

Survey of the Accessibility of Selected New Zealand Web Pages and Apps for People with Disabilities

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# ""Introduction

A World Internet Project New Zealand Survey, *Internet Trends in New Zealand 2007–2013*, found that the percentage of New Zealanders using the Internet has increased since 2007, from 82% of participants to 92% in 2013. There was also an exponential increase in the use of mobile handheld devices (e.g., smartphones and tablets) from 8% of Internet users in 2007 to 69% in 2013.[[1]](#footnote-1) As well as using the Internet more, New Zealanders also increasingly see the Internet as more important in their lives. In 2007, 56% of New Zealanders thought that the Internet is important or very important in their everyday life. This increased to 73% in 2013.

In New Zealand, as the Internet draws near saturation with more than nine out of ten New Zealanders using it, the World Internet Project New Zealand (WIPNZ)Survey questioned "whether any online activities are becoming "necessities", ... [and] what kind of burden of exclusion non-users may face. The WIPNZ team have maintained over the years the idea that as the proportion of non-users decreases, the extent to which those non-users may face disadvantage is likely to increase, as they are more easily overlooked as a shrinking minority." For example, in the UK, 90% of jobs are now only advertised online so that people with disabilities may be excluded from the labour market if they cannot access the Internet. WPINZ also note that "new technology can create new divides, so that even users of the Internet may be disadvantaged by not using certain devices."

Part of this "shrinking minority" of people in New Zealand who do not use the Internet may be people with disabilities for whom the Internet is not always accessible or not accessible on equal terms with other users. For example, in 2014, the Blind Foundation surveyed its clients and found only 41% had access to internet and email services. However it is also important to note that there is a difference between people who choose not to use the Internet and those people who want to access the Internet but cannot do so because they have a disability.

Technology is accessible if it can be used as effectively by people with disabilities as by those without.[[2]](#footnote-2) In the Disability Action Plan 2014-2018 people with disabilities said that what matters most to them is being treated as equals with the same rights of citizenship and participation as other New Zealanders.[[3]](#footnote-3) They want to be able to access and use the Internet and other technology on equal terms with other New Zealanders.

Surveys of New Zealand Government Web Standards show that overall levels of compliance with the New Zealand Government Web Accessibility Standard are low and no government agency is fully compliant.[[4]](#footnote-4) There are no requirements for New Zealand non-government Websites to comply with any Web accessibility standards. Currently no apps (government and non-government) are required to comply with any standards. There have been no reported surveys of the accessibility of New Zealand non-government Websites or apps.

An April 2014 submission by Blind Citizens NZ to the Human Rights Commission[[5]](#footnote-5) includes an appendix listing Web pages that have come to the organization’s attention as causing significant barriers to blind and vision impaired people. These sites cover a wide range of everyday transactions that New Zealanders want to undertake (e.g., ordering pizza, booking flights, buying lotto tickets, making a submission to Parliament or obtaining consumer information). The 12 sites included are from both the State and private sector and are Web pages of government departments, agencies in the wider State sector, local government, and private sector businesses.

Unfortunately the accessibility problems reported are based on anecdotal evidence and not the results of a survey where users were asked to perform specific tasks and their experience recorded against specific metrics (e.g., success rate, time on task, errors). However the submission raises the question of whether there are problems with the accessibility with New Zealand Web pages which warrants further investigation. Several overseas studies have documented accessibility and usability problems with Web pages for people with disabilities. Given the exponential increase in the use of mobile handheld devices (e.g., smartphones and tablets) and the increasing use of apps the accessibility for people with disabilities of New Zealand apps also requires investigation.

This survey tested the accessibility of 3 New Zealand Web pages and 3 native apps[[6]](#footnote-6) by 4 people with visual, cognitive, and motor skill disabilities. Two Web pages and 1 native app with videos (requiring Closed Captioning to be usable) were tested by a person with a hearing impairment. These Web pages and apps cover a range of everyday transactions that New Zealanders want to undertake (e.g., ordering groceries, booking flights, finding a job, or obtaining information). The survey results illustrate that the things most New Zealanders want to do, and are able to do, online either cannot be achieved by people with disabilities or are subject to significant time barriers because of accessibility issues with the relevant Web page or app.

The present study and two comparable overseas studies all found that accessibility and usability are significant issues for people with disabilities compared to control groups of users without disabilities. This was reflected in completion rates and in the time taken to complete tasks. Web pages and apps are not accessible if they cannot be used as effectively by people with disabilities as by those without.

These findings and New Zealand anecdotal evidence suggest that there are issues with the accessibility and usability of New Zealand Web pages and apps which warrant further investigation to ascertain the size of the problem and the nature of the issues. The present survey can be viewed as an exploratory study and the information obtained from it could be used in the development of future confirmatory studies using larger sample sizes.

# Methodology

The purpose of this research is to ascertain the accessibility of selected New Zealand Web pages and apps for people with disabilities through two groups of users: people with disabilities and a Control Group of people without disabilities.

Before outlining the methodology used in the design of this survey some explanation of the reasons for the choice of the sampling method for this survey and about sample size are provided.

## Sample Selection Methods

A sample is the group of people who are selected to undertake a survey and are known as participants or (test) subjects. Samplingis the method of selecting participants from a population. A target population is the total group of individuals from which the sample could be taken. In this case the target population is people with disabilities.

The most common method of selecting participants from the population to participate in a survey is random sampling. Randomization is used to get an unbiased sample. In a simple random sample participants (a sample) are selected from a bigger group (a population) by a method where each participant is selected by chance and each member of the population has an equal chance of being included in the sample. For example, a group of 15 high school students (sample) selected out of a hat from a high school of 150 students (population) would constitute a simple random sample.

Sometimes non-random sampling techniques are more appropriate for the type of research being undertaken. Where data needs to be obtained from a very specific group of people purposive sampling can be a better sampling method. Purposive samples focus on people with specific characteristics relevant to the research being undertaken. The researcher selects the sample based on these characteristics. It is often used in market research where researchers want to focus on specific groups, e.g., female television viewers aged 18-24.

Purposive sampling has advantages such as taking less time than other sampling techniques as it is directed only at appropriate participants and a purposive sampling survey's results are usually more representative of the target population than some other sampling techniques.

There are several types of purposive sampling. Homogeneous Sampling is one of the most common methods and involves selecting a small, uniform sample with very specific characteristics (e.g., female, high school students, age 15-18) in order to study that group in detail.

Since the purpose of this research is to ascertain the accessibility of selected New Zealand Web pages and apps for people with disabilities a purposive, homogeneous sample was the sampling method chosen for this survey.

## Sample Size

There is no specific method to determine the size of a purposive research sample. There are a number of factors to be considered such the objectives of the study, and resource limitations for conducting the research. Resources required for doing research include financial resources, time, human resources, access to research participants, and the connections to find suitable research participants when a research sample requires specific characteristics.

However, no matter what approach is used to determine sample size, it needs to be determined according to some underlying principle. Two common approaches are data saturation (the stage in data collection when new data no longer provide more insights into the research questions) and data sufficiency (the data is sufficient to allow meaningful comparisons and to address the questions posed by the research). An alternative approach is to determine the sample size and scope in advance especially when resources are constrained. Research studies using purposive sampling usually have a selected number of participants instead of using criteria such as data saturation or data sufficiency.

There are some caveats associated with small sample size. A small sample size may lead to issues of statistical power (the ability of a survey sample to demonstrate characteristics that that are present in the target population). Therefore if the sample size is too small the study may be unreliable. Statistical significance may also be an issue with small samples, i.e., are any differences observed big enough to be significant? The ability to generalize research findings from a small sample to the target population can also be a problem with small sample sizes. However where statistical significance may be an issue findings may still be of value if they are consistent with other knowledge such as the findings of a comparable survey.

Small sample sizes (studies that have 5-30 users) are [very common in usability studies](http://www.measuringusability.com/blog/actual-users.php).[[7]](#footnote-7) As Sauro notes, "there are limitations to these smaller sample studies: you are limited to seeing big differences or big "effects". To put it another way, statistical analysis with small samples is like making astronomical observations with binoculars. You are limited to seeing big things: planets, stars, moons and the occasional comet." He continues: "fortunately, in user-experience research we are often most concerned about these big differences—differences users are likely to notice, such as [changes in the navigation](https://www.measuringusability.com/blog/10-navigation-metrics.php) structure or the improvement of a search results page."[[8]](#footnote-8)

When conducting a study with a small sample size, therefore, researchers must be cautious in the interpretation of results. They must check that their interpretation of the results is adequately based in the evidence collected in the survey and not draw conclusions that go further than the sample used. However small samples can still present meaningful, descriptive evidence of user’s performance on tasks if interpreted correctly.

While data from small samples will not allow broad generalizations to target populations it can be used to design larger confirmatory studies. Small exploratory studies (e.g., pilot or preliminary studies to test a methodology or provide estimates of something) are often conducted before a larger study and are sometimes call "proof of concept" studies. Exploratory studies are not intended for generalization to a large populations. They are designed to increase the knowledge of the field of study. The information obtained from an exploratory study can be used to conduct confirmatory studies using larger sample sizes.[[9]](#footnote-9)

## Survey Design

This survey draws on work done by Jakob Nielson of the Nielsen Norman Group. Nielsen has been described as "the guru of Web page usability" (The New York Times) and "the world's leading expert on Web usability" (U.S. News & World Report).[[10]](#footnote-10)

Nielsen's work is focused on the usability of websites rather than just accessibility:

It's time we moved beyond technical accessibility when discussing how to improve the Web for users with disabilities. We should consider these users as **users:**As people who have jobs to perform and goals to accomplishwhen they use websites and intranets. Once we've achieved technical accessibility, our new goal must be task supportand increased usability of websites and intranets for people with disabilities.

Sure, users with disabilities **are**disabled, and many must use assistive technologies to access the Web. Obviously, websites must be accessible through alternative user interface devices, such as screen readers and screen magnifiers. If you can't get at the information or services that a website or intranet offers, then you definitely can't use it either. But, just because a design is theoretically accessible, doesn't mean that it's easy to use, simple to learn, or supports efficient job performance. [[11]](#footnote-11)

For Nielsen "usability is not just a matter of whether or not it is **possible**for a user to perform a task. It is also a matter of how **easy**and **fast**it is for them to do so."[[12]](#footnote-12)

In 2001 Nielson conducted a usability study of 19 websites in the United States and Japan, observing 84 users who were either blind or had low vision or motor impairments and a control group of 20 users without disabilities as they performed a variety of tasks. The survey "collected measurement statistics from four tasks:

* **Buy an item**: Purchase Janet Jackson's CD "All for You" from [www.target.com](http://www.target.com).
* **Information retrieval**: Find a bus departing from O'Hare airport to a specific address in Chicago, using [www.transitchicago.com](http://www.transitchicago.com).
* **Compare and contrast**: Find the best mutual fund satisfying certain criteria on [www.schwab.com](http://www.schwab.com).
* **Fact-finding**: Find the average temperature in Dallas, Texas in January (for this task, participants could use any site they wanted)."[[13]](#footnote-13)

The survey used four usability metrics averaged across these tasks for three groups of users: people using screen readers (mainly users who were blind), people using screen magnifiers (users with low vision), and the control group of users without disabilities. The usability metrics were:

* Success rate;
* Time on task (min:sec);
* Errors; and
* Subjective rating (1-7 scale).

The study "focused on design usability, aiming to identify which design elements slowed users down, confused them, or caused them to make errors, such as visiting the wrong part of a website."[[14]](#footnote-14)

The major finding of Nielsen's study was that "the Web's current usability is about three times better for users without disabilities than it is for users with disabilities. This is a huge difference; the numbers are much bigger than we typically see in usability testing."[[15]](#footnote-15)

Our survey seeks to replicate Nielsen's survey on a limited scale to see whether selected New Zealand Web pages and apps[[16]](#footnote-16) are technically accessible and assess their usability for people with disabilities compared to a control group without disabilities. We were also interested to see whether the usability of the Web had improved for people with disabilities in the 15 years since Nielsen's study was reported.

Due to resource constraints (e.g., financial resources, time, human resources, access to research participants, and the connections to find suitable research participants when a research sample requires specific characteristics) our sample size was much smaller than Nielsen's and we tested 3 Web pages and 3 apps by 4 users with disabilities (sight, cognitive and motor) and 2 Web pages and 1 app by a hearing impaired user. A Control Group of 5 users without disabilities (split into 2 groups: 1 on the tasks set for the hearing impaired user and the other 4 users undertaking the tasks of the other users with disabilities) was also tested. Nielsen's study did not test accessibility and usability for users with hearing impairment.

The results of this survey are compared with Nielsen's study in the Analysis section of this paper (below).

## Testing Panel

A panel of users was identified by the Blind Foundation's Web Accessibility Team with the following disabilities:

Cognitive, motor (stroke survivor, aphasia) - motor skill and cognitive impairment;

* Cognitive (Autism, Irlen Syndrome) - motor skill and cognitive impairment (including colour perception issues);
* Visually impaired (blind); and
* Visually impaired (low vision).

Two of the testers used assistive technologies while a third used a keyboard only (not a mouse). The users are all experienced users of their technology.

A user with a hearing impediment was also tested but was assigned different tasks (videos requiring captions) to the non-hearing impaired users.

The panel of users with disabilities was compensated for their time at their standard agreed contract rate by the Blind Foundation.

## Control Group

A Control Group of 5 users without disabilities was assigned the same tasks as the panel of users with disabilities (4 on the sight, cognitive and motor tasks and 1 on the hearing impaired tasks).

The Control Group was comprised of 5 employees of the Blind Foundation without disabilities who do not require any assistive technologies to access Web pages or apps. Three women and two men, aged 18-64 years, were tested. Occupations included librarian, team manager, and administrator. The Control Group are all experienced users of their Web browser and smartphone but are not technical experts.

# Testing Method

Testers were asked to complete a specified task to gauge the accessibility of selected Web pages and apps. They were asked to complete a task (e.g., buy something) or obtain information from a Web page or app that any user might reasonably want to find or do. The Web page tasks for the main group of users were to:

* Purchase an item: buy a specified item from an online supermarket;
* Fact finding: find the weather for their town for that day; and
* Find a job and apply for it.

The app tasks for the main group of users were to:

* Information retrieval: find the job prospects and entry requirements to a selected occupation'
* Compare and contrast: find the best fare satisfying certain criteria on an airline app and book it; and
* Purchase an item: buy a specified item from a pizza store app.

The tasks for the hearing impaired user (all involving video captioning) were to:

* Information retrieval: watch an instructional video on car jack safety on the Website of an auto-related retailer;
* Information retrieval: watch an instructional video on how to paint exteriors on a hardware store's Website; and
* Find and watch the latest episode of a popular New Zealand TV programme on a television on demand app.

The Blind Foundation’s Web Accessibility Team oversaw the testing and result collation. Members of this team hold a Professional Certificate in Web Accessibility.

## Metrics

* Success rate;
* How long to complete each task (min: sec);
* Errors: to be reported on the Blind Foundations issue template (specific point in task where issue occurred and severity/impact of the issue);
* Is there a feedback option on a website/app and how easy was it to use; and
* Subjective rating (1-4 scale).

# Results For Main User Group Tasks

## Task 1: Online Supermarket

Testers were asked to visit a supermarket online store and order a bottle of Wattie's tomato sauce and carry the transaction through to the payment screen.

All users with disabilities were able to complete the task. The time taken to complete the task ranged from 5 minutes to 15 minutes; an average of 10 minutes. The time taken to complete the task varied significantly from the non-disabled Control Group. The Control Group all completed the task but only took between 2 to 5 minutes on task averaging 4 minutes to complete the task. It therefore took the users with disabilities two and a half times as long on average to complete the task as the Control Group.

The disparity between the two groups on length of time on task was reflected in how the testers rated the accessibility of the site. Testers were asked to describe any accessibility issues and assign the issue a severity rating (severe, major, minor). The users with disabilities rated accessibility issues with this site from "minor" to "major" while the Control Group rated accessibility issues with this site from "none" to "minor (annoying)".

Testers were asked whether they could find a feedback/customer support option on the website (to report any accessibility issues with the site) and how easy it was to use. All testers were able to find a feedback/customer support option on the website without difficulty.

All testers were asked to give a summary rating of the site's overall accessibility from 1-4 below:

1. Completely accessible: no barriers encountered;
2. Mostly accessible: minor barriers with easy workarounds;
3. Mostly inaccessible: major workarounds or assistance required;
4. Completely inaccessible: unable to overcome barriers to complete the task.

The users with disabilities all rated this site a 2 (mostly accessible: minor barriers with easy workarounds) which was surprising given the time it took them on task compared to the Control Group (two and a half times longer). Two of the Control Group rated the site a 1 while the other two testers rated it a 2 (average rating = 1.5) which is consistent with their time on task and their rating of no issues or minor (annoying) with the accessibility of the site.

## Task 2: Weather Service Website

Testers were asked to visit the site and check today's weather in their town.

Three of the four users with disabilities were able to complete the task. The time taken to complete the task varied significantly ranging from 2 minutes to 18 minutes; an average of 10 minutes. The time taken to complete the task varied radically from the non-disabled Control Group. The Control Group all completed the task but only took between 0.5 to 1 minute on task averaging 0.75 minutes to complete the task. It therefore took the users with disabilities more than 10 times as long on average to complete a simple task as the Control Group. This task presented the greatest variance in time on task between the two user groups in all tasks surveyed.

Consistent with this variance the disparity between the two groups in time on task was reflected in how the testers rated the accessibility of the site. Testers were asked to describe any accessibility issues and assign the issue a severity rating (severe, major, minor). The users with disabilities rated accessibility issues with this site from "minor" to "severe" while the Control Group all rated accessibility issues with this site as "none".

Testers were asked whether they could find a feedback/customer support option on the website (to report any accessibility issues with the site) and how easy it was to use. All the Control Group testers were able to find a feedback/customer support option on the website without difficulty. However of the users with disabilities only two (50%) were able to find a feedback/customer support option on the website and one reported that it was difficult to use.

All testers were asked to give a summary rating of the site's overall accessibility from 1-4 below:

1. Completely accessible: no barriers encountered;
2. Mostly accessible: minor barriers with easy workarounds;
3. Mostly inaccessible: major workarounds or assistance required;
4. Completely inaccessible: unable to overcome barriers to complete the task.

The two of the users with disabilities rated this site a 2 (mostly accessible: minor barriers with easy workarounds) which was consistent with the time it took them on task (2 minutes and 5 minutes) compared to the other two users with disabilities who rated the site a 3 (18 minutes on task) and a 4 (15 minutes on task before giving up as unable to complete the task).

The Control Group all rated the site a 1 which is consistent with their very short time on task and their rating of no issues with the accessibility of the site.

## Task 3: Job Search Website

Testers were asked to visit a job search website, find a job in their occupational field in their town and fill out the online application form up to the point where they needed to upload their CV and cover letter.

All users with disabilities were able to complete the task. The time taken to complete the task ranged from 5 minutes to 15 minutes; an average 10 minutes. The time taken to complete the task varied significantly from the non-disabled Control Group. The Control Group all completed the task but only took between 3 to 8 minutes on task averaging 4.75 minutes to complete the task. It therefore took the users with disabilities more than twice as long on average to complete the same task as the Control Group.

The disparity between the two groups on length of time on task was reflected in how the testers rated the accessibility of the site. Testers were asked to describe any accessibility issues and assign the issue a severity rating (severe, major, minor). The users with disabilities rated accessibility issues with this site from "minor" to "major" while the Control Group rated accessibility issues with this site from "none" (3 users) to "minor" (1 user).

Testers were asked whether they could find a feedback/customer support option on the website (to report any accessibility issues with the site) and how easy it was to use. All testers were able to find a feedback/customer support option on the website without difficulty.

All testers were asked to give a summary rating of the site's overall accessibility from 1-4 below:

1. Completely accessible: no barriers encountered;
2. Mostly accessible: minor barriers with easy workarounds;
3. Mostly inaccessible: major workarounds or assistance required;
4. Completely inaccessible: unable to overcome barriers to complete the task.

Three of the users with disabilities rated this site a 2 (mostly accessible: minor barriers with easy workarounds) and one user it a 1 (average rating = 1.75). The Control Group were evenly split: two of the Control Group rated the site a 1 while the other two testers rated it a 2 (average rating = 1.5) which is consistent with their time on task and their rating of no issues or minor issues with the accessibility of the site.

## Task 4: Occupation Information App

This app provides students with information on 60 occupations in New Zealand to help them make well-informed career choices when thinking about their study and career options. It contains education, employment and income information on 60 occupations in New Zealand to outline possible career paths. These occupations were included in the app for their size, popularity, and potential for future growth. The app shows the income, fees and job prospects for each occupation.

Testers were asked to download the app for iOS or Android and to choose an occupation that is of interest to them and find out: 1: its job prospects, and; 2: how to enter the field.

All users with disabilities were able to complete the task. The time taken to complete the task ranged from 3 minutes to 5 minutes; an average of 4 minutes. The time taken to complete the task varied significantly from the non-disabled Control Group. The Control Group all completed the task but only took between 1 to 3 minutes on task averaging 1.75 minutes to complete the task. It therefore took the users with disabilities more than twice as long on average to complete the same task as the Control Group.

The disparity between the two groups on length of time on task was not reflected in how the testers rated the accessibility of the site. Testers were asked to describe any accessibility issues and assign the issue a severity rating (severe, major, minor). The users with disabilities rated accessibility issues with this site from "none" (3 users) to "major" (1 user). The Control Group rated accessibility issues with this site from "none" (3 users) to "minor" (1 user).

Testers were asked whether they could find a feedback/customer support option on the app (to report any accessibility issues with the site) and how easy it was to use. Only one user with disabilities was able to find a feedback/customer support option while the Control Group were evenly split: two of the Control Group were able to find a feedback/customer support option and two could not find it.

All testers were asked to give a summary rating of the app's overall accessibility from 1-4 below:

1. Completely accessible: no barriers encountered;
2. Mostly accessible: minor barriers with easy workarounds;
3. Mostly inaccessible: major workarounds or assistance required;
4. Completely inaccessible: unable to overcome barriers to complete the task.

Two of the users with disabilities rated this app a 1 (completely accessible: no barriers encountered), one user rated it a 2 (mostly accessible: minor barriers with easy workarounds) and one user it a 3 (average rating = 1.75). Three of the Control Group rated this app a 1 while the fourth member of the Control Group rated it a 2 (average rating = 1.25).

## Task 5: Airline App

Testers were asked to download the app for iOS or Android and find the best fare for a one-way flight from Auckland to Wellington tomorrow for one adult and carry the transaction through to the payment screen.

Only half of the users with disabilities were able to complete the task. The time taken to complete the task ranged from 10 minutes to 22 minutes (before giving up as unable to complete the task) ; an average of 15.5 minutes. The time taken to complete the task varied significantly from the non-disabled Control Group. The Control Group all completed the task but only took between 4 to 6 minutes on task averaging 5 minutes to complete the task. It therefore took the users with disabilities on average more than three times as long to complete the same task as the Control Group.

The disparity between the two groups on length of time on task was reflected in how the testers rated the accessibility of the site. Testers were asked to describe any accessibility issues and assign the issue a severity rating (severe, major, minor). The users with disabilities rated accessibility issues with this site from "major" (2 users) to "severe" (2 users). The Control Group rated accessibility issues with this site from "none" (3 users) to "none (annoying)" (1 user).

Testers were asked whether they could find a feedback/customer support option on the app (to report any accessibility issues with the site) and how easy it was to use. Users with disabilities were split evenly between those who were able and those who were unable to find a feedback/customer support option. Of the two users who were able to find a feedback/customer support option one user could only find a phone only option. In contrast all of the Control Group were able to find a feedback/customer support option but one of the Control group could only find a phone only option.

All testers were asked to give a summary rating of the app's overall accessibility from 1-4 below:

1. Completely accessible: no barriers encountered;
2. Mostly accessible: minor barriers with easy workarounds;
3. Mostly inaccessible: major workarounds or assistance required;
4. Completely inaccessible: unable to overcome barriers to complete the task.

Two of the users with disabilities rated this app a 3 (mostly inaccessible: major workarounds or assistance required), one user rated it a 2 (mostly accessible: minor barriers with easy workarounds) and one user it a 4 (completely inaccessible: unable to overcome barriers to complete the task). The average rating for the users with disabilities was a 3 . Three of the Control Group rated this app a 1 while the fourth member of the Control Group rated it a 3 (average rating = 1.5).

|Task 6: Pizza Ordering App

Testers were asked to download the app for iOS or Android and order a specified pizza to be delivered to their address and to carry the transaction through to the Order Details screen.

Only half of the users with disabilities were able to complete the task. The time taken to complete the task ranged from 5 minutes to 25 minutes (before two users gave up as they were unable to complete the task); an average of 16.25 minutes. The time taken to complete the task varied significantly from the non-disabled Control Group. The Control Group all completed the task but only took between 3 to 6 minutes on task averaging 5.25 minutes to complete the task. It therefore took the users with disabilities on average more than three times as long to complete the same task as the Control Group.

The disparity between the two groups on length of time on task was reflected in how the testers rated the accessibility of the site. Testers were asked to describe any accessibility issues and assign the issue a severity rating (severe, major, minor). The users with disabilities rated accessibility issues with this site from "major" (2 users) to "severe" (2 users). The Control Group rated accessibility issues with this site from "none" (2 users) to "none (annoying)" and "none ( slow and annoying)" (2 users).

Testers were asked whether they could find a feedback/customer support option on the app (to report any accessibility issues with the site) and how easy it was to use. None of the users with disabilities were able to find a feedback/customer support option. In contrast all but one of the Control Group were able to find a feedback/customer support option.

All testers were asked to give a summary rating of the app's overall accessibility from 1-4 below:

1. Completely accessible: no barriers encountered;
2. Mostly accessible: minor barriers with easy workarounds;
3. Mostly inaccessible: major workarounds or assistance required;
4. Completely inaccessible: unable to overcome barriers to complete the task.

Consistent with the time on task two of the users with disabilities rated this app a 3 (mostly inaccessible: major workarounds or assistance required) and two users rated it it a 4 (completely inaccessible: unable to overcome barriers to complete the task). The average rating for the users with disabilities was a 3.5. Two of the Control Group rated this app a 1, one user rated it a 2, while the fourth member of the Control Group rated it a 3 (average rating = 1.75).

# Results For Hearing Impaired User Tasks

Most of the information or entertainment available on the Web in videos is spoken rather than written which necessitates the use of Closed Captions[[17]](#footnote-17) by deaf or hearing impaired people. A large proportion of users without disabilities also make use of Closed Captions. Today most television programmes provide accurate Closed Captions. However, Internet videos are often captioned automatically by technology rather than by manually captioning each video and are frequently inaccurate.

YouTube, Google's video-sharing site, hosts many instructional videos, lectures, and other videos which may be auto-captioned using speech-recognition modelling software:

The company's speech-recognition model has acoustic, lexicon and language components. The acoustic portion is a statistical model of the basic sounds made in spoken language (all of the vowels and consonants, for example). This is a large and complex model because those sounds often vary based on context (that is, where a speaker is raised and the dialect spoken).[[18]](#footnote-18)

One of the main issues with auto-captioning is the model's inability to understand accents which are not North American. When used to caption videos containing words spoken with New Zealand accents the error rate may be so high that the videos become nonsensical. Captions can be corrected manually but this is not done in most cases.

## Task 1: Auto-related Retailer Online Instructional Video

Users were asked to visit the Web site of an auto-related retailer and watch a video on car jack safety. This required the use of Closed Captions on the video by the hearing impaired user.

The hearing impaired user was able to complete the task (watch the video) on a personal computer with Windows but the captions were inaccurate so the instructional video could not be understood. The user also used a tablet with iOS but was not able to complete the task as captions were not available. The time taken to complete the task was 5 minutes searching on iOS and 5 minutes to find and watch the video on a personal computer.

The Control Group member was able to complete the task without difficulty as they did not require captions to understand the video. They spent 3 minutes on task. If the user without disabilities turned off the sound and attempted to understand the video using only captions they would experience the same difficulties with inaccurate captions as the hearing impaired user.

The difference in the two users experience was reflected in how the testers rated the accessibility of the video. Testers were asked to describe any accessibility issues and assign the issue a severity rating (severe, major, minor). The hearing impaired user rated accessibility issues with this site as "major" or "severe" while the Control Group member encountered no accessibility issues with this video.

Testers were asked whether they could find a feedback/customer support option on the site (to report any accessibility issues with the site) and how easy it was to use. Both of the users tested were able to find a feedback/customer support option and found it easy to use.

Both testers were asked to give a summary rating of the video's overall accessibility from 1-4 below:

1. Completely accessible: no barriers encountered;
2. Mostly accessible: minor barriers with easy workarounds;
3. Mostly inaccessible: major workarounds or assistance required;
4. Completely inaccessible: unable to overcome barriers to complete the task.

Consistent with the issues encountered the hearing impaired user rated this video a 3 (mostly inaccessible: major workarounds or assistance required) for the personal computer using Windows and rated it a 4 (completely inaccessible: unable to overcome barriers to complete the task) for iOS. The Control Group member rated it a 1 reflecting their experience of no accessibility or usability issues encountered when not relying on captions.

## Task 2: Hardware Store Online Instructional Video

Users were asked to visit the Web site of a hardware store and watch a video on how to paint exteriors. This required the use of Closed Captions on the video by the hearing impaired user.

As with the previous task the hearing impaired user was able to complete the task (watch the video) on a personal computer with Windows but the captions were difficult to find (required fine motor control skills with a mouse) and inaccurate. The user also used a tablet with iOS but was not able to complete the task as captions were not available. The time taken to complete the task was not recorded for iOS as no captions were available on iOS and it took 10 minutes to find and watch the video on a personal computer.

The Control Group member was able to complete the task without difficulty as they did not require captions to understand the video. They spent 5 minutes on task. If the user without disabilities turned off the sound and attempted to watch the video using only captions they would experience the same difficulties with inaccurate captions as the hearing impaired user.

The difference in the two users experience was reflected in how the testers rated the accessibility of the video. Testers were asked to describe any accessibility issues and assign the issue a severity rating (severe, major, minor). The hearing impaired user rated accessibility issues with this site as "major" or "severe" while the Control Group member encountered no accessibility issues with this video.

Testers were asked whether they could find a feedback/customer support option on the site (to report any accessibility issues with the site) and how easy it was to use. Both of the users tested were able to find a feedback/customer support option and found it easy to use.

Both testers were asked to give a summary rating of the video's overall accessibility from 1-4 below:

1. Completely accessible: no barriers encountered;
2. Mostly accessible: minor barriers with easy workarounds;
3. Mostly inaccessible: major workarounds or assistance required;
4. Completely inaccessible: unable to overcome barriers to complete the task.

Consistent with the issues encountered the hearing impaired user rated this video a 3 (mostly inaccessible: major workarounds or assistance required) for the personal computer using Windows and rated it a 4 (completely inaccessible: unable to overcome barriers to complete the task) for iOS. The Control Group member rated it a 1 reflecting their experience of no accessibility or usability issues encountered as they were not relying on captions.

## Task 3: Television On Demand App

Users were asked to download the app for a television network's on demand service and find the latest episode of a New Zealand soap opera and watch the first three minutes.

The hearing impaired user was unable to complete the task (watch the video) as Closed Captions are not available on any programmes via the app. The same programmes when shown on television are Closed Captioned.

The time taken to complete the task was not recorded as no captions were available but the user spent 15 minutes searching for help with captioning on the app and 10 minutes on Google researching whether Closed Captioning is available on the app.

The Control Group member was able to complete the task without difficulty as they did not require captions to understand the video. They spent 3 minutes on task. If the user without disabilities turned off the sound and attempted to watch the video using only captions they would not have been able to do so given there are no captions on the app.

The difference in the two users experience was reflected in how the testers rated the accessibility of the app. Testers were asked to describe any accessibility issues and assign the issue a severity rating (severe, major, minor). The hearing impaired user rated accessibility issues with this site as "severe" while the Control Group member encountered no accessibility issues with this video.

Testers were asked whether they could find a feedback/customer support option on the site (to report any accessibility issues with the site) and how easy it was to use. Both of the users tested were able to find a feedback/customer support option and but the hearing impaired user could not find any information or support on Closed Captioning.

Both testers were asked to give a summary rating of the video's overall accessibility from 1-4 below:

1. Completely accessible: no barriers encountered;
2. Mostly accessible: minor barriers with easy workarounds;
3. Mostly inaccessible: major workarounds or assistance required;
4. Completely inaccessible: unable to overcome barriers to complete the task.

Consistent with the issues encountered the hearing impaired user rated this app a 4 (completely inaccessible: unable to overcome barriers to complete the task). The Control Group member rated it a 1 reflecting their experience of no accessibility or usability issues encountered as they were not relying on captions to use the app.

# Analysis

While a user study with such a small sample size lacks statistical significance it may still be able to identify big differences or big effects.[[19]](#footnote-19) Further where statistical significance is an issue, findings may still be of value if they are consistent with other knowledge such as the findings of a comparable survey.

The present study drew on Nielsen's 2001 survey of Web page usability for people with visual and motor skill disabilities. The sample size was larger in Nielsen's survey and it did not include apps.

The major findings of the present study are consistent with those of Nielsen's survey. In the Nielsen study "the control group's success rate was 78%, which is considerably higher than the [success rates](https://www.nngroup.com/articles/success-rate-the-simplest-usability-metric) we've found in most of our other studies. Usually, success rates in Web usability studies range from 40% to 60%."[[20]](#footnote-20) In the present study the Control Group's success rate was even higher at 100%.

Although all the tasks set for users in the Nielsen survey seem to have involved technically accessible Web sites Nielsen's major finding was that "the Web's current usability is about three times better for users without disabilities than it is for users with disabilities. This is a huge difference; the numbers are much bigger than we typically see in usability testing."[[21]](#footnote-21) For Nielsen " usability is not just a matter of whether or not it is *possible* for a user to perform a task. It is also a matter of how *easy* and *fast* it is for them to do so."[[22]](#footnote-22)

The present study found comparable large differences between the experience of users with disabilities and that of the Control Group. Users with disabilities took between twice and ten times as long to complete the tasks (average = 3.75). However, unlike the Nielsen study, in several cases the users with disabilities found a Web page or app inaccessible and were unable to complete the task at all. It is also worth noting that the participants with disabilities in the present study are experienced users of their technologies and more likely to be able to find a way to access Web pages and apps than the general population of people with disabilities.

A 2004 British study for the Disability Rights Commission investigated the accessibility of the Web for people with disabilities. Like Nielsen the report starts from the premise that " it is ... clear that compliance with the technical guidelines and the use of automated tests are only the first steps towards accessibility: there can be no substitute for involving disabled people themselves in design and testing ..."[[23]](#footnote-23)

The report notes that several previous British studies had identified significant issues with Web accessibility for people with disabilities. The report used the following methodology:

The DRC commissioned the Centre for Human Computer Interaction Design at City University, London to survey a large and representative sample of websites used by the British public. Using a commercially available software tool, City University tested the home pages of 1,000 sites for technical compliance with the Guideline Checkpoints. Since some of the Checkpoints are qualitative, their violation cannot be detected automatically; for these the software issues warnings of the need for human inspection.

To establish how far compliance with the Guidelines as revealed by automated testing matches the practical accessibility and usability of the sites tested a representative 10% of these sites was selected for detailed evaluation by a group of 50 users with a variety of impairments which influenced their methods of Web access, as well as for evaluation by accessibility experts.[[24]](#footnote-24)

The survey sample was composed of the following user testers:

* blind people who use screen readers with synthetic speech or Braille output;
* partially sighted people who may use screen magnification people who are profoundly deaf and hard of hearing;
* people with specific learning difficulties such as dyslexia; and

physically impaired people whose use of the Web may be affected by their lack of control of arms and hands, by tremor and by lack of dexterity in hands and fingers.[[25]](#footnote-25)

The survey found that most websites (81%) fail to satisfy the most basic Web Accessibility Initiative category.[[26]](#footnote-26) To better understand users’ experiences with websites:

a controlled study was undertaken with a sample of six websites, three with high accessibility ratings and three with low accessibility ratings. This study concentrated on comparing the experiences of a group of blind Panel members (as the most disenfranchised group in the overall study) and a matched group of non-disabled web users. On the sites with high accessibility, both groups successfully completed nearly all their tasks. However, on sites with low accessibility, non-disabled users still completed all their tasks, whilst blind users completed only 67%.[[27]](#footnote-27)

As well as the variance in completion rates there was a substantial difference between the times taken to perform tasks. On low accessibility sites blind users took nearly four times as long to complete a task as a user without disabilities and on a high accessibility site it took more than three times as long.[[28]](#footnote-28)

Although this survey was limited to blind users the results are consistent with the findings of the present study regarding completion rates and variances in the time taken to complete tasks. They are also consistent with the findings of the Nielsen survey.

# Conclusion

Accessibility of Web pages was an issue for users with disabilities in the present study, the British study analysed above, and the Nielsen survey. The accessibility of apps was also an issue for users with disabilities in the present study. The present study and two comparable studies all found that usability was a significant issue for people with disabilities compared to control groups of users without disabilities. This was reflected in completion rates and in the time taken to complete tasks.

These findings and New Zealand anecdotal evidence suggest that there are issues with the accessibility and usability of New Zealand Web pages and apps which warrant further investigation to ascertain the size of the problem and the nature of the issues. This research can be viewed as an exploratory study and the information obtained from it could be used in the development of future confirmatory studies using larger sample sizes.

Nielsen believes that the Web can be made accessible and usable for people with disabilities and that in doing this it will make the Web more usable for both people with and without disabilities. However this is not a goal shared by all:

Some critics of our study have claimed that having Web designs that treat people with disabilities three times worse than other users is not a big problem. After all, the argument goes, people with disabilities should expect some difficulties, and they should be grateful if a website aims for basic accessibility and allows them to use it at all. As these critics assess it, it is an unrealistic goal to make the Web as usable for users with disabilities as it is for those without.[[29]](#footnote-29)

Nielsen's response to these critics is:

I will grant these critics that it may be hard to achieve truly equal usability for the two user groups...

However, accepting the level of discrimination implied by treating people with disabilities three times worse is unreasonable. We can reach much better levels by reducing the usability problems in Web designs. Although we probably won't achieve perfection, focusing on usability can significantly improve the user experience for people with disabilities relative to the current horrible state of websites and intranets.[[30]](#footnote-30)

In the current survey users with disabilities on average took 3.75 times as long to complete tasks on New Zealand Web pages and apps. This is consistent with the "implied level of discrimination" in Nielsen's survey. This is also "unreasonable" but can be ignored or tolerated since no research demonstrating the problem in the New Zealand context exists.

While discrimination is not acceptable accessibility is not only a human rights issue. If people with disabilities are denied access to opportunities and resources on equal terms with other New Zealanders then this constitutes exclusion.

The impact of exclusion is much wider than discrimination. Exclusion has profound economic impacts on people with disabilities and for the country as a whole. While the cost to New Zealand of paying benefits to working-age people is known "it is only a portion of the entire economic and social price New Zealand pays as a result of lost productivity and negative social impacts.”[[31]](#footnote-31) The cost of exclusion of people with disabilities needs to be recognised and quantified. Further research is required on the effects of accessibility and usability issues for people with disabilities on New Zealand's productivity. As Nielsen concludes:

As long as companies and government agencies **view accessibility as solely a matter of complying with regulations** and technical specifications, rather than a way to **support the work practices and customer needs** of people with disabilities, equal opportunity will remain a travesty. Websites and intranets must follow usability principles and make it easier for customers and employees with disabilities to perform their tasks.[[32]](#footnote-32)

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2. Jim Thatcher, Accessibility Consultant, JimThatcher.com [↑](#footnote-ref-2)
3. Office of Disability Issues, *Disability Action Plan 2014-2018*, 4 [↑](#footnote-ref-3)
4. Human Rights Commission,Better Information for Everyone: Disabled People’s Rights in the Information Age, 2012, 13. [↑](#footnote-ref-4)
5. The Case for a Comprehensive Review of Website Accessibility for People with Disabilities, http://www.abcnz.org.nz/case-review-website-accessibility [↑](#footnote-ref-5)
6. A N[ative app](http://itknowledgeexchange.techtarget.com/discussions/content/native-app/) is an application that has been written for a specific mobile operating system or platform, usually [iOS](http://ipad.about.com/od/iPad-Glossary/g/What-Is-iOS.htm) (iPhone and/or iPad) or [Android](http://google.about.com/od/socialtoolsfromgoogle/p/android_what_is.htm), and is not HTML repurposed. A native application must run on the platform for which was written, while a Web app has a wider reach because it can run in any Web browser. [↑](#footnote-ref-6)
7. See Jeff Sauro, Best Practices for Using Statistics on Small Sample Sizes, August 13, 2013, http://www.measuringu.com/blog/small-n.php [↑](#footnote-ref-7)
8. Ibid. [↑](#footnote-ref-8)
9. #  See Jennifer R. Gray, Susan K. Grove, Nancy Burns, The Practice of Nursing Research: Appraisal, Synthesis, and Generation of Evidence, Elsevier, 2013, 370.

 [↑](#footnote-ref-9)
10. https://www.nngroup.com/people/jakob-nielsen/ [↑](#footnote-ref-10)
11. Jakob Nielsen, Beyond Accessibility: Treating Users with Disabilities as People, 2011, https://www.nngroup.com/articles/beyond-accessibility-treating-users-with-disabilities-as-people/ [↑](#footnote-ref-11)
12. Ibid. [↑](#footnote-ref-12)
13. Ibid. [↑](#footnote-ref-13)
14. Ibid. [↑](#footnote-ref-14)
15. Ibid. [↑](#footnote-ref-15)
16. Nielsen's survey did not include apps since the results were published in 2001 when apps were not ubiquitous as they are in 2016. [↑](#footnote-ref-16)
17. Closed (cf. "open") captions are not visible until turned on by the viewer. [↑](#footnote-ref-17)
18. [Larry Greenemeier](http://www.scientificamerican.com/author/larry-greenemeier/), Say What? Google Works to Improve YouTube Auto-Captions for the Deaf, Scientific American, June 23, 2011, http://www.scientificamerican.com/article/google-youtube-auto-caption/ [↑](#footnote-ref-18)
19. Sauro, op. cit. [↑](#footnote-ref-19)
20. Nielsen, op.cit. [↑](#footnote-ref-20)
21. Ibid. [↑](#footnote-ref-21)
22. Ibid. [↑](#footnote-ref-22)
23. Disability Rights Commission, The Web: Access and Inclusion for Disabled People, 2004 https://www.city.ac.uk/\_\_data/assets/pdf\_file/0004/72670/DRC\_Report.pdf [↑](#footnote-ref-23)
24. Ibid., 5-6. [↑](#footnote-ref-24)
25. Ibid., 6 [↑](#footnote-ref-25)
26. Ibid., 7 [↑](#footnote-ref-26)
27. Ibid., 27 [↑](#footnote-ref-27)
28. Ibid. [↑](#footnote-ref-28)
29. Ibid. [↑](#footnote-ref-29)
30. Ibid. [↑](#footnote-ref-30)
31. http://www.treasury.govt.nz/statesector/socialinvestment [↑](#footnote-ref-31)
32. Ibid. [↑](#footnote-ref-32)