



International  
**Orientation & Mobility**  
Online Symposium

**Date: January 25, 2018**

**Time: 1:45-2:45 PM EST (World Clock)**

**Title: The Toddler App and Cane System: A Step Forward in VI Toddler O&M**

**Presenter: Dr. Grace Ambrose-Zaken, Certified Orientation and Mobility Specialist, Hunter College CUNY & Safe Toddlers, Inc., New York**

Description: Dr. Ambrose-Zaken will provide video and single-subject data on the usability trials of the wearable toddler cane aka the hands-free cane for toddlers with severe visual impairment and blindness. Results: Wearable cane usability: Fifteen 2-5 year olds tested toddler cane prototype iterations over 3 months (May 2017 to August 2017). These trials resulted in the Phase II prototype toddler cane. Aug-October, 11 subjects aged 2- 5 ½ wore toddler canes in classrooms and outside on many terrains. TAC App usability: Parent-facing, family centered app that provides developmentally appropriate activities and motivators for parents who use it, will be demonstrated, usability results will also be reported.

Study Results & Implications: 11 subjects (aged 2-5 1/2) with Visual Impairment tested wearable cane prototype: linoleum flooring, sidewalks, playground soft surfaces, sand, dirt, gravel, grass and other uneven surfaces. Results: Eight learners donned the toddler cane with ease. Three learners initially refused to wear the cane, one of whom did agree to wear it. The 9 learners who wore the toddler cane never requested to remove the cane due to frustration or any expressed dislike. Instead, multiple learners communicated a desire not to have the toddler cane taken off them, two of them requested that the toddler cane put on and one insisted they she be allowed to bring it home with her. Three subjects wore it during seated (floor and chair) activities. Parents and O&M specialists provided feedback on the TAC System. Parents requested the TAC App be designed to help their child practice O&M skills and reward them for these activities. Parents and professionals commented on the immediate benefits and positive changes observed in subjects wearing their cane and they also suggested how wearable cane prototype could be improved. Implications: The wearable cane is an important advancement in safe mobility for learners with severe visual impairment and blindness.

# SAFETODDLES

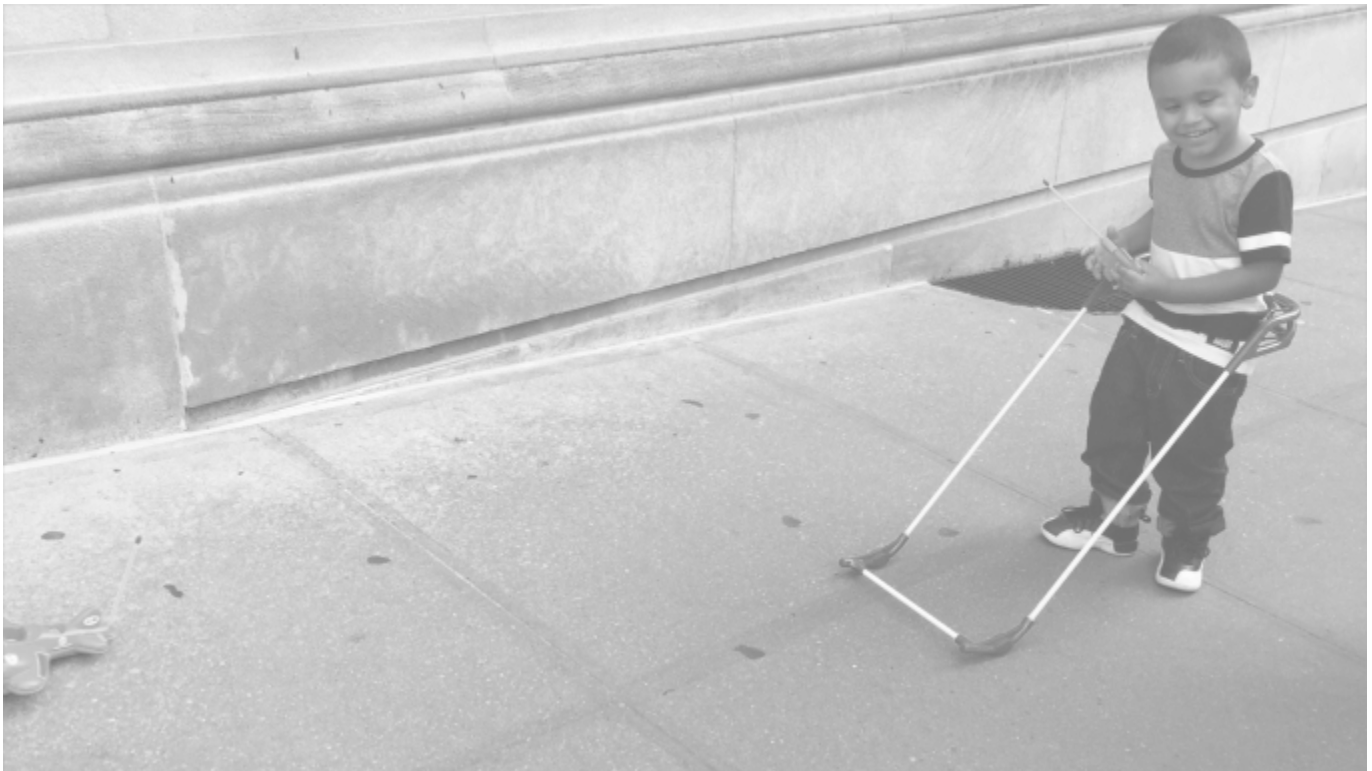
SafeToddlers

Toddler APP and Cane System:

An Innovative Program

for Teaching Orientation and Mobility to Toddlers with  
Severe Visual Impairment and blindness (SVI&B)

*Funded by IES Department of Education: Small Business Innovation  
Research Phase I CONTRACT NO. ED-IES-17-C-0041*



**Figure 2: Image of a preschool-age boy walking with the SafeToddlers cane.**

## Slide 1, STAGES OF WALKING – ROLE OF VISION

- Vision–Encourages Exploration



Figure 3: A baby crawls towards the camera on his/her hands and knees.



Figure 4: A baby holds on to a tall play-toy, looking upward.

## Slide 2, STAGES OF WALKING – ROLE OF VISION

- Vision– Balance when first learning to stand



Figure 5: A baby is standing with her legs straight. A man stands behind her and holds the back of her arms, as if for support.

## Slide 3, STAGES OF WALKING – ROLE OF VISION

- Vision– Balance when taking first Steps



Figure 6: A baby stands by herself, smiling. An adult is standing behind her with their arms reached out toward the baby, but not holding the baby.

## Slide 4, STAGES OF WALKING – ROLE OF VISION

- Vision– Balance when practicing steps



Figure 7: A baby stands strong on one leg, lifting her other foot as though she is about to walk.

## Slide 5, Why do Infants Give up the Stability of Crawling?

- A study of 151 sighted infants (11 months to 19 months-old) asked who fell more?

Expert Crawlers?



Figure 8: A picture of a baby crawling on the ground, looking at the camera and smiling.

## New Walkers?



**Figure 9: Image of a girl running and then falling down.**

### **Slide 6, Walking Improves with Practice**

The more steps sighted toddlers walked, the less they fell and the better their gait, pace and obstacle negotiation skills were in cluttered settings (Adolph, et al., 2012).

Sighted toddlers walked more because they found walking was a safer and more efficient way for them to move about...

Toddlers with SVI&B are at a distinct disadvantage in development that is dependent upon increasingly safer more efficient walking.



**Figure 10: Image of a man crawling.**

## **Slide 7, VISUAL ACUITY, CONTRAST SENSITIVITY, STEREOACUITY**

- Visual acuity - Detail of an object at a distance
- Contrast sensitivity - Discriminate object and background
- Stereoacuity –Depth perception
- Studies have confirmed that when participants with SVI&B walked without mobility tools they demonstrated slower walking speeds (West, et al., 2002), greater likelihood of incident mobility (e.g., tripping over obstacles) (Deshpande, Metter, Ferrucci, 2011; Subhi, Latham, Myint, & Crossland, 2017), and greater risk of developing a mobility disability (Salive, et al., 1994).

## **Slide 8, Cane Skills**

- Studies of adult long cane use documented effectiveness (e.g. for detecting drop-offs) only when paired with a syncoated cane arc and the user was able to quickly respond to long cane tactile feedback (Bongers, Schellingerhout, van Grinsven, & Smitsman, 2002; Shik Kim, Wall Emerson, & Naghshineh, 2017).
- Anthony, Lowry, Brown, & Hatton (2004) observed that when learners under 5 with SVI&B used long canes they left “broad areas of the body unprotected” (p. 29).



## Slide 9, Motor Skills

- Children under five with SVI&B may be at a distinct physical and cognitive disadvantage when attempting to employ syncopated long cane rhythm for safety.
- St. Onge (2007) had toddlers and college-aged teachers wear accelerometers during movement activities.

### Average Acceleration Velocity

- College-aged adults 1.9 m/s<sup>2</sup>
- Toddlers' was equivalent to 3.1 m/s<sup>2</sup>
- On average, toddlers had lower walking speed, higher cadence (approximately 2.93 steps per minute), and shorter step length compared to 8-year-olds.

## Slide 10, Wearable White Canes for Toddlers Development

- A toddlers' pace (3.1 m/s<sup>2</sup>) is significantly quicker than college adult's pace (1.9 m/s<sup>2</sup>).



Figure 11: Image of a toddler girl walking on a sidewalk, looking at her feet.

**Slide 11, Three Sweeps a Second – Hard to Master**



**Figure 12: Image of a cane on the tile floor.**

**Slide 12, Compare – Long white cane – 3 ½ year old**



Figure 13: Image of a child walking with a cane on gravel as seen from the knees down.

**Slide 13, PRESCHOOL PARTICIPANT LONG CANE POSITIONS**

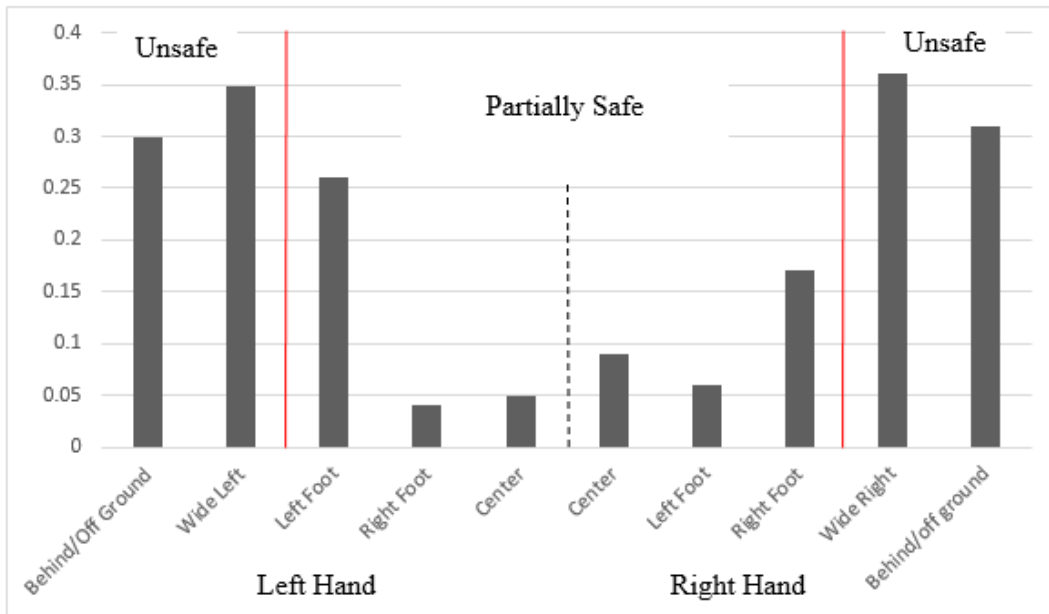


Figure 14 Cane tip position when long cane held in left and right hand.

**Slide 14, Compare – With wearable white cane – 3 ½ years old**



Figure 15: Girl walking with the Safe Toddles cane

## Slide 15, PRESCHOOL PARTICIPANT LANGUAGE TWO CONDITIONS

Long Cane	n	Wearable Cane	n
Initiated Question about Sensory Info	18	Initiated or Responded to Orientation and Route Planning	20
Responded to Adult Direct Question	15	Initiated or Responded to Concept Development	15
Subject Talking to Herself	13	Initiated or Responded to Play	14
Student Declaration about Sensory Information	4	General Content Verbalizations	9
Student Declaration or Request - General Content	4	Initiated Safe Mobility Adages and Warnings	2
Other	2	Subject Talking to Herself	1

Figure 16 Subject language content.

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Figure 17 Instructor language content.

## Slide 17, 2 and 3 year-olds of various shapes and sizes



Figure 18: Toddler walking with a gait trainer and using the Safe Toddles cane.

## Slide 18, High Grass and Dirt Roads



Figure 19: An adult and child are walking together, holding a Safe Toddles cane together.

## Slide 19, Phase II – Summation Video



Figure 20: Image of two large buildings at dusk.

## Slide 20, Phase II and Beyond



Figure 21: Image of a young boy using the safe toddlers cane.



**Figure 22: Image of two young children using the SafeToddles cane, facing one another.**

**Slide 21, THANK YOU!**



**Figure 23: Image of a young girl standing, wearing Safe Toddles cane and holding a toy broom.**







## Texas School for the Blind & Visually Impaired Outreach Programs



Figure 2 TSBVI logo.



"This project is supported by the U.S. Department of Education, Special Education Programs (OSEP). Opinions expressed here the authors and do not necessarily represent the position of the Department of Education."

Figure 3 IDEAs that Work logo and U.S. Dept. of Education OSEP disclaimer.