

“See in 3D “

Cartoons that improve stereoacuity and fusion

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Patent is pending

- Title: SYSTEMS AND METHODS FOR CONTROLLED DICHOPTIC VIEWING
- Applicant: Vicki M. Chen
- Application No.: 62/615,519
- Filing Date: January 10, 2018
- Country: United States of America

Simple, low cost, easy.

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Stereoacuity Deficiency, ICD10: H53.33

- Caused by amblyopia and strabismus which are the most common eye conditions in children
- Together, they occur in 3-5% of the general population ~2,946,923 children ≤ 18 years in the U.S. based upon 2016 census data ^{1,2}
- Of those with amblyopia, 96% have depth perception problems ³
- Depth perception improves in 20% of treated children, which leaves 80% with persistent problems
- The remaining **2,263,237** children are likely to have abnormal depth perception (stereoacuity) that is permanent and continues into adulthood
- More significant vision is lost in the U.S. < 45 years of age than from all other causes combined (NIH)

1. Under 18 years = 73,673,072 = 22.8% of U.S. population total 323,127,510

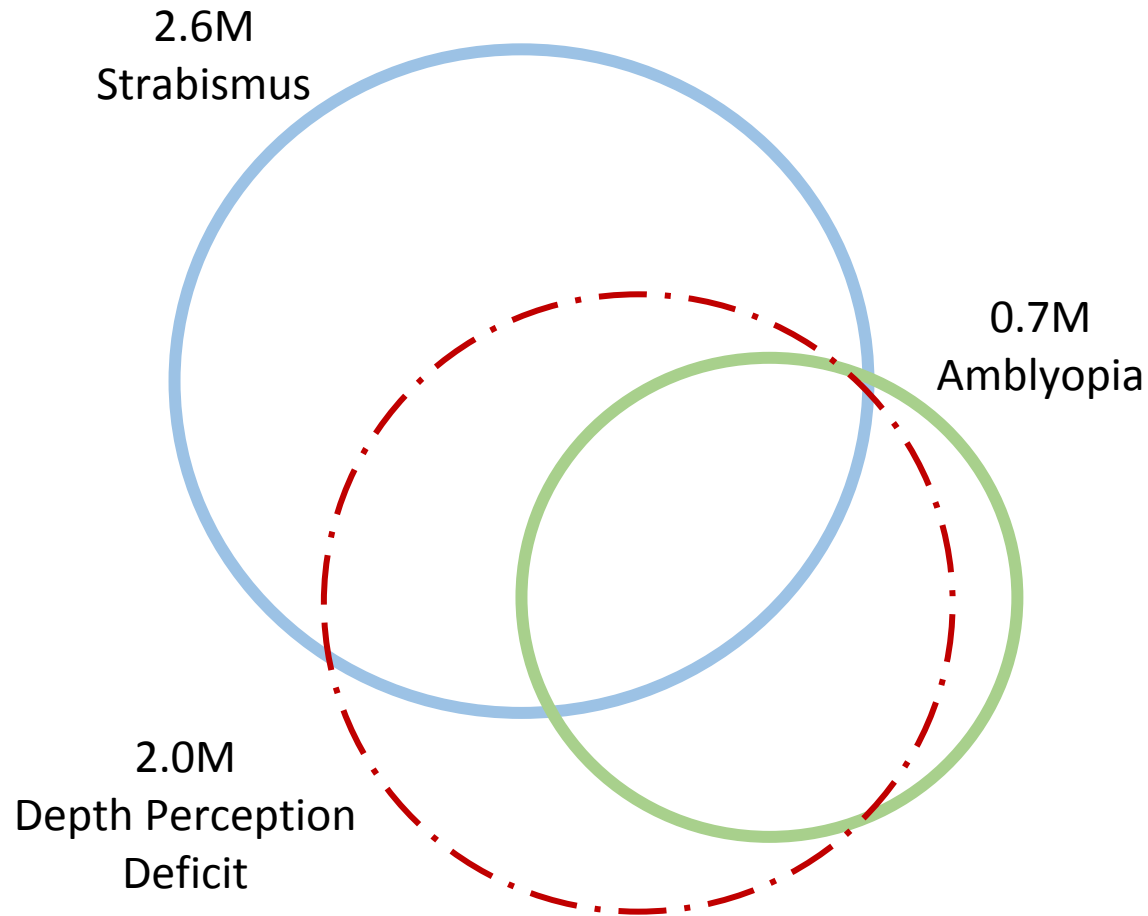
2. Reference: <https://www.census.gov/quickfacts/fact/table/US#viewtop> accessed 3.23.18

3. Wallace et al. Stereoacuity in children with anisometropic amblyopia. JAAPOS 2011;15:455-461.

Why is depth perception so important ?

1. It allows us to see 3D movies and games, play sports better, drive, fly
2. Many professions in the military and civil service require good depth perception
3. Impact reading: children without depth perception learn vocabulary more slowly
4. Lack of depth perception doubles the risk of surgery for eye misalignment (strabismus)
5. Fine motor skills are slower (surgeons operate 2x slower without depth perception)

Why treat MORE than just vision (amblyopia)?



- Amblyopia and strabismus are the most common eye conditions in children = 4.5% of the general population
- Total with one or both diseases: 3,315,288
 - 2-5% of children have strabismus = 2.6M
 - 2% have amblyopia = 0.7M
 - ½ with amblyopia also have strabismus
- After treatment, still missing depth perception in **2,007,591**
 - 42-68% of strabismus = 1.4M
 - 80% of amblyopes = 0.59M
- **Conclusion: Depth perception deficiency affects a MUCH larger population than amblyopia**

Accepted therapies for amblyopia do not improve depth perception in the majority of patients



Author, year	Treatment	No. of Subjects	Duration Tx (follow-up)	Mean stereo gain in log arcsecs	Subjects imp \geq 2 octaves (%)
Holmes, 2016	Patching	188	4 months	0 (median)	22 %
Steward, 2013	Patching	69	Until improved	0.6 (p=0.21)	16 %
Wallace, 2011	Patching / atropine	248	6 months	0.2	28 %
PEDIG, 2010	Bangerter	76	6 months	no change (p=0.9)	16%

Even **new** experimental therapies do not improve depth perception

The minimal amount needed to be considered "real" is 0.3 log arcsecs¹

Author, year	Treatment	No. of Subjects	Duration Tx (follow-up)	Mean stereo gain in log arcsecs	Subjects imp ≥ 2 octaves
Kelly, 2018	Binocular games (Digrush) and movies	20 (games) 21 (movies)	2 weeks	0.1 (p=0.046)	20% (CI 10-34%)
Kelly, 2016	Binocular games (Digrush)	14	2 weeks	0 (median)	not reported
Holmes, 2016	Dichoptic games (ATS18)	181	4 months	0 (median)	18 %
Herbison, 2016	Dichoptic games and videos (i-Bit)	75	6 weeks	no change	not reported
Li, 2015	Dichoptic movies (on 3D monitor)	8	2 weeks	0 (median)	0 %

1.

Our program improves 3-5 times more depth perception

Author, year	Treatment	No. of Subjects	Duration Tx (follow-up)	Mean stereo gain in log arcsecs	Subjects imp \geq 2 octaves
Our study	Dichoptic videos	27	4 weeks	0.569 (p=0.001) 0.310 (median)	63%
Kelly, 2018	Binocular games (Digrush) and movies	20 (games) 21 (movies)	2 weeks	0.1 (p=0.046)	20% (CI 10-34%)
Kelly, 2016	Binocular games (Digrush)	14	2 weeks	0 (median)	not reported
Holmes, 2016	Dichoptic games (ATS18)	181	4 months	0 (median)	18 %
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Multicenter trial to improve stereoacuity in children

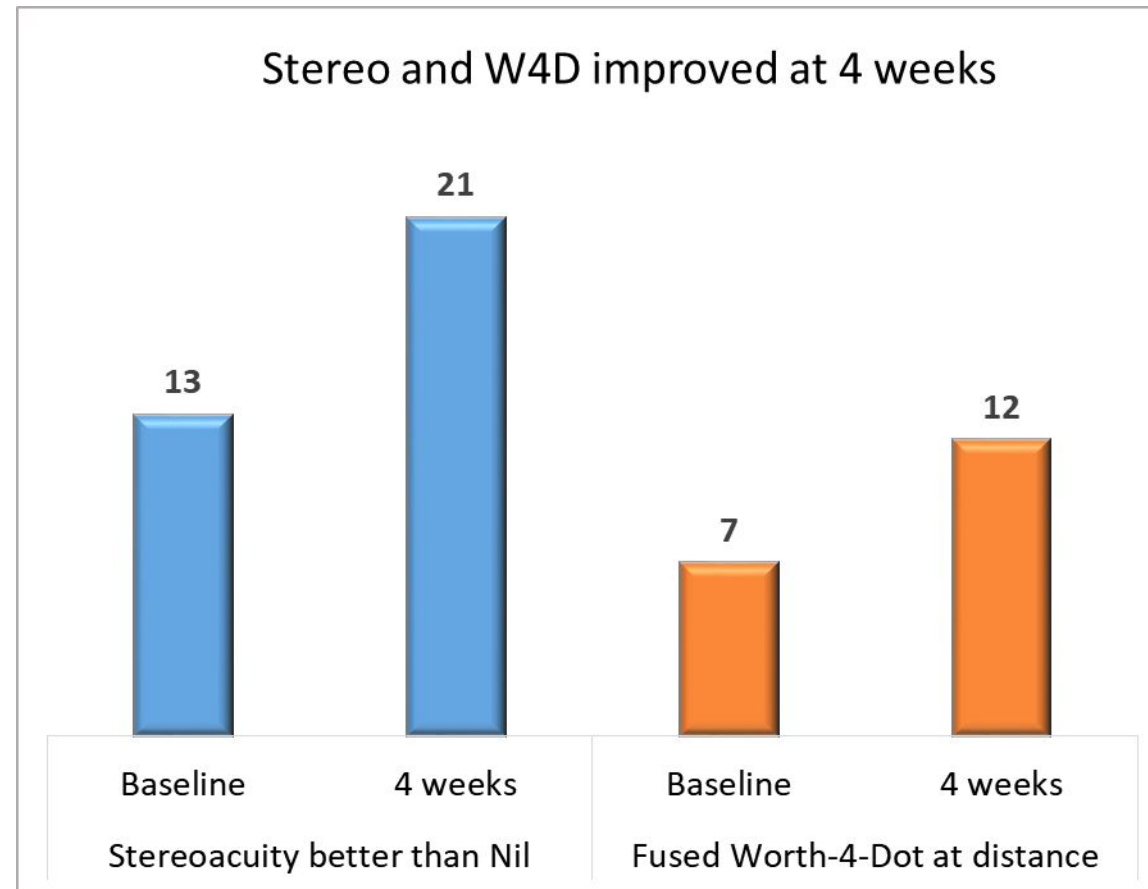
- We are running a RCT at a handful of selected university ophthalmology departments with research experience
- Recruitment goal N= 80
- Randomized centrally at Tufts Medical Center, Boston
- Quick study visits involve testing stereoacuity with Preschool Randot Stereotest and Butterfly Stereo book, BCVA, ACT (5-10 minutes more than routine exam)
- Only 2-3 visits: baseline and 4 weeks, with optional 16 week visit
- All study materials will be provided to each site
- For benefit study, minimal risk, IRB expedited review
- Authorship to PI at each site

How do the cartoons and glasses work?



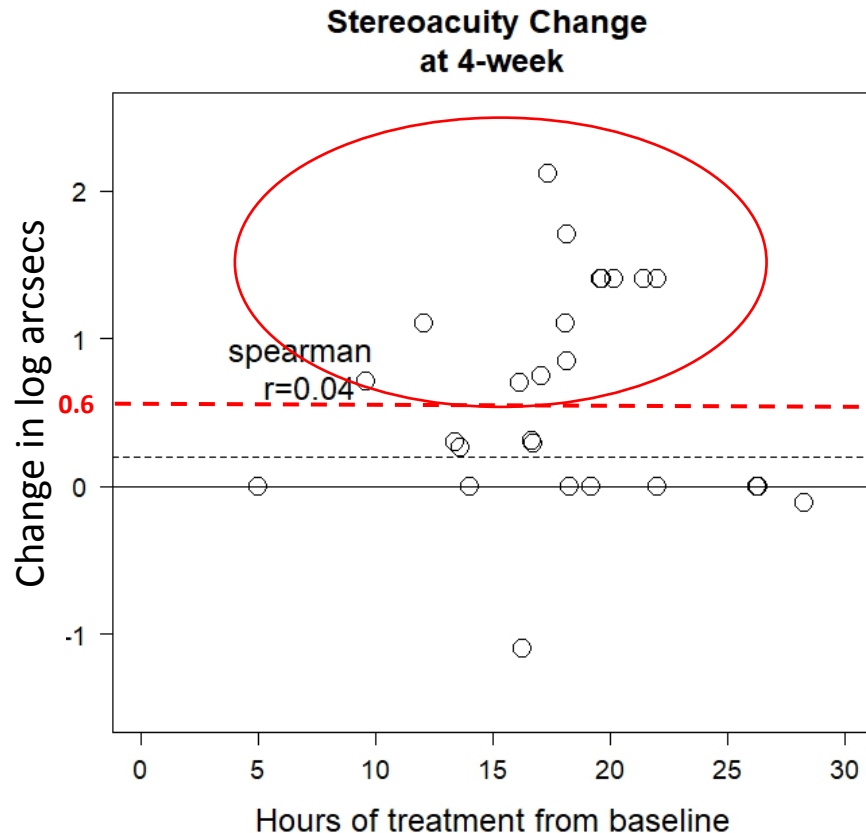
- Green lens filters green images and provides a strongly contrasted image of Clifford (100%) to the amblyopic (lazy) eye
- Red lens filters out Clifford and shows the muted green images
- The brain receives equal input from both the lazy and normal eye
- Binocular cells in the brain are then stimulated
- Visual pathway is not known (suspect accessory visual systems: V2, V3a, V4, V5/MT)

Children gained depth perception and binocular vision in 4 weeks



Stereoacuity measures fine depth perception
Worth-4-Dot measures binocular vision

What is meaningful improvement in depth perception ?



Meaningful is:

- Gain of 1-2 levels or more = 0.3- 0.6 log arcsecs
- Dashed line = 0.6 log arcsecs

In our study of 27 children:

1. **3-5 times more depth perception improved** than any other experimental treatment
2. Depth perception improved in **63%**
3. Average improvement was 0.569 log arcsecs (CI 0.269 - 0.870, $p=0.001$) which is highly statistically significant

Did kids watch the videos ? Yes, happily !

- 20/ 27 (77%) reported viewing 80% of prescribed hours
- All children reported they preferred this therapy to standard patching or atropine for amblyopia (lazy eye)

Problems ? (adverse events)

- No headaches, double vision or eye straining reported
- 2 subjects lost depth perception after 4 weeks but both recovered by 16 weeks
- 1 subject showed worsening of previous eye misalignment, but had special type of misalignment (ARC) that can be identified before treatment

Please feel free to call or email me directly

Thank you for considering this!

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