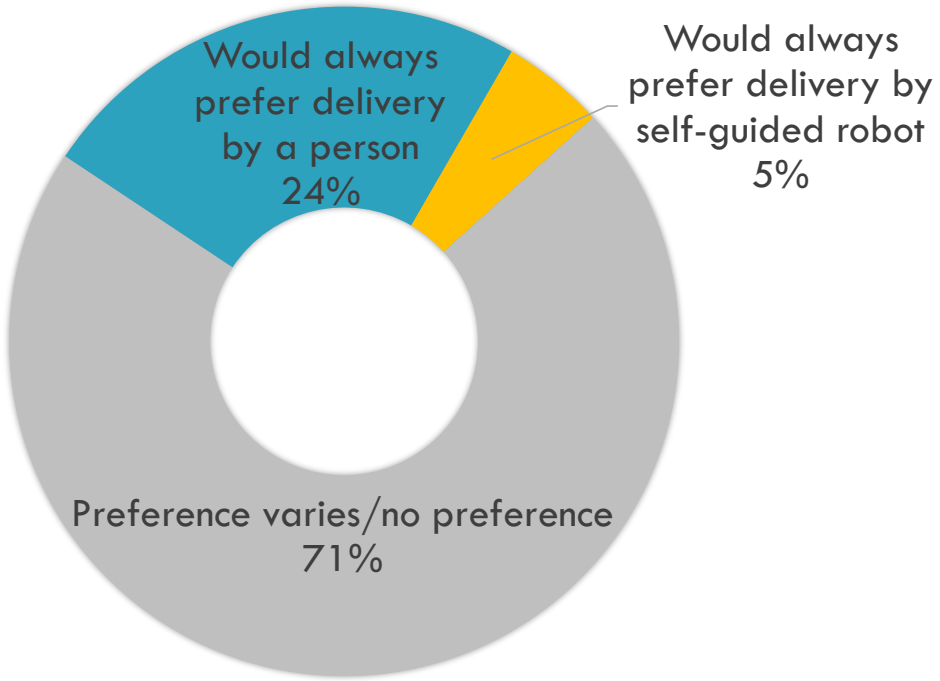
| | | National Sample (n=2942) | Rurality: Urban (n=1027) A | Rurality: Suburban or Small Town (n=1500) B | Rurality: Rural or Remote (n=414) C |
|---|---|---|---|---|---|
| Independent Delivery | Concept Would Work in My Area | 50% | 59%$^{BC}$ | 48%$^{C}$ | 35% |
| | Concept Would Not Work in My Area | 42% | 32% | 44%$^{A}$ | 57%$^{AB}$ |
| Helper Robots | Concept Would Work in My Area | 61%$^{\uparrow}$ | 68%$^{BC\uparrow}$ | 61%$^{C\uparrow}$ | 39% |
| | Concept Would Not Work in My Area | 31%$^{\downarrow}$ | 24%$^{\downarrow}$ | 30%$^{A\downarrow}$ | 51%$^{AB}$ |

The data shown combines scale points for clarity of presentation. | Rurality based on responses to the question "S3. Which of the following best describes the area where you live?" Respondents classified as Urban answered "A city or urban area." Respondents classified as Suburban answered "A town or suburban area" or "A small town." Respondents classified as Rural answered "A rural area" or "A remote area with few other nearby residents." | A/B5 asked following exposure to descriptions of Independent Delivery/Helper Robots concepts. | A/B5. Overall, how well do you think [the use of self-guided robots for the delivery of food, mail, priority documents, or packages as just described/delivery people using self-guided robots to help them complete their deliveries] would work in the area where you live? (Scale: The idea would work very well; The idea would work somewhat well; The idea would not work very well; The idea would not work at all; Not sure/don't know enough to say (omitted from graph)). | 95% confidence interval (National Sample): +/- 1.8%. | A,B,C: Significantly higher than corresponding group. | ↑ / ↓: Significantly higher/lower than assessment of Independent Delivery.

## 7 in 10 U.S. residents would consider receiving deliveries from unaccompanied robots. Even if it cost more or took longer to receive their shipment, 24 percent would always prefer to receive their deliveries from a person, while 5 percent would always prefer to receive delivery from a robot.

Independent Delivery

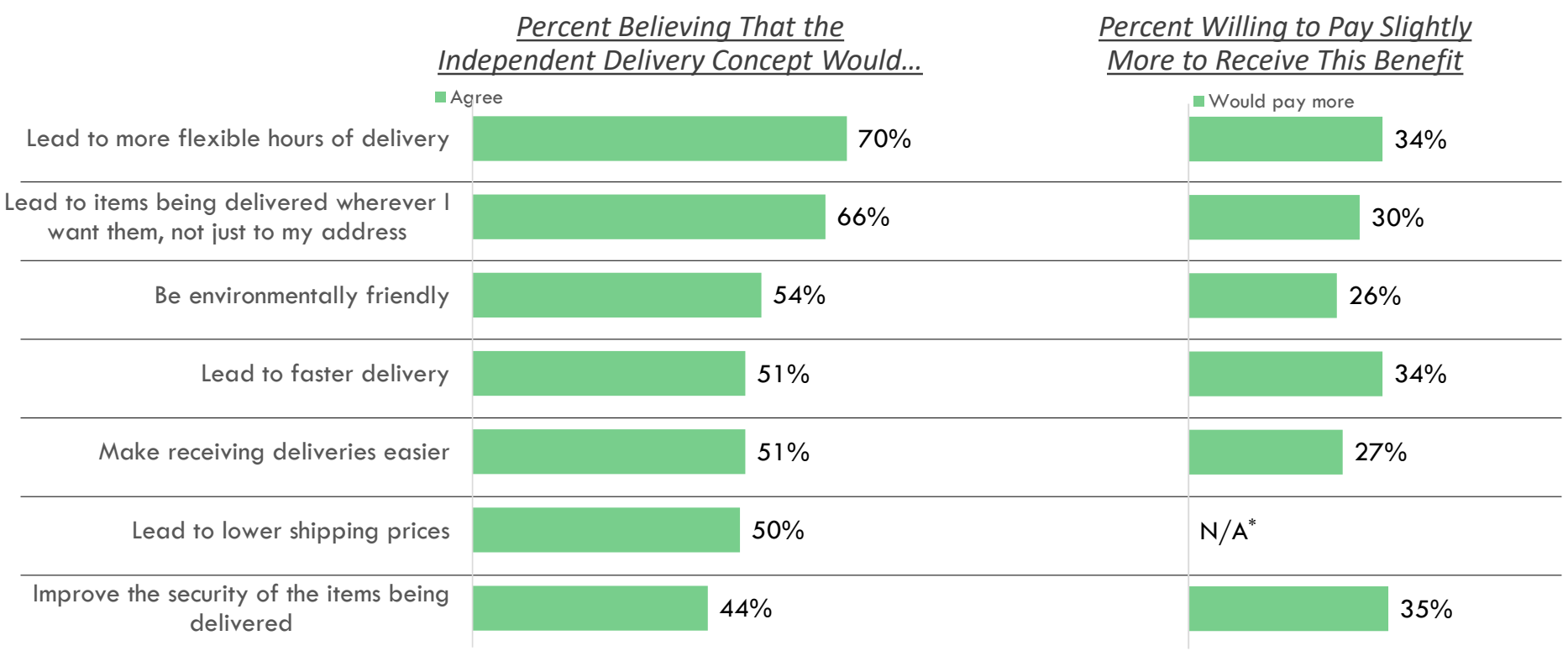
### *Delivery Preference: Independent Delivery Robots vs. Delivery People*




Findings presented are based on the National Sample (n=2,942). The data shown combines scale points for clarity of presentation. | Question asked following exposure to description of concept. | A6. If the technology for self-guided delivery robots was fully developed and in use today, and the below statements were true, would you prefer to receive your items from…? [Options evaluated: Delivery time and delivery cost would be the same whether delivered by a person or by a self-guided robot; Delivery time would be shorter if delivered by self-guided robot; Delivery time would be shorter if delivered by a person; Delivery cost would be slightly lower if delivered by a self-guided robot; Delivery cost would be slightly lower if delivered by a person] (Scale: Prefer to receive delivery from a self-guided robot; No preference; Prefer to receive delivery from a person; Not sure). | Question not asked for Helper Robot concept, where the robot would be accompanied by a person. | 95% confidence interval (National Sample): +/- 1.8%.

# Most of those surveyed believe that Independent Delivery robots could offer a more flexible delivery experience, and around 1 in 3 say that they would be willing to pay slightly more to receive those benefits.

Independent Delivery

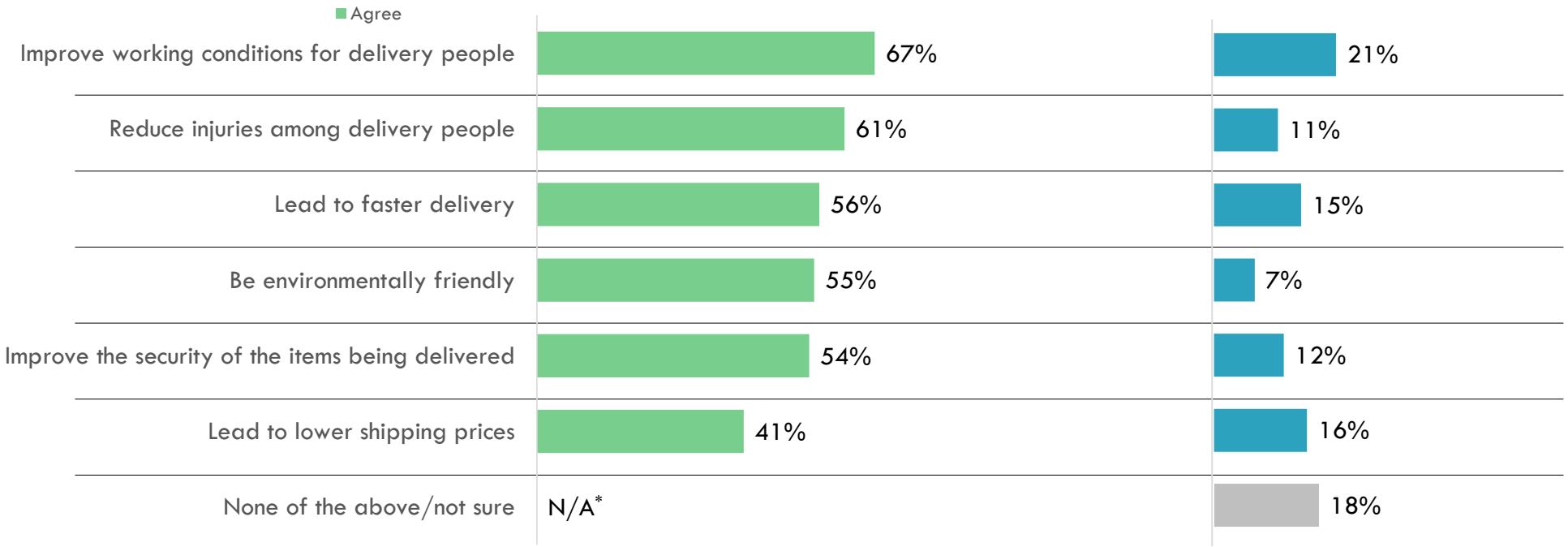



Findings presented are based on the National Sample (n=2,942). The data shown combines scale points for clarity of presentation. | All questions asked following exposure to description of concept. | A8. To what extent do you agree or disagree that using self-guided robots as we just described for the delivery of food, mail, priority documents, or packages would…? (Scale: Strongly agree; Somewhat agree; Neither agree nor disagree; Somewhat disagree; Strongly disagree) | A9. Would you be willing to pay slightly more for delivery by self-guided robots if you knew that their use would…? (Scale: I would pay slightly more, I would not pay slightly more, Not sure). | *Not asked at A9 (paying more in order to have lower prices would not make sense). | 95% confidence interval (National Sample): +/- 1.8%.

# The public believes that using Helper Robots would lead to improved working conditions for carriers — a claim that they also believe to be the concept's greatest benefit.

- Those surveyed also found lower shipping prices and faster delivery to be appealing benefits.

Helper Robots



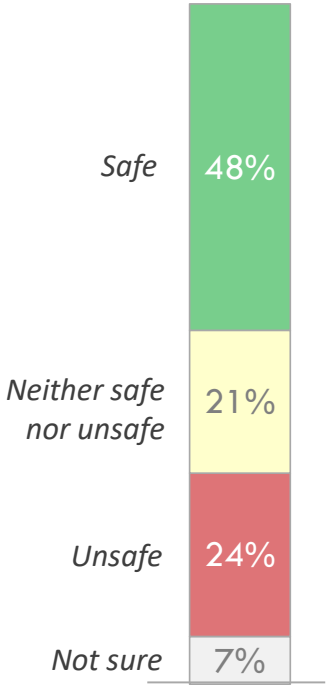

Findings presented are based on the National Sample (n=2,942). The data shown combines scale points for clarity of presentation. | All questions asked following exposure to description of concept. | B7. To what extent do you agree or disagree that using self-guided robots to help delivery people complete their work as we just described would…? (Scale: Strongly agree; Somewhat agree; Neither agree nor disagree; Somewhat disagree; Strongly disagree). | B8. Assuming that they were all true, which, if any, of the below benefits of using self-guided robots to help delivery people complete their work would be the most appealing to you personally? | *Not asked at B7. | 95% confidence interval (National Sample): +/- 1.8%.

# Respondents' biggest concern about Independent Delivery robots was theft, followed by possible job losses for carriers.

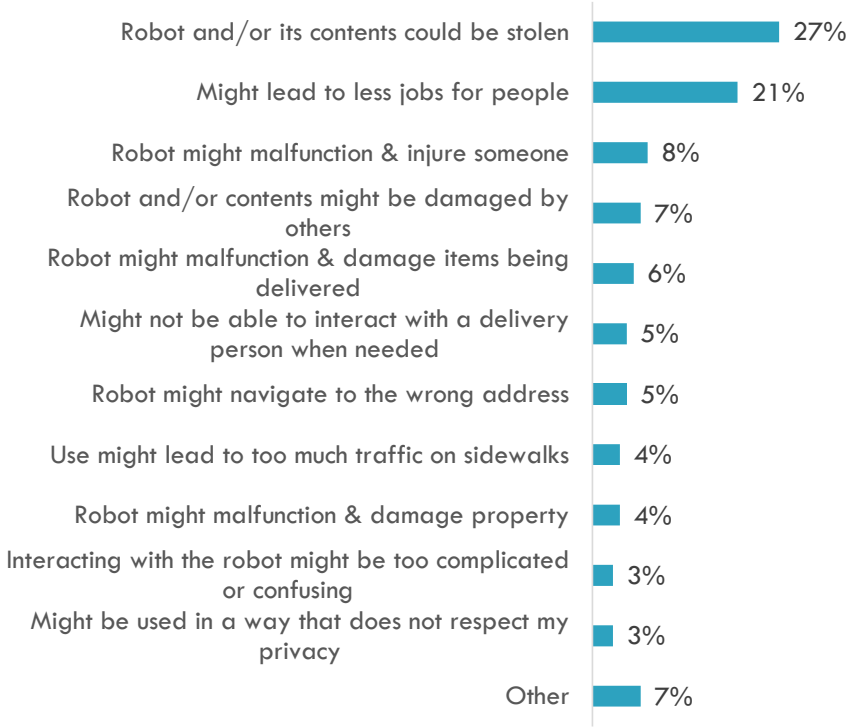
- Convincing the public that delivery robots are secure will be a challenge for any organization offering Independent Delivery.

Independent Delivery

*If Encountered on the Street, Independent Delivery Robots Would Be…**




*Most Concerned About…***

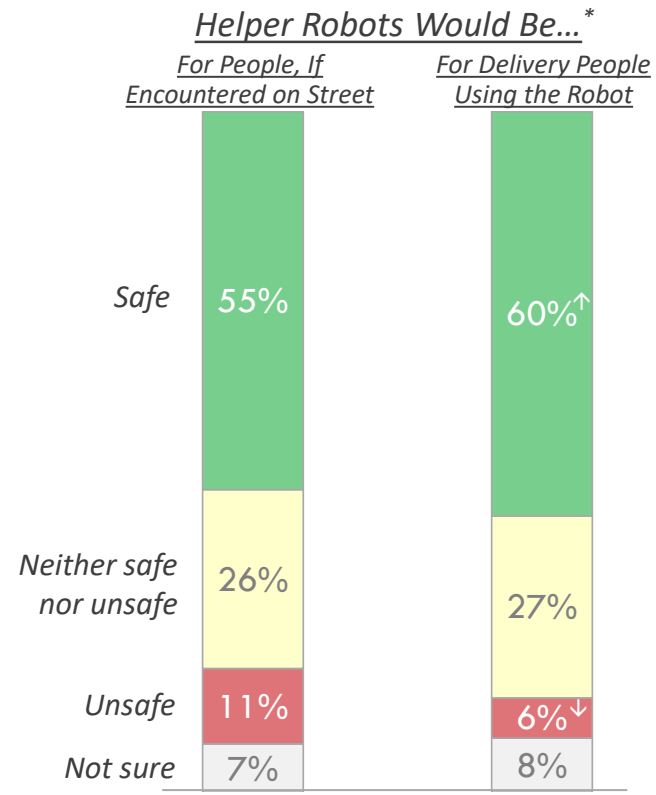


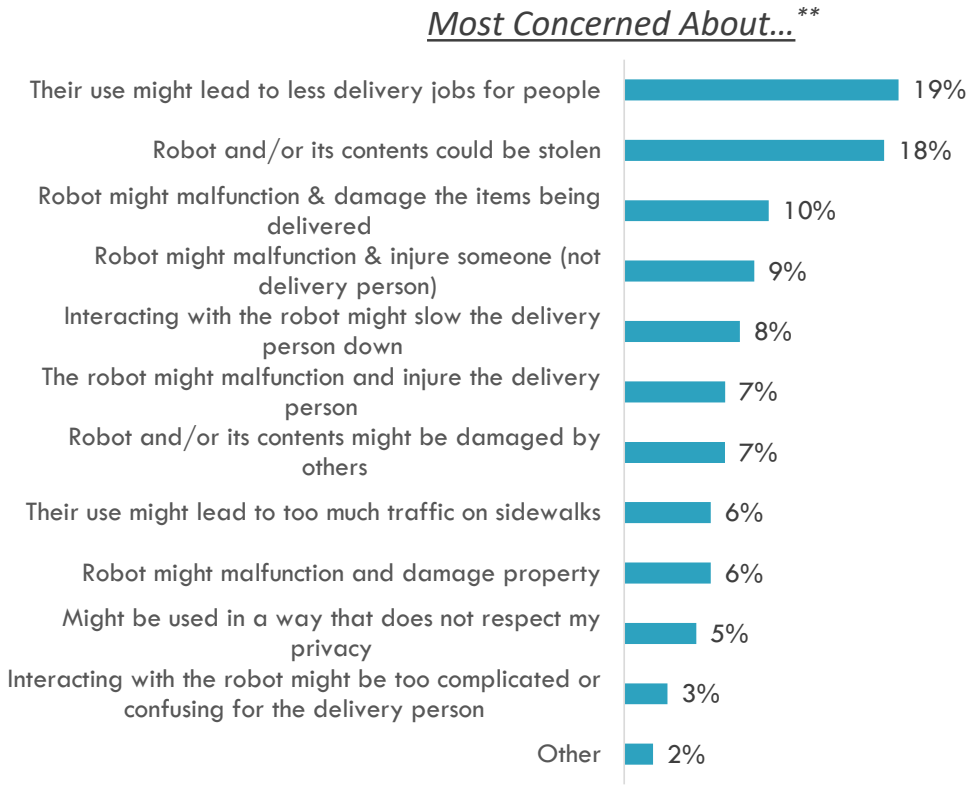

*Findings presented are based on the National Sample (n=2,942). The data shown combines scale points for clarity of presentation. | **Findings presented are based on 92% citing any concern at A15. Which, if any, of the following would you be concerned about if companies were to use self-guided robots for the delivery of food, mail, priority documents, or packages? (n=2,707). | All questions asked following exposure to description of concept. | A14. Based on what you read in the description of the concept, how safe or unsafe do you feel using self-guided robots for the delivery of food, mail, priority documents, or packages would be for people if they were to encounter these robots in the sidewalk or street? | A16. And which of the following would you be most concerned about if a company were to use self-guided robots for the delivery of food, mail, priority documents, or packages? | Mentions by 3% or greater shown. | 95% confidence interval (National Sample): +/- 1.8%.

# The public does not have strong safety concerns around the implementation of a Helper Robot concept.

- Respondents' primary concerns revolved around theft and the loss of delivery jobs.

Helper Robots




*Findings presented are based on the National Sample (n=2,942). The data shown combines scale points for clarity of presentation. | **Findings presented are based on 86% citing any concern at B15. Which, if any, of the following would you be concerned about if companies were to use self-guided robots to help delivery people complete their work? (n=2,522). | All questions asked following exposure to description of concept. | B13. Based on what you read in the description of the concept, how safe or unsafe do you feel using self-guided robots to help delivery people complete their work would be for the delivery people using the robots, compared completing their work without a self-guided delivery robot? | B14. Based on what you read in the description of the concept, how safe or unsafe do you feel using self-guided robots to help delivery people complete their work would be for people if they were to encounter these robots in the sidewalk or street? | B16. And which of the following would you be most concerned about if a company were to use self-guided robots for the delivery of food, mail, priority documents, or packages? | Mentions by 3% or greater shown. | 95% confidence interval (National Sample): +/- 1.8%. | ↑ / ↓: Significantly higher/lower than assessment of safety "for people if encountered on street."

# Respondents report that package delivery is the application that best fits delivery robot technology, regardless of which concept is implemented.

- Food delivery is the lowest ranked use of either concept, though many organizations are investigating delivery robot technologies for this purpose.

Ranking from First (1) to Last (4) as a Use for Delivery Robots

*Independent Delivery*

*Helper Robots*

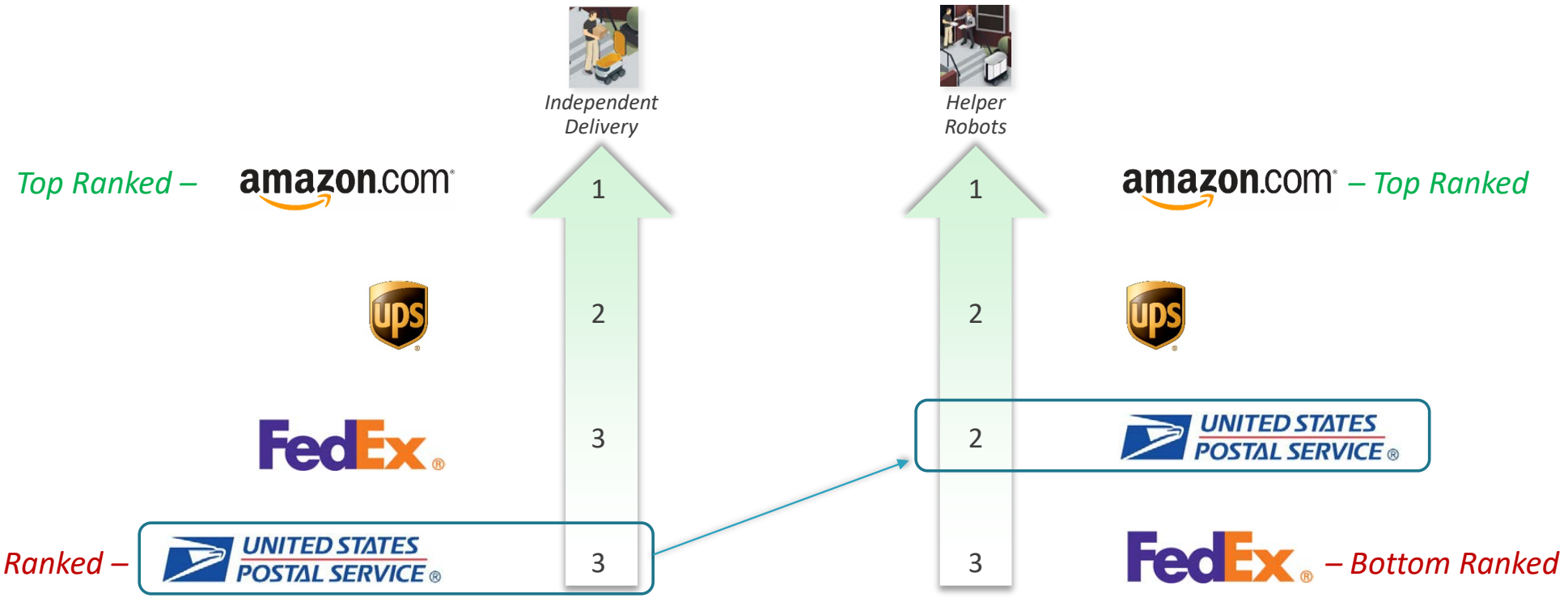
| | | Independent Delivery | Helper Robots | |
|---|---|---|---|---|
| *Best use of Technology –* | Packages | 1 | 1 | Packages |
| | Mail | 2 | 2 | Mail |
| | Important documents | 3 | 3 | Important documents |
| *Bottom Ranked –* | Food/groceries | 4 | 4 | Food/groceries |

Findings presented are based on the National Sample (n=2,942). The data shown summarizes average rankings for clarity of presentation. Rankings shown as tied when not statistically significantly different from any item at the next highest rank at the 95% c.l. | Questions asked following exposure to description of concept. | A10. How would you rank the below items as possible delivery uses for self-guided delivery robots? Please rank the below from 1 to 4, where 1 is the best fit for delivery using self-guided delivery robots, and 4 is the worst fit for delivery using self-guided delivery robots. | B9. How would you rank the below items as possible delivery uses for self-guided robots helping delivery people complete their work? Please rank the below from 1 to 4, where 1 is the best fit for delivery using self-guided delivery robots, and 4 is the worst fit for delivery using self-guided delivery robots.

# Those surveyed say that they would better trust USPS to implement Helper Robots, for which it is on par with UPS, than to implement Independent Delivery robots.

- Amazon ranks the highest as a trusted brand for implementing either concept.

Ranking from First (1) to Last (4) as a Trusted Brand for Implementing Delivery Robots

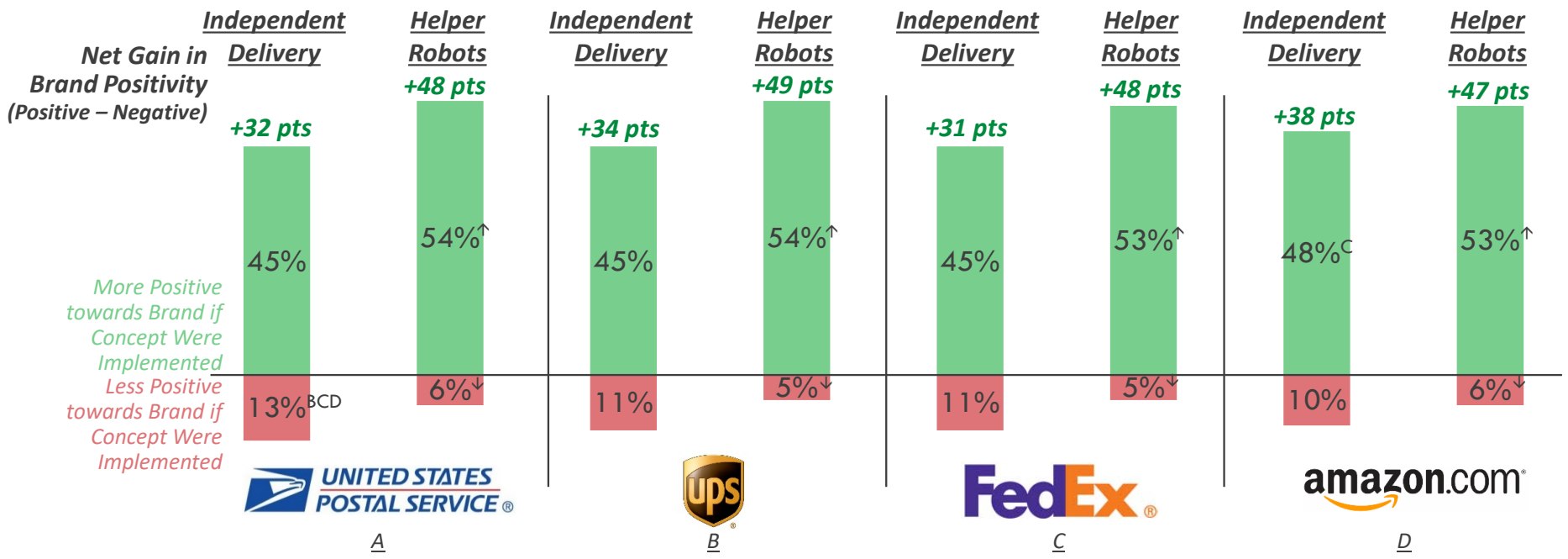



The data shown summarizes average rankings for clarity of presentation. Rankings shown as tied when not statistically significantly different from any item at the next highest ranked at the 95% c.l. | Findings presented are based on respondents slightly familiar or more with all brands at Q2. How familiar are you with the following organizations? (n=2,737). | A11/B10 asked following exposure to descriptions of Independent Delivery/Helper Robots concepts. | A11/B10. Please rank the following organizations from 1 to 4, where 1 is the organization you would most trust to use self-guided robots [for the delivery of food, mail, priority documents, or packages/to help delivery people complete their work] and 4 is the organization you would least trust to use self-guided robots [for the delivery of food, mail, priority documents, or packages/to help delivery people complete their work].

# The implementation of delivery robots into their operations could greatly improve brand positivity for any of the organizations tested.

- The effect is particularly strong for the use of Helper Robots, which are more popular than the Independent Delivery concept.

## Effect of the Use of Delivery Robots on Brand Positivity

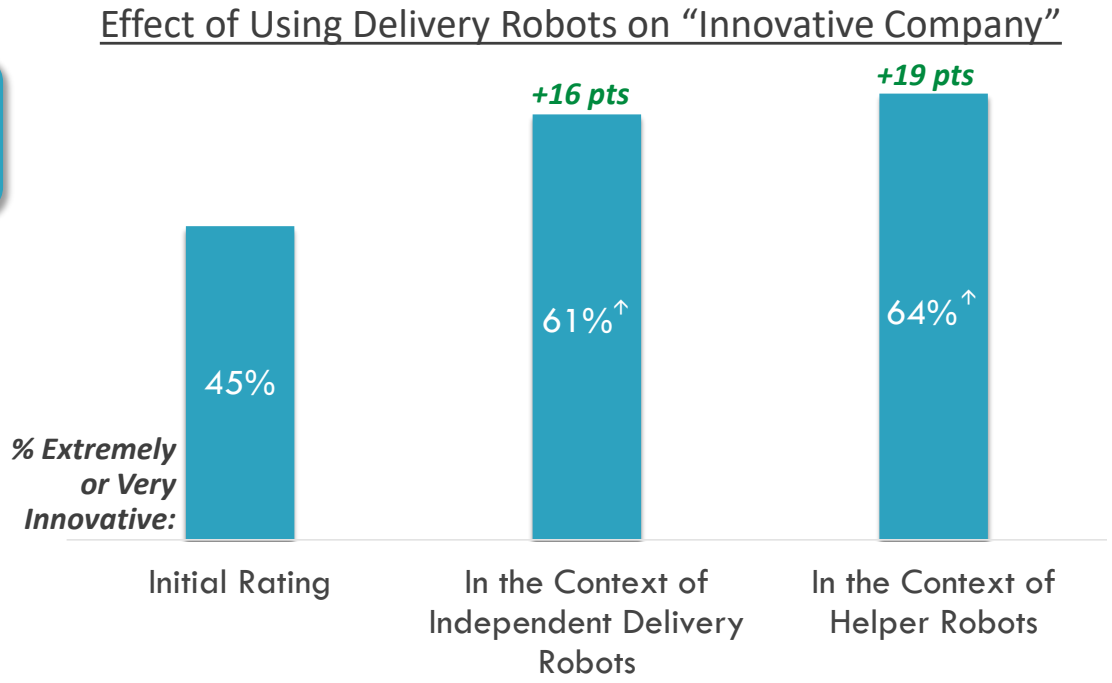



Findings presented are based on respondents slightly familiar or more with all brands at Q2. How familiar are you with the following organizations? (n=2,737). The data shown combines scale points for clarity of presentation. | A12/B11 asked following exposure to descriptions of Independent Delivery/Helper Robots concepts. | A12/B11. Would your overall impression of the following organizations be more or less positive if you knew that they would be using self-guided robots [for the delivery of food, mail, priority documents, or packages/to help delivery people complete their work]? (Scale: Much more positive, Somewhat more positive, About the same (omitted from the graph), Somewhat less positive, Much less positive). | A,B,C,D: Increase is significantly higher than the corresponding group at the 95% c.l. | ↑ / ↓: Significantly higher/lower than assessment of Independent Delivery.

# Delivery robots could greatly improve USPS' image as an innovative company.

- The Independent Delivery and Helper Robots concepts lead to similar positive impacts for USPS.

Initial Rating: Assessment of brand before any concept questions were asked



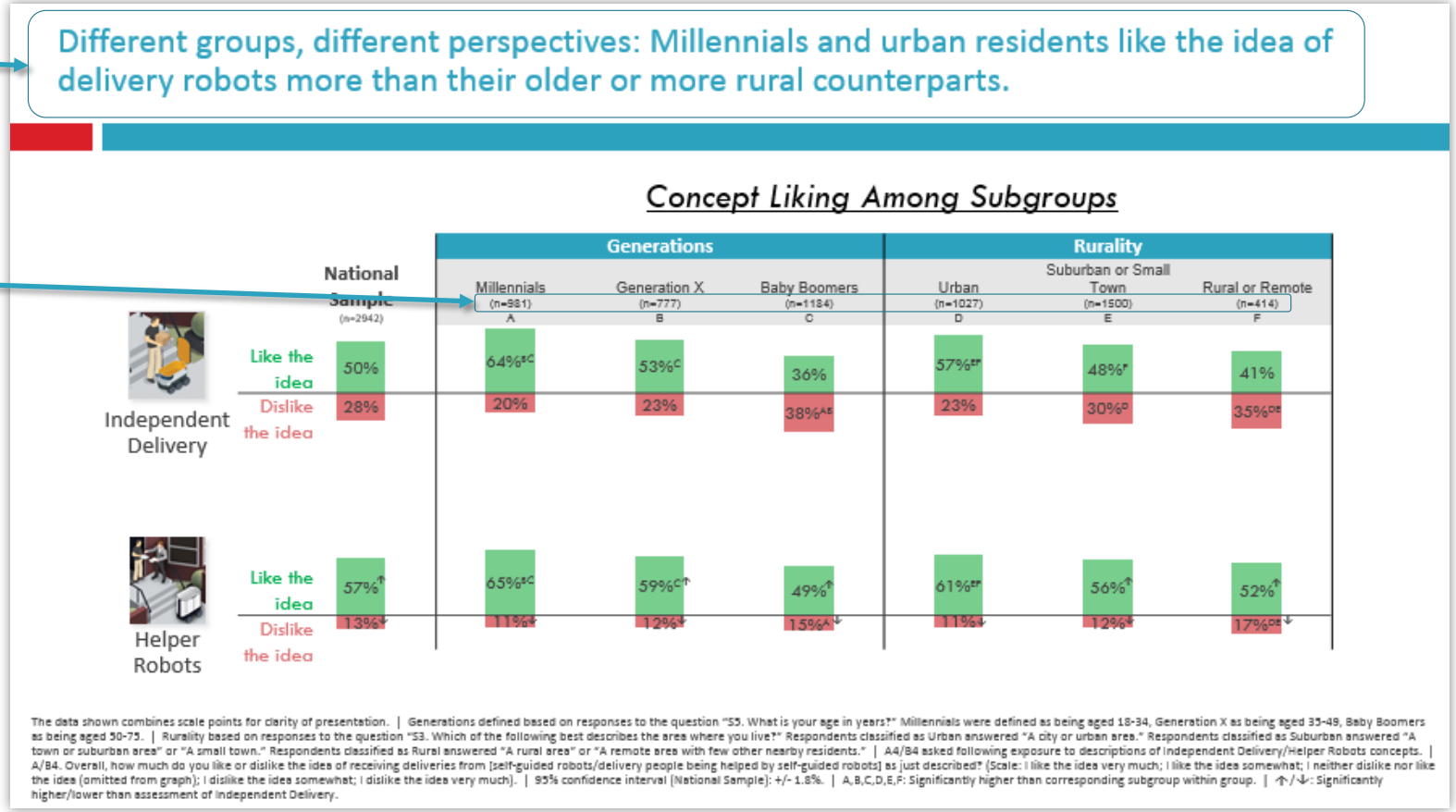

Findings presented are based on respondents slightly familiar or more with all brands at Q2. How familiar are you with the following organizations? (n=2,737). Data shown combines data points for clarity of presentation. | Q2 and Q4 asked prior to exposure to descriptions of "Independent Delivery" and "Helper Robot" concepts, A13/B12 asked following concept exposure. | Q4. Overall, how innovative do you feel the following organizations are? (Scale: Extremely innovative, Very innovative, Moderately innovative (omitted from graph), Slightly innovative (omitted from graph), Not at all innovative (omitted from graph)). | A13/B12. How innovative would you feel that the following organizations were if you knew that they would be using self-guided robots [for the delivery of food, mail, priority documents, or packages/to help delivery people complete their work]? | ↑ / ↓: Significantly higher/lower than initial rating.

# Appendix A

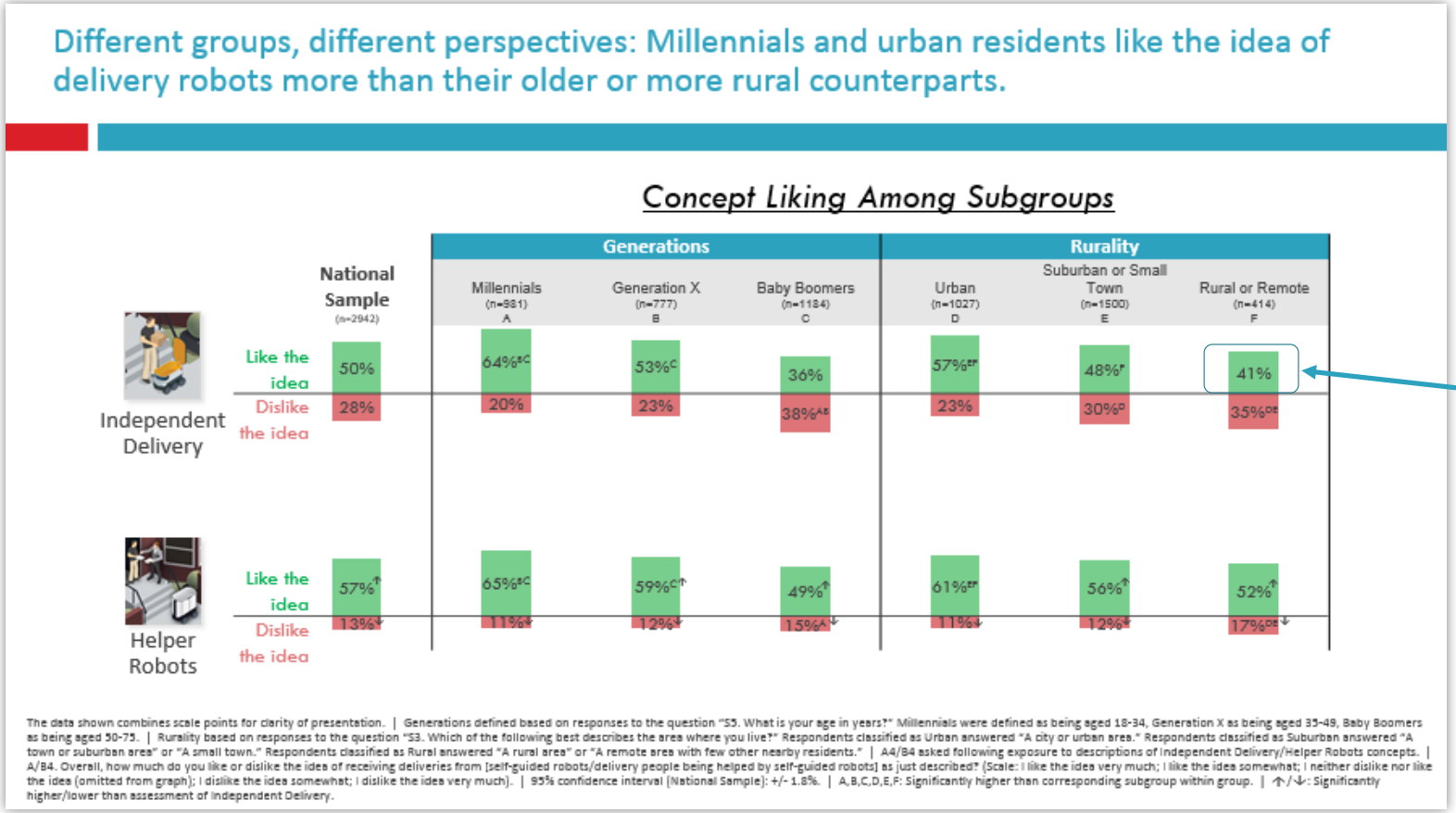
## *Guide to Interpreting the Detailed Data Visualizations in this Report*

# VISUAL ELEMENTS INCLUDED WHEN PRESENTING DETAILED DATA

- Findings are presented at the top of each slide and are written in a way that should be understandable for non-technical audiences.
- The number of respondents — shown as "(n=)" — is included for all groups on a slide.



# UNDERSTANDING "NETTED" DATA

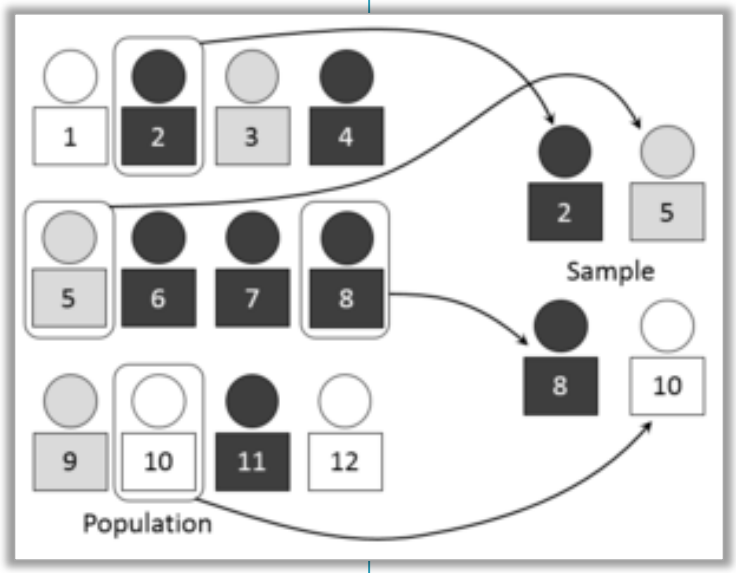



- On many slides, data are presented in "nets," where respondents' selection of any combination of response items within an overarching category is counted as one selection when calculating the percentage of people who selected the "netted" category.
  - *For example, the Rural or Remote respondents that reported that they liked the Independent Delivery concept "very much" or "somewhat" were combined here to show that 41 percent of Rural or Remote respondents liked the concept overall.*
- Note: Netted data is presented in several ways. It might be combined into a data point on a graph, as in this example slide, or next to a bracket, or it might be included as text on its own row at the top of a graph.

# AN OVERVIEW OF INTERPRETING STATISTICAL SIGNIFICANCE

Numbers, such as percentages, that are derived from a sample can only provide estimates of the true number that exists in a population. Differences in opinion between two reported groups might be due to random variation, or might be due to a true difference of opinion between the groups.

In order to help interpret the numbers reported from a sample, it is common to perform "statistical significance testing" to determine the probability that the difference between two percentages observed in the sample would have occurred by chance if the population proportions were equal.



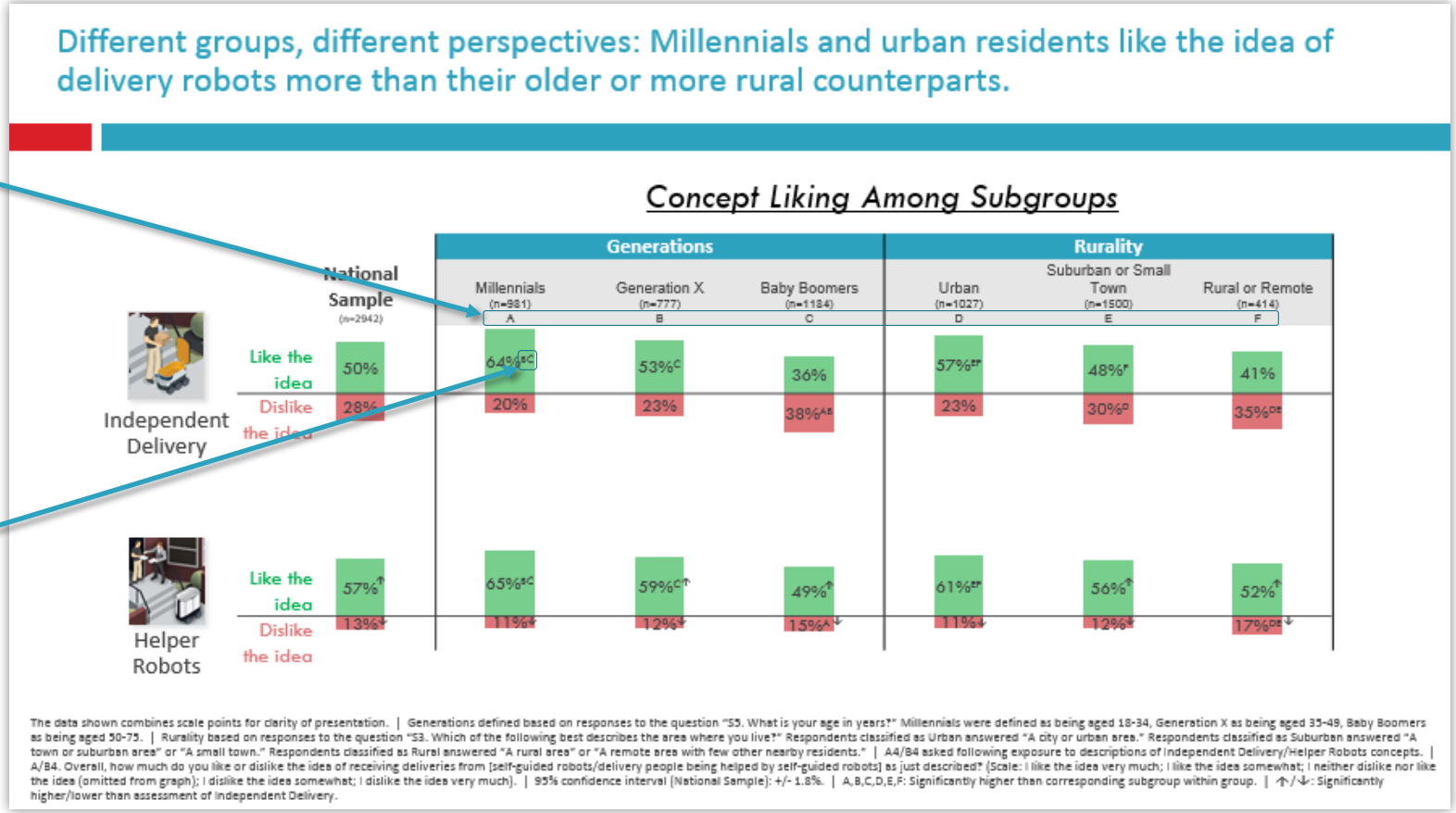

Statistical significance is calculated using "confidence levels," referred to as "c.l." throughout this report. Higher confidence levels provide analysts with greater certainty about the conclusions drawn from data. Data in this report use a 95 percent confidence level, which is commonly used in academic and government survey research.

When two numbers are different at the confidence threshold that was used, they are said to be "significantly different."

While it is still possible that the differences between two tested numbers could be due to chance, or due to the other issues that are discussed in Appendix B of this report, differences of opinion between groups whose results are "significantly different" meet a higher, more credible standard than differences that do not pass significance testing.

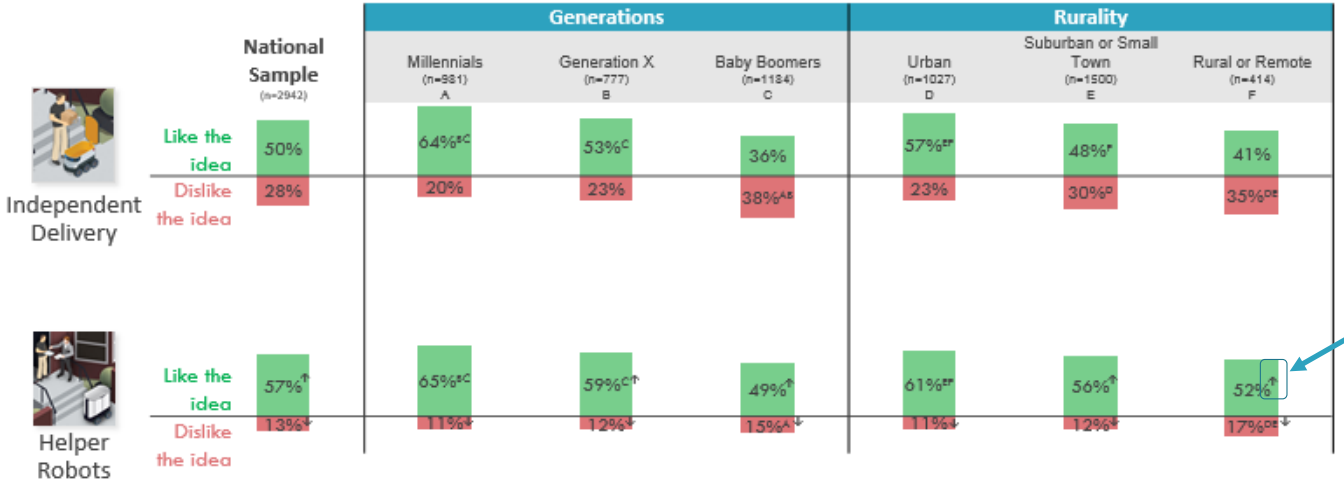
# UNDERSTANDING STATISTICAL SIGNIFICANCE AS REPORTED WITH LETTER NOTATION

- When tests were employed in order to determine whether the difference between two numbers was statistically significant, visual elements, such as the letter notations (A,B,C,D,E,F) shown in this example slide, are assigned to the groups whose results were being reported.
- In cases where the difference between two numbers is statistically significant, a letter is placed next to the larger of the two numbers.
  - *For example, the "BC" shown here indicates that the 64 percent of Millennials that like the Independent Delivery concept is "significantly higher" than the 53 percent reported among Generation X, and is also "significantly higher" than the 36 percent reported among Baby Boomers. Results are only tested between related groups, and so this 64 percent was not tested against the Rurality groups' findings (D,E,F).*



# UNDERSTANDING STATISTICAL SIGNIFICANCE AS REPORTED WITH ARROWS

## Different groups, different perspectives: Millennials and urban residents like the idea of delivery robots more than their older or more rural counterparts.

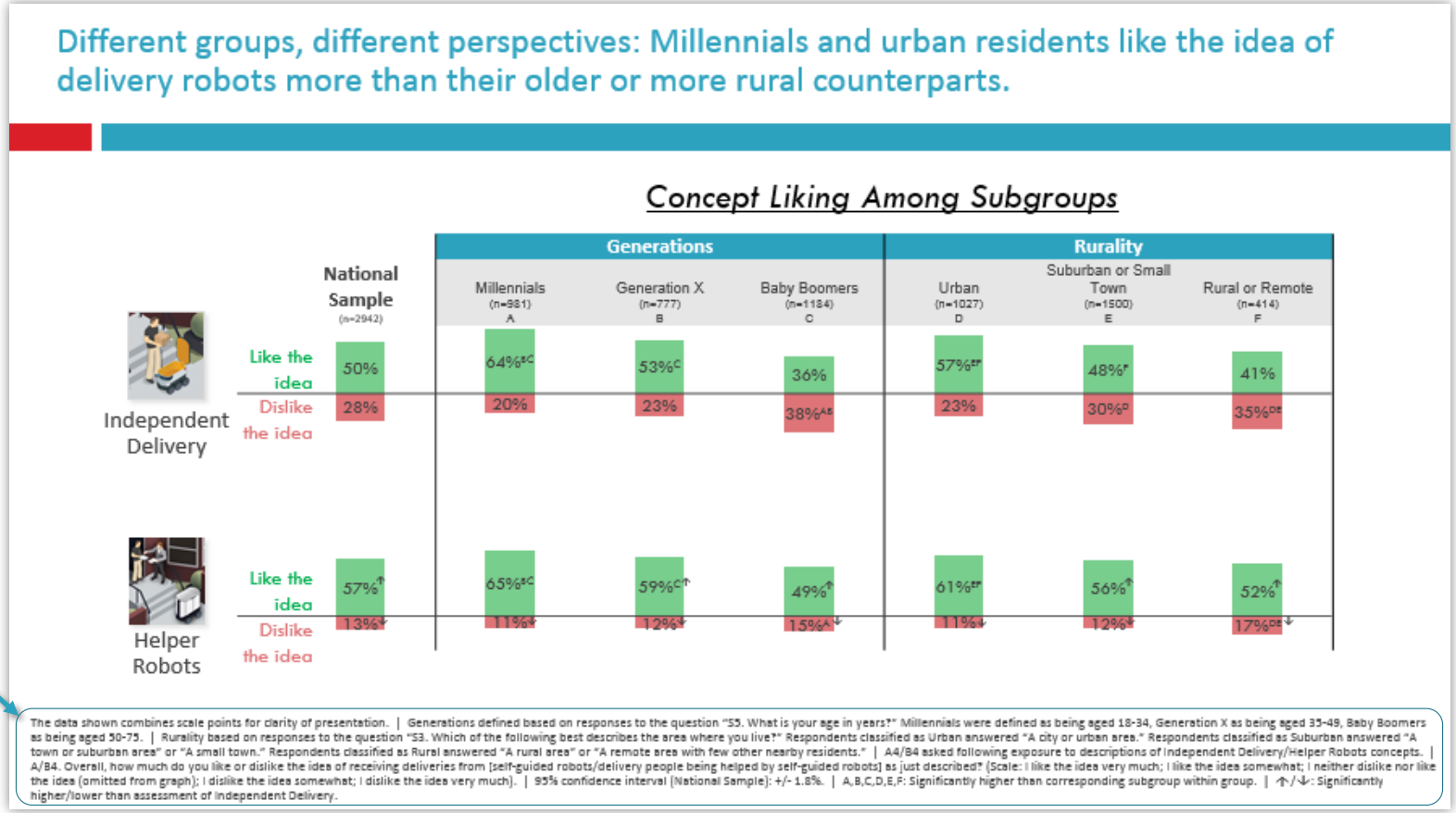



The data shown combines scale points for clarity of presentation. | Generations defined based on responses to the question "S5. What is your age in years?" Millennials were defined as being aged 18-34, Generation X as being aged 35-49, Baby Boomers as being aged 50-75. | Rurality based on responses to the question "S3. Which of the following best describes the area where you live?" Respondents classified as Urban answered "A city or urban area." Respondents classified as Suburban answered "A town or suburban area" or "A small town." Respondents classified as Rural answered "A rural area" or "A remote area with few other nearby residents." | A4/B4 asked following exposure to descriptions of Independent Delivery/Helper Robots concepts. | A/B4. Overall, how much do you like or dislike the idea of receiving deliveries from [self-guided robots/delivery people being helped by self-guided robots] as just described? (Scale: I like the idea very much; I like the idea somewhat; I neither dislike nor like the idea (omitted from graph); I dislike the idea somewhat; I dislike the idea very much). | 95% confidence interval (National Sample): +/- 1.8%. | A,B,C,D,E,F: Significantly higher than corresponding subgroup within group. | ↑/↓: Significantly higher/lower than assessment of Independent Delivery.

- In other places, arrows (↑↓) are used to indicate statistically significant differences.
- In these cases, the direction of the arrow indicates whether the number shown is significantly higher or lower than the group against which the presented number is being tested.
  - *For example, the 52 percent of Rural or Remote respondents that like the Helper Robots concept reported here is "significantly higher " than the 41 percent reported regarding Independent Delivery in the same group.*

# REPORT FOOTNOTES

- Footnotes are included on all data slides throughout the report. These include important details for both technical and non-technical audiences, such as complete question text, and specifications for any statistical testing performed.
  - *Footnotes are the first place to look for most of the questions that readers might have about each individual slide.*



# Appendix B

## *External Review Certification*

Chase H. Harrison Ph.D.
Somerville, MA 02143

United States Postal Service Office of Inspector General (OIG)
Risk Analysis Research Center
1735 N Lynn St
Arlington, VA 22209

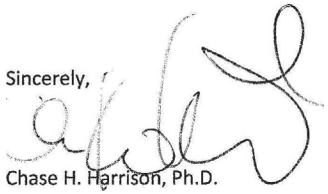
February 5, 2018

To Whom It May Concern;

I certify that I have reviewed the survey methodology and reporting for the USPS OIG's paper regarding public perception of delivery robots in the United States.

I am confident that this report and its underlying methodology meet the professional standards typically employed for online opt-in market and survey research, and that researchers have provided the documentation required by the American Association for Public Opinion Research's guidelines for public disclosure.

Sincerely,



Chase H. Harrison, Ph.D.

KEVIN L. MCADAMS
VICE PRESIDENT, DELIVERY OPERATIONS

UNITED STATES POSTAL SERVICE

March 30, 2018

AMANDA MARTINEZ
MANAGER, RARC CENTRAL
RISK ANALYSIS RESEARCH CENTER

SUBJECT: Public Perception of Delivery Robots in the United States
Project Number 2017RARC009

Postal Service Headquarters has reviewed the survey paper titled *Public Perception of Delivery Robots in the United States*. The Postal Service welcomes technological advancements that will allow for more efficient delivery of letters and packages. This paper detailed that the public at large is generally accepting of the use of robots to deliver packages, there are operational considerations for the types of robots described in the paper that will need to be considered before these robots are able to be successfully integrated into use by the Postal Service.

**Model 1: Independent Delivery**

The Postal Service has several questions on how this robot would operate. Consideration needs to be given to the travel speed, battery life and operational range of this robot. These factors will determine the ability of the Postal Service to make use of such a robot, given that a robot with a limited travel range will not provide the same potential benefit as a robot with a wider travel range. Parallel these concerns regarding the distance that this robot would travel, there are questions regarding how well the robot will be able to travel on crowded sidewalks with many pedestrians or when the sidewalks are icy or snowy.

There are also questions regarding the general maintenance of the robot. How would the Postal Service be expected to respond if the robot needs assistance? If for example, the robot got tipped over or the battery ran out of power, what methods would need to be in place to properly service the robot to bring it back to normal function? Along these lines, would the Postal Service be liable for any damage caused by the robot?

Finally, how many packages would each robot be able to carry on a single trip?

475 L'ENFANT PLAZA SW
WASHINGTON, DC 20260-1600
202-268-6500
FAX 202-268-3331
WWW.USPS.COM

Would the robot be able to deliver to multiple addresses prior to returning to the Post Office?

**Model 2: Helper Robots**

As in the case of the Independent Delivery robot, the Postal Service has several questions on the operation of this robot. First, how will the robot be transported from place to place within the carrier's route? A letter carrier will typically make deliveries on one section of their route before driving to another part of the route to make deliveries there. Would the carrier be expected to put the robot in their vehicle when they drive to the new location and then retrieve the robot when they park at their new location? If the carrier is to be expected to put the robot in the vehicle, how heavy will the robot be? If the robot is traveling in the carrier's vehicle how much space will that take up?

It is also unclear how closely the robot would follow the carrier. Carriers often walk across lawns and cross streets at locations other than the corner to deliver the route most efficiently. Would the robot be expected to follow behind? If so, would the robot be able to go over curbs and stairs like a carrier? Also would the robot potentially damage customer landscaping (i.e. flowers, lawns, etc.) following the carrier?

The Postal Service also has questions about the size of the package compartment. Will the compartment be sized such that all carriers will be able to easily retrieve items from the bottom of the compartment?

Kevin L. McAdams

cc: Paola Piscioneri
Fredy Diaz
CARM
E-FOIA

# POINTS OF CONTACT

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Risk Analysis Research Center
1735 N. Lynn St.
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**Media or General Inquiries Point of Contact**
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