

## Background

- Current standards and guidelines for creating accessible web and information technology have focused on people with visual, auditory, and motor differences. Little attention has been paid to creating evidence-based guidelines for people with autism spectrum disorder (ASD)
- The use of technology is ubiquitous in teens with ASD and their typically developing (TD) peers (Cohen, 2015) Many people with autism spectrum disorder (ASD) are interested in and prefer screen-based activities to other activities (Mazurek, 2012).
- Computer competency is an important adaptive skill and is necessary for many careers.
- Little research has been done to understand what programs (applications) are being used, whether teens with ASD can use them, and whether current design guidelines adequately address the diverse needs of people with ASD.

## Objectives

- To understand which commonly used applications are difficult for teens with ASD to use and to identify avenues for improvement.

## Methods

- An anonymous 80-question online survey developed in SurveyMonkey; University of Baltimore IRB: Exempt
- Recruited via email to Interactive Autism Network (IAN) Research registry participants, IAN Community ([www.iancommunity.org](http://www.iancommunity.org)), and Facebook
- Administered September 9, 2015 through October 24, 2015 to parents/guardians of children ages 13 – 17, with and without ASD, in the US

## Results

### Analysis groups (n=347):

- **ASD Low** (134; 39%) - Teens with ASD and parent-reported below-normal intellectual ability
- **ASD Normal** (129; 37%) - Teens with ASD and parent-reported normal or higher intellectual ability
- **TD** (84; 24%) - Typically-developing teens with parent-reported normal or higher intellectual ability
- No statistically significant differences between the groups in demographic characteristics (skewed toward higher SES). Gender ratio within expected range.

### Use of Common Office/Productivity, Entertainment, and Educational Applications

Parents were asked which applications their teens were using and rated the difficulty. Tables 1 and 2 show the differences between analysis groups.

- Teens were using a wide variety of applications, with ASD Low teens using fewer office/productivity applications and having more difficulty when using them than ASD Average and TD groups.
- The ASD Low teens were using entertainment applications less and having greater difficulty than the other groups.
- There was no significant difference between the groups in the use or difficulty of educational applications, which tend to be tailored for different skill levels.

**Table 1: Comparison of teen use of and difficulty with common office productivity applications**

	ASD-Low	ASD-Average	TD	Analysis
<b>Office/Productivity Applications</b>				
<b>Word processor use</b>	55.8% (72/129)	81.9% (104/127)	78.6% (66/84)	Fewer ASD Low and Hispanic used ( $p < .001$ FET). More ASD Low and younger teens had difficulty. ( $p < .001$ FET)
Had difficulty using	36.1% (26/72)	10.6% (11/104)	4.6% (3/66)	
<b>Spread sheet use</b>	30.2% (39/129)	50.8% (65/128)	67.9% (57/84)	Fewer ASD Low and younger teens used. ( $p < .001$ FET). ASD Low and then TD predicting spread sheet difficulty. ( $p < .001$ FET)
Had difficulty using	82.1% (32/39)	23.1% (15/65)	7.0% (4/57)	
<b>Graphics, drawing, or video editing use</b>	39.2% (51/130)	62.2% (79/127)	80.7% (67/83)	Fewer ASD Low and girls used. ( $p < .001$ FET). ASD Low had more difficulty. ( $p < .001$ FET)
Had difficulty using	45.1% (23/51)	13.9% (11/79)	4.5% (3/67)	
<b>Calendar/scheduling use</b>	31.3% (41/131)	43.0% (55/128)	65.5% (55/84)	Fewer ASD (both) used, gender, and Hispanic. ( $p < .001$ FET) ASD Low had more difficulty. ( $p < .001$ FET)
Had difficulty using	53.7% (22/41)	21.8% (12/55)	7.3% (4/55)	
<b>Calculator on device use</b>	61.8% (81/131)	78.1% (100/128)	95.2% (80/84)	Fewer ASD (both) used. ( $p < .001$ FET) ASD Low had more difficulty. ( $p < .001$ FET)
Had difficulty using	16.1% (13/81)	1.0% (1/100)	1.3% (1/80)	

Statistical model used Logistic Regression controlling for age, gender, white (vs. non-white), Hispanic (vs. non-Hispanic).

**Table 2: Comparison of teen use of and difficulty with common entertainment and educational applications**

	ASD-Low	ASD-Average	TD	Analysis
<b>Entertainment Applications</b>				
<b>Video/movie service use</b>	75.4% (98/130)	81.9% (104/127)	95.2% (80/84)	Fewer ASD used. ( $p < .001$ FET)
Had difficulty using	8.2% (8/98)	0.0% (0/104)	2.5% (2/80)	
<b>Games on device use</b>	83.7% (108/129)	91.3% (116/127)	96.4% (81/84)	Fewer ASD Low used, but still high usage. ( $p < .009$ FET) Fisher's exact test (FET)/Chi-Square could not be performed
Had difficulty using	5.6% (6/108)	0.0% (0/116)	0.0% (0/81)	
<b>Reads books, magazines, web</b>	55.0% (72/131)	88.3% (113/128)	88.1% (74/84)	Fewer ASD Low and Hispanic used. ( $p < .001$ FET) Fisher's exact test (FET)/Chi-Square could not be performed
Had difficulty using	19.4% (14/72)	6.2% (7/113)	0.0% (0/74)	
<b>Camera on device use</b>	74.0% (97/131)	80.5% (103/128)	97.6% (82/84)	Fewer ASD Low and younger children used. ( $p < .001$ FET) ASD Low had more difficulty. ( $p < .001$ FET)
Had difficulty using	12.4% (12/97)	1.0% (1/103)	1.2% (1/82)	
<b>Educational Applications</b>				
<b>Educational programs/apps use</b>	83.0% (107/129)	76.6% (98/128)	83.3% (70/84)	No significant difference
Had difficulty using	32.7% (35/107)	18.4% (18/98)	10.0% (7/70)	No significant difference

Statistical model used Logistic Regression controlling for age, gender, white (vs. non-white), Hispanic (vs. non-Hispanic).

## Results (continued)

Parents were asked, "What advice do you have for people who design computers and other digital devices, computer applications, and web pages so that they could improve these technologies for your child?" A thematic content analysis revealed the following themes for the ASD groups, in order of frequency:

**Simple and predictable.** Use clear, simple, concrete language; clean design; predictable navigation; and clear instructions.

*"Stop making everything take a million unnecessary steps."*

**Error free.**

*"Make them so nothing ever goes wrong and they always do what they are supposed to do! Ha ha!"*

**Safe.** Provide safe spaces for the teens to explore and better ways to monitor and control activities. The outside world should help foster a safe environment.

*"It would be fantastic if parental controls vis-à-vis time and content were more user-friendly."*

**Multi-sensory.** Spaces should accommodate a variety of learning and perceptual differences.

*"More visual, language, and auditory"*

**Respect.** Despite cognitive differences, their teens appreciate games and information with sophisticated, age appropriate material.

*"Design fun and interesting spaces for older people with lower cognitive abilities. They're not children."*

**Accommodate motor differences.** 59% of the ASD teens had fine and 41% had gross motor problems. The ASD teens had more difficulty with device use, but were using all devices.

*"Touch screen is the best. Mouse use is difficult, double clicking is difficult."*

## Conclusions

- Most of the teens in this study with ASD were active technology users. When programs were tailored to the needs of the ASD Low teens, they are able to use them.
- People who design office/productivity and entertainment applications should provide simplified versions so that people with lower intellectual ability and cognitive differences can have equal access to occupational and entertainment opportunities.
- Adherence to current accessibility guidelines for people with cognitive and motor differences will help increase technology access for people with ASD. These guidelines include: Web Accessibility Initiative ([w3.org/WAI/intro/wcag](http://w3.org/WAI/intro/wcag)), Plain Language.gov ([www.plainlanguage.gov](http://www.plainlanguage.gov)), and W3C Cognitive Accessibility User Research ([w3.org/TR/coga-user-research/](http://w3.org/TR/coga-user-research/)).

## References

- Cohen, C.A. (2015). *Identifying Opportunities to Improve the Accessibility of Web and Information Technology for People on the Autism Spectrum*. Master's Thesis. University of Baltimore.
- Mazurek, M. O., Shattuck, P. T., Wagner, M., & Cooper, B. P. (2012). Prevalence and correlates of screen-based media use among youths with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 42(8), 1757–1767. doi:10.1007/s10803-011-1413-8