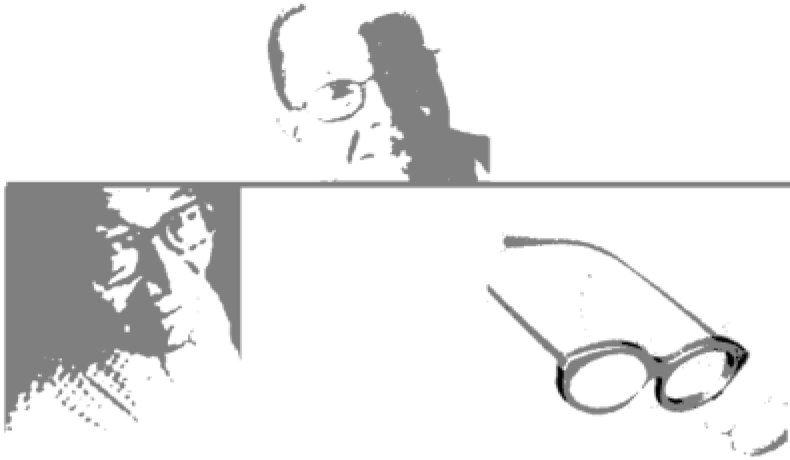
Making corrective lenses more affordable



OptiOpia, Inc.

The Opportunity
Auto-Refractor Overview
Team
Status

April 1, 2011

Saul Griffith, Ph. D.

David Grosof, Ph.D., M.B.A.

The World's #1 Vision Problem

"Uncorrected refractive error is the major and most easily avoidable cause of vision loss"

- Brien A Holden

Opportunity

500 Million to 1 Billion people need single vision glasses and can pay $5 or more for good far vision

OptiOpia's Approach

Make vision screening and refraction easier

Lower the cost of delivering prescription lenses

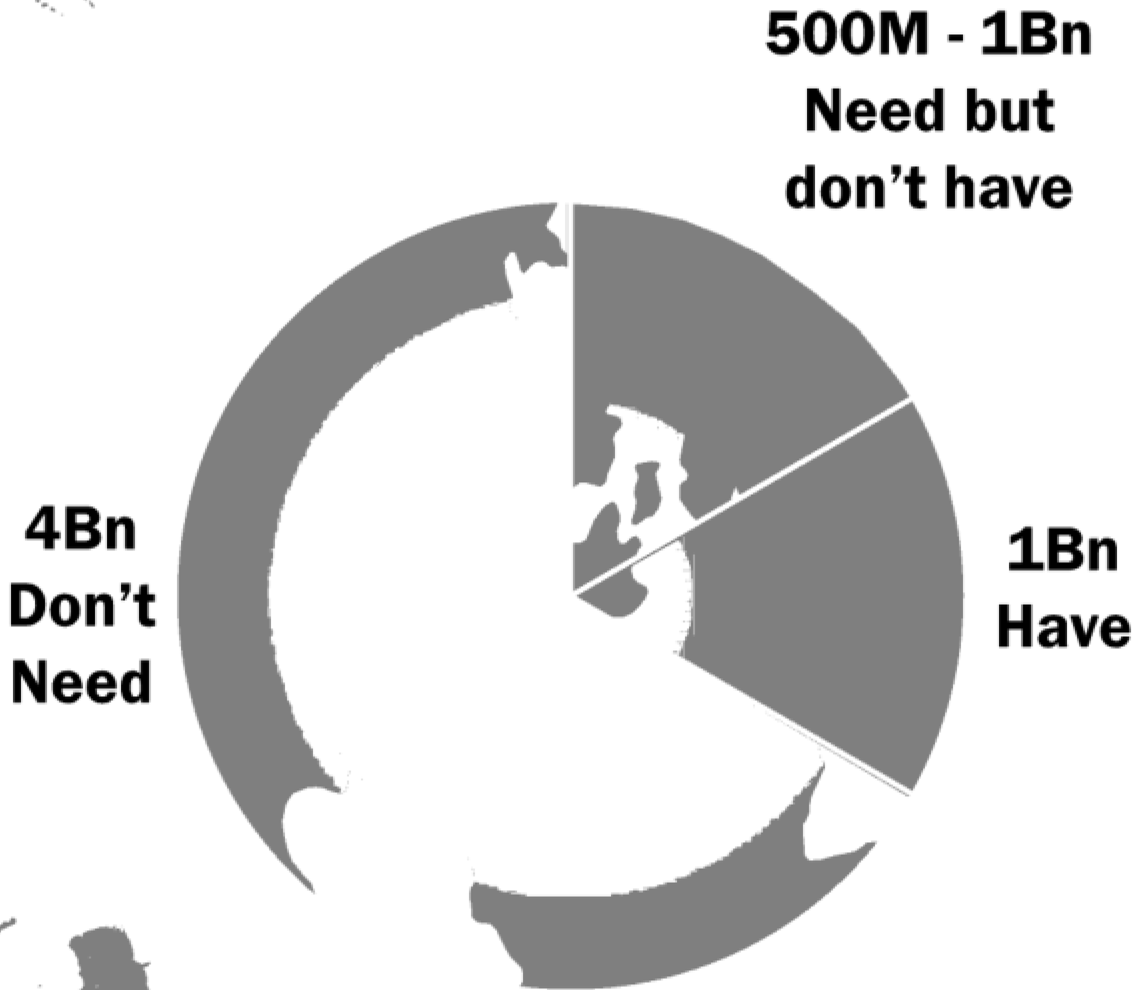
Products

Low-cost auto-refractor

Desktop spectacle lens molder

Neglected Global Demand for quality low cost eyeglasses

Global Perspective – Possibility for Major Impact



- 1Bn People Need
  - Majority can afford ~$5 glasses
- $40Bn Existing Market
- >$75Bn Economic Damage from uncorrected refractive error
- >150MM blind or severely visually impaired
- > 400 MM impaired by presbyopia

Source: World Health Organization, Brien Holden et al.

Two Sides to the Problem

1. Measure refractive error at low cost

Problem:
- Scarcity of trained optometrists / ophthalmologists
- Lack of low cost, low skill, refraction device

Solution:
- Automatic refraction requires little skill to operate
- Robust, low cost, accurate vision testing device
- Design for "minimal environment" without phoropter

2. Deliver corrective lenses at low cost

Problem:
- High capital costs of equipment to fabricate lenses
- Skilled, trained technicians required to operate fabrication equipment
- Capital tied up in large inventory of lens blanks at multiple distribution layers

Solution:
- Much less expensive equipment
- Low technical skill requirements
- Little / no inventory of blanks to carry

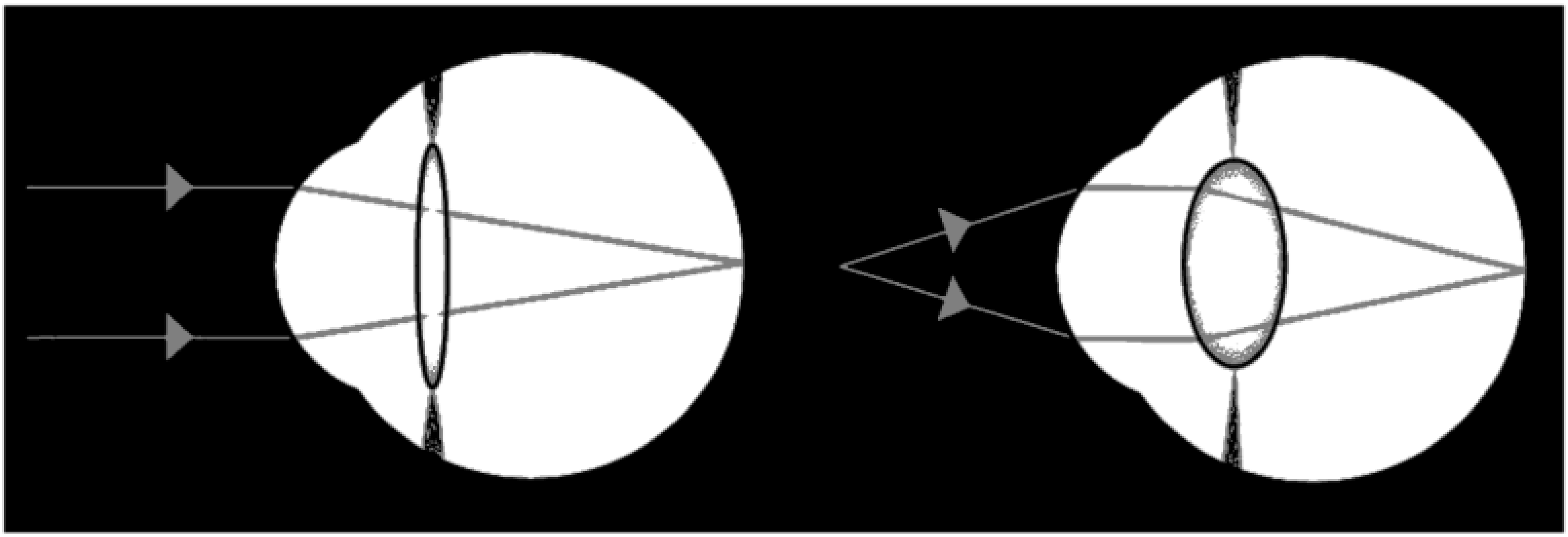
Current Auto-refractors

Today's auto-refractors (ARs) are for offices in US, EU, Japan

Almost all use virtual targets

Technician uses to help doctor prescribe more quickly & accurately

Highly accurate – unless accommodation fluctuates



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Current Auto-refractors

Two Portable Models

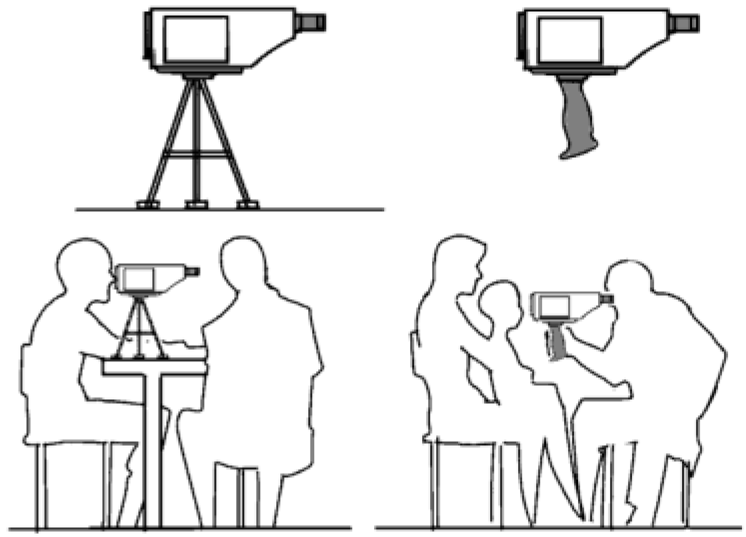
- Welch-Allyn SureSight ($5,000) is failing
- Right Medical RetinoMax (ex-Nikon) is more expensive (>1M Yen or $12,000)
- Extensive research in US by NEI on value for *screening*
- 3-5 year-old children

Table-top models range in price, quality & after-market service

- $6,000 to $15,000

The OptiOpia Auto-Refractor will be manufactured for less than $200 COGS and priced for each region $2,500 - $5,000 for US; < $1,000 for very poor regions

OptiOpia Autorefractor - Additional Product Benefits



Fixed or Portable

Stabilize Accommodation with Familiar
& Interactive Targets

Subjective Refraction

See-through feature

+

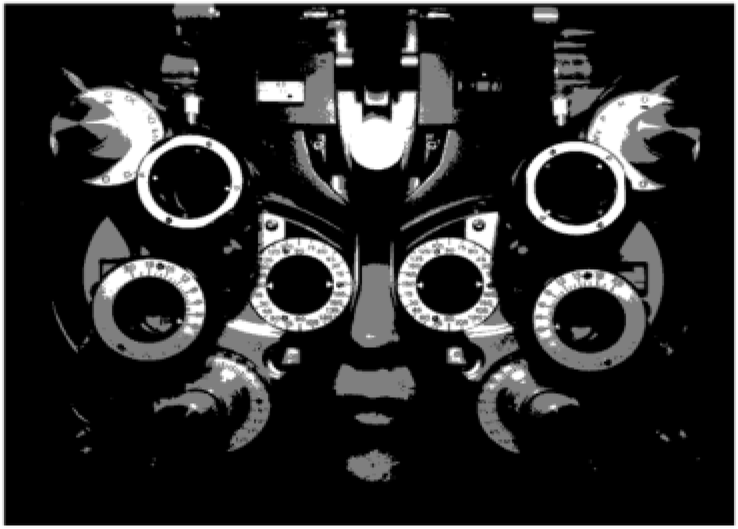
manual control of lens power =

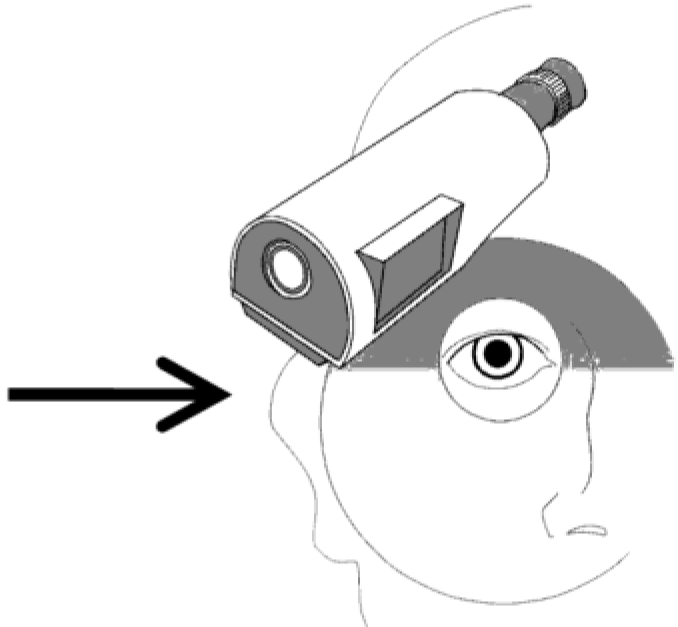
subjective refraction capability

Streamlined refractive service delivery:

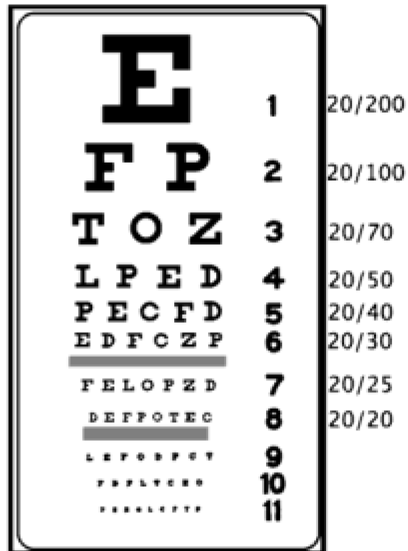
no need to reposition at phoropter station

Special Product Benefits





- Monocular Subjective Refraction Capability
- Phoropter not necessary for many patients
- Device is more powerful with more skilled operator



Children & Special Patients

Objective refraction (ARs & retinoscopy) is necessary method for

- young children (< 7)
- mentally disabled
- across a language barrier

(And is a useful method for routine refractive service on all patients)

OptiOpia Autorefractor - Key Product Benefits

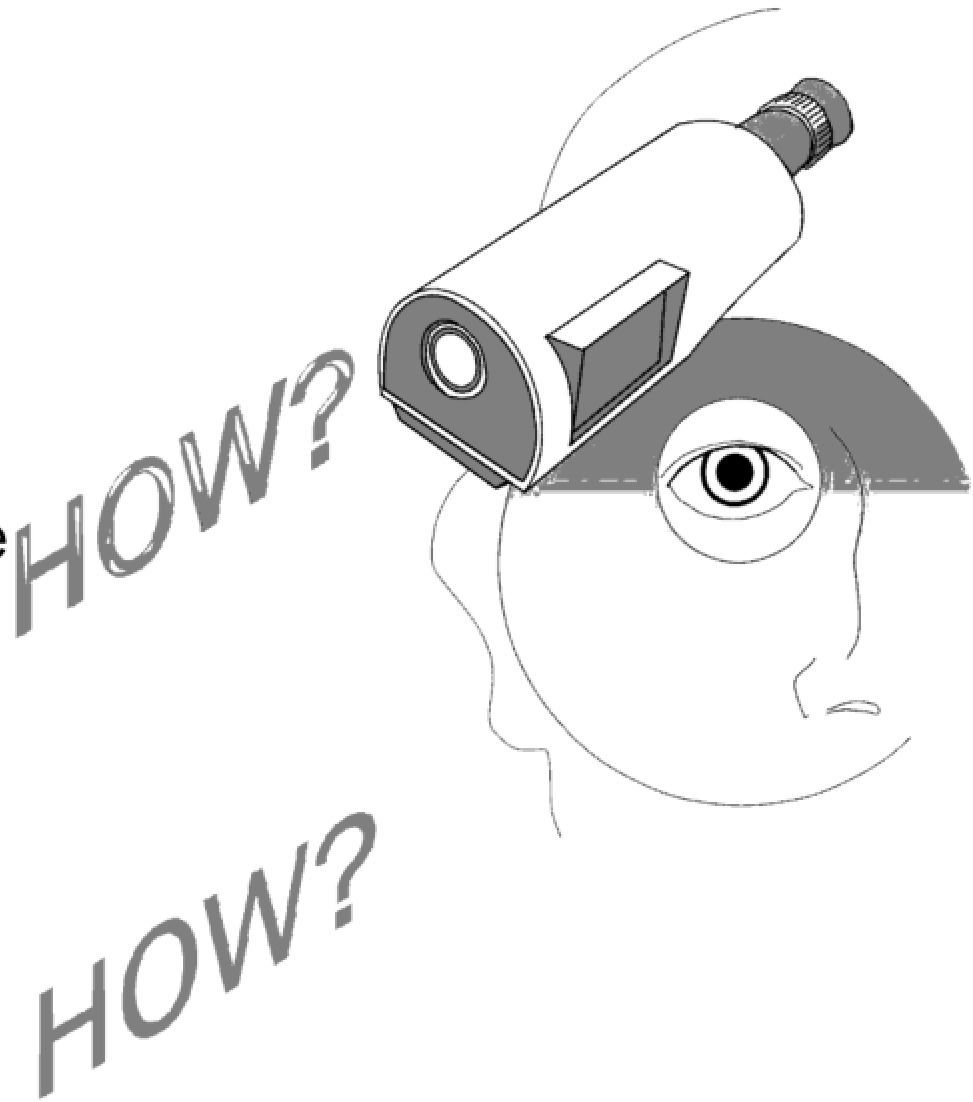
Portable

Rugged

Accurate

Easy-to-Use

Low-Cost



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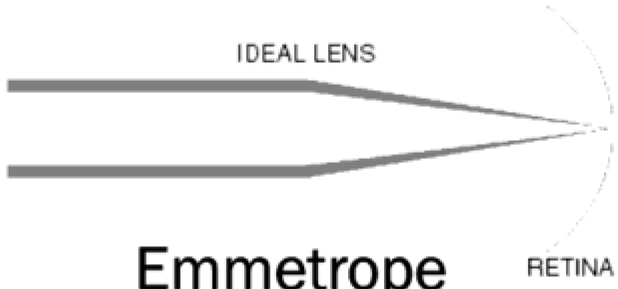
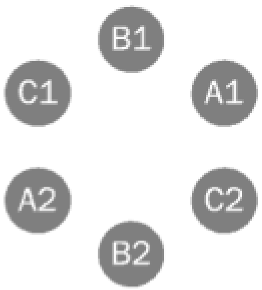
Scheiner Double-Pinhole Principle

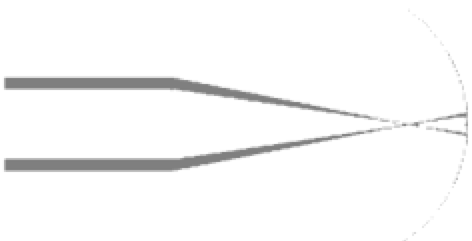
Two parallel beams of light intersect at a single retinal locus in emmetrope
and in ametropia at 2 loci with separation proportional to absolute value of ametropia



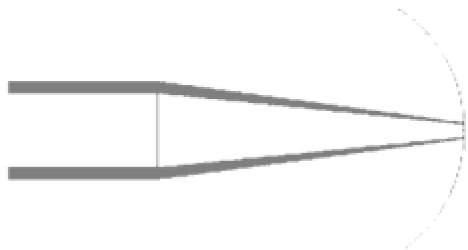
Emmetrope



3 Pairs of Beams



Myope



Hyperope

Our approach is to cancel the refractive error
with a variable-power optic
Three meridia suffice to measure astigmatism

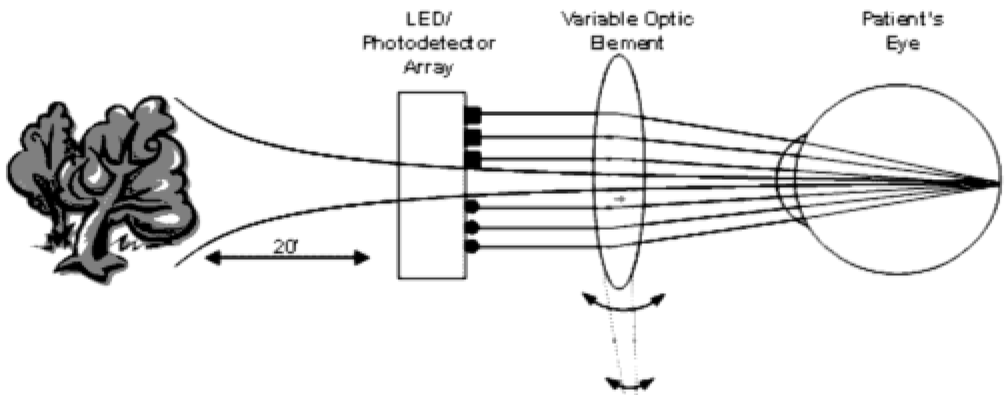
Low Cost Autorefractor – Design Features

Inexpensive <$200 COGS vs. current $5,000 - $15,000
- Mass-produced high-performance components
  Lasers, CMOS imaging, Microprocessor
- Modern plastic optics manufacture
  Special Variable Optic Lens (confidential)

Portable, Rugged & See-through – Compact Design

Easy to use - (features of competition)

Accurate - "See-through" feature
- increases stability of accommodation:
  patient looks at real world and device "auto-focuses" to correct prescription
- enables fine-tuning of prescription by trained eyecare professional or technology-assisted vision tester



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Autorefractor Specifications & Components

Specifications

Prescriptive Range: ±12 D sphere, 4D cylinder by nulling method; full range is TBD empirically

Portable (similar or less weight and volume than Retinomax)

Battery Powered

Compact & Potentially Supports a Wearable Design

Patient sees real target in examining room (10 degree linear field of view)

- More stable accommodation achieved, thus addressing
  - the major source of error in objective refraction
- Real target is superior for pediatric, anxious and naïve patients
- Enables near-vision testing
- However: cannot so easily be located in outer office suite

Components

Infrared illumination of retina (850 nm VCSEL laser) → favorable cost trends

CMOS imaging chip for fundus reflection → favorable cost trends

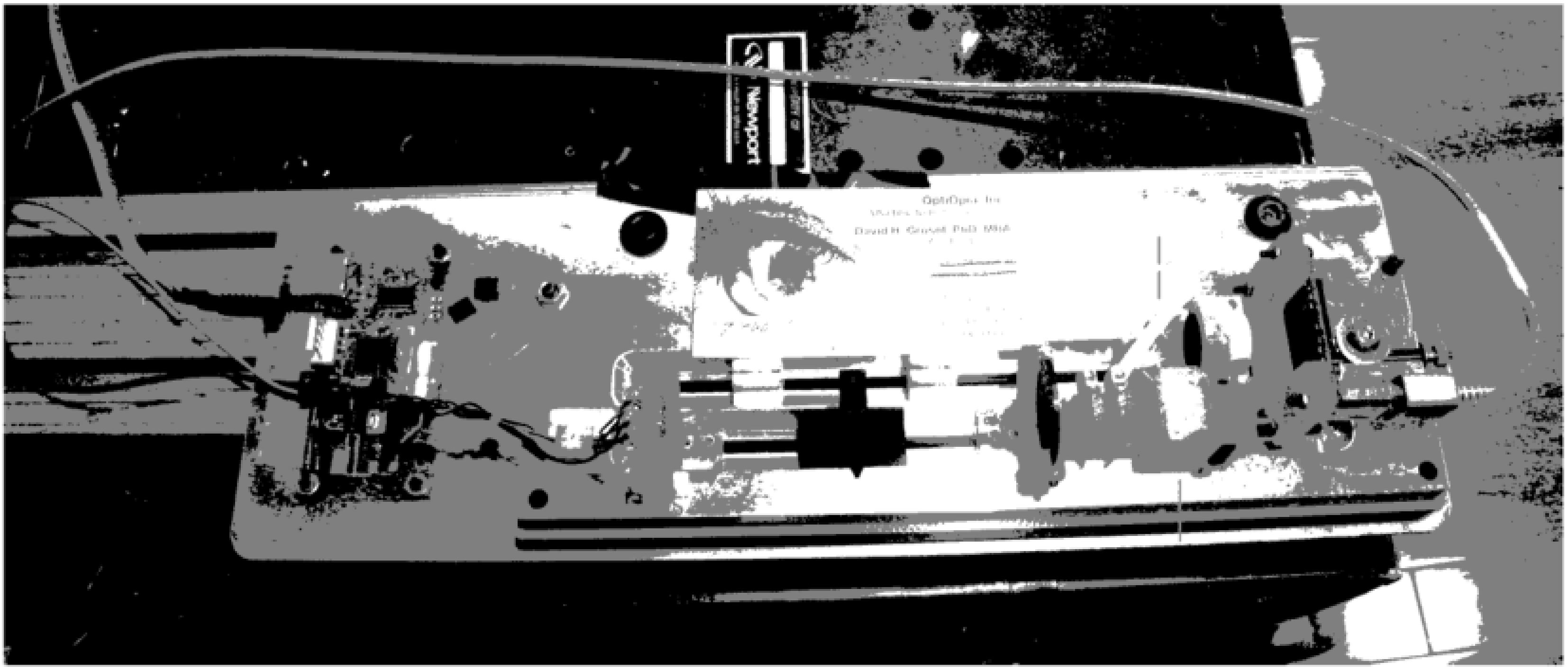
Simple optical design: 2 apertures, 4 lenses, 2 beam-splitters; only 2 moving parts

Embedded processor (not specified yet) → favorable cost trends

The special component:

- The variable-power optic, which requires
- Precision plastic molding → favorable cost trends

Current Prototype



Autorefractor specifications (routine)

<u>Routine Specifications</u>

Display screen for display of

- external eye and alignment,
- results and
- settings

Touch pad and remote control, for fast easy subjective refraction

Thermal printer

Data port for office management systems, telemedicine prescriptions, & lens molder

Carrying case

OptiOpia – where are we & where are we going

From Auto-refractor Technology to Manufactured Product

Optical Design – completed, optimization under way

Motion Control of Variable Power Lens

    several designs compared, built one now
    manufacturable, patentable, compact, robust

Specialty lens fabrication –vendor identified

Image Processing – tools in place, building ⟵ Now

Design and Testing of the "auto-focus" control in development

    Model Eye testing ⟵ Now
    MILESTONE **Limited human testing**

Design for Manufacture and pre-production prototypes (contractor identified)

Clinical Equivalence Testing

Regulatory Clearance, IP Defenses

"Clinical Rules Engine" because ametropia ≠ best prescription

Field testing

    Identifying influential, reputable partners for field testing of pre-production auto-refractors

OptiOpia – who are we & where are we going

The Company

Team Building

- Bruce Moore – NECO professor, pediatric optometrist, internationally recognized clinical expertise; World Bank
- Dan Laser – entrepreneur, engineering PhD, CEO Wave80 Diagnostic
- Charles Campbell – expert on auto-refractors and ophthalmic optic devices
- Engineers (mechanical and electronic)

Planning Market Entry - Strategy, Alliances & Research

- Opportunities identified and prioritized (more work to be done; we were aided by former Sola executive)
- Product features analyzed

OptiOpia Autorefractor - Key Product Benefits

Portable

Rugged

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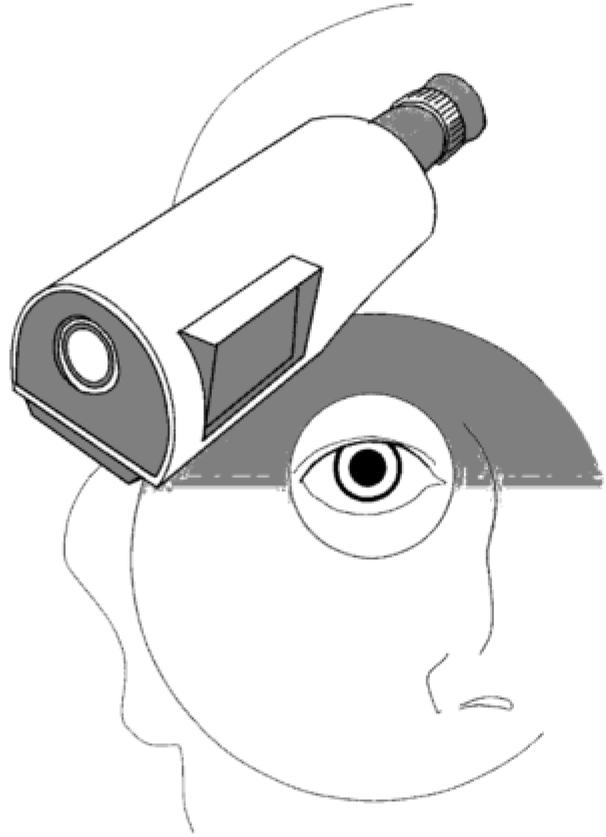
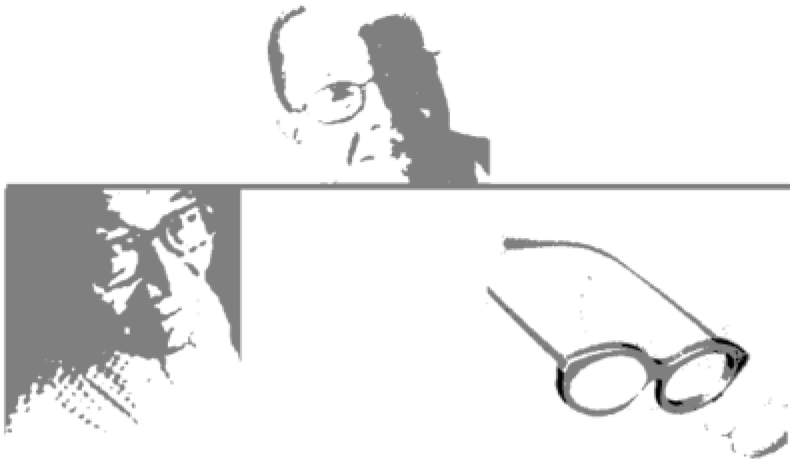


Making primary eyecare more affordable: OptiOpia



Opportunity

1 Billion people need single vision glasses and can pay >= $5

Approach

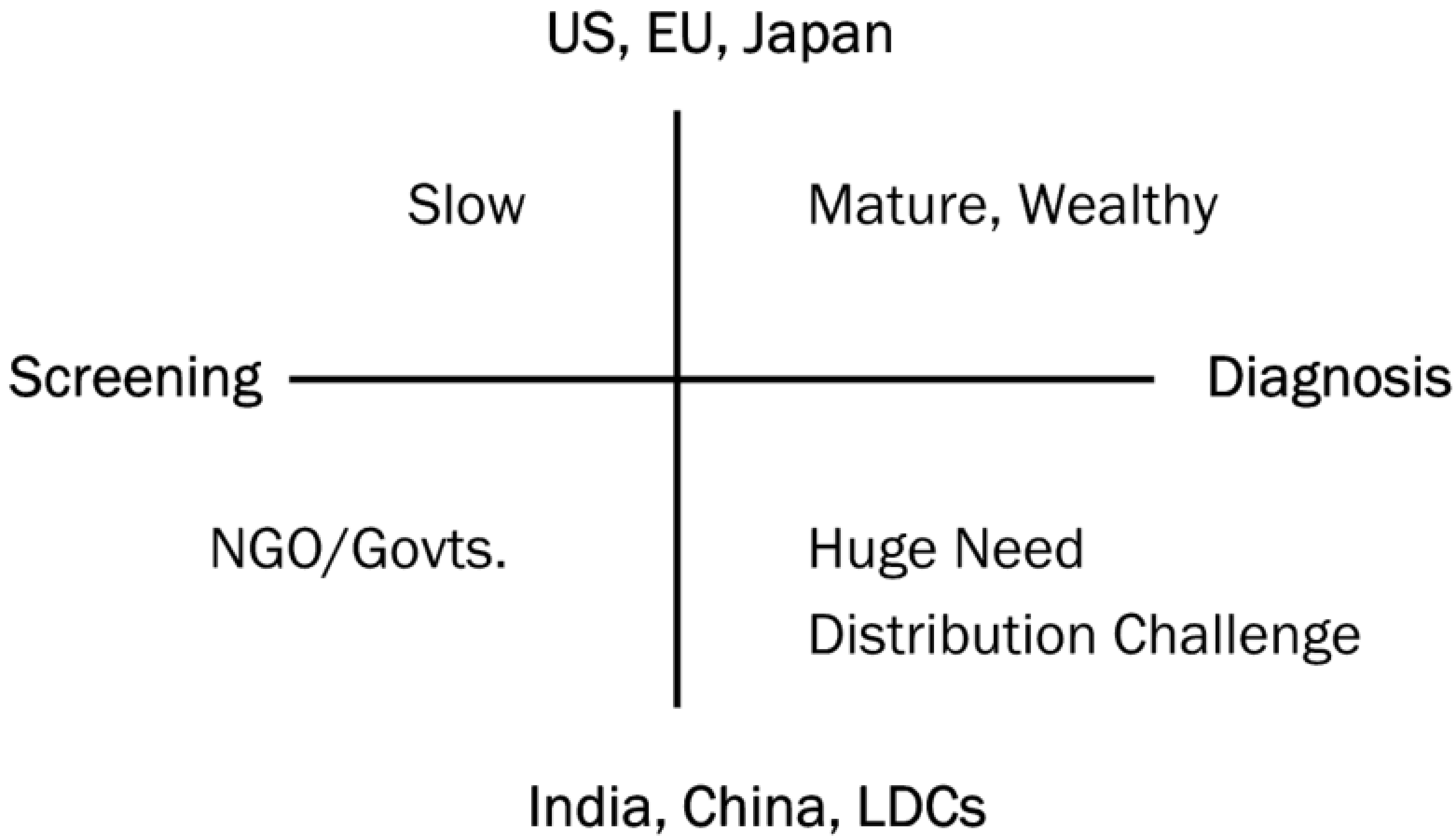
Lower the cost of vision screening and refraction

Lower the cost of glasses delivery

Extra Slides Follow

The slides that follow this largely technical presentation may answer questions you may have about the team, market and technology.

Market Segments



Nulling Mode

Patient is aligned,

Patient relaxes accommodation and fixates on distant target (+ power to force = "fogging")

Retina is illuminated with one of six pencils of near-infrared light

Retina is imaged and location of pencil of light back-scattered from retina is found

After up to six pencils are imaged, refractive state of eye plus variable lens is computed

Variable-power lens is repositioned to make eye+lens "emmetropic" and 6 loci coincident

Retinal imaging of 6 loci repeated

Converges to make Alvarez lens power = - 1 * sphero-cylindrical ametropia*

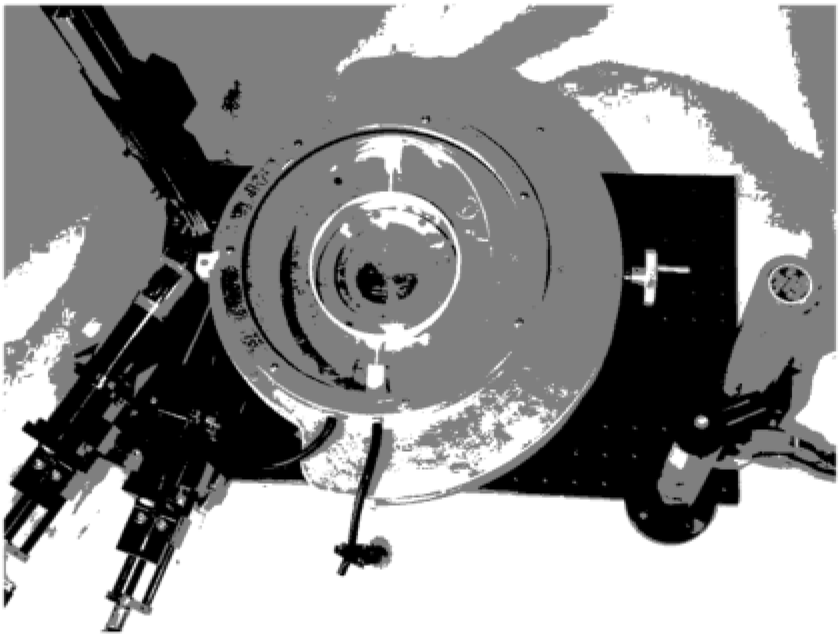
** adjusted by factor for distance of Alvarez lens from cornea*

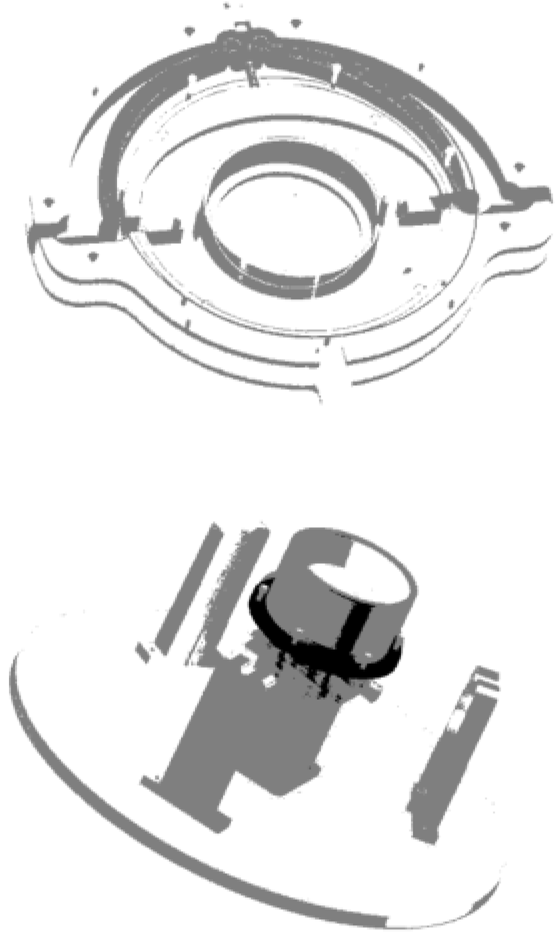
Imaging Mode

Beyond the "nulling range" of ±12D sph/4D cyl, it is possible to compute ametropia from changes in retinal loci of pencils as a function of the variable lens power.

TBD empirically in model and human eyes

Molding Prototype v.III





Both lens surfaces cast on flexible molds
(top and bottom)

Saul Griffith, PhD, Chairman & Advisor to President of OptiOpia

Education

Ph.D. (2004) MIT (Media Lab) Thesis: "Growing Machines"

Autonomously replicating robots & Programmable assembly (Advisor: Joe Jacobson)

M Sc. MIT (Media Lab) Micron and Sub-micron scale rapid prototyping.

Designed and developed novel 3-dimensional, multiple material, methods and apparatus for processing nanocrystalline suspensions into electronically functional devices.

M.E. (Mechanical Eng.) U. Sydney Fibre Composite Materials; Reprocessing materials

B.Met.E U. New South Wales Materials science (Metallurgy thesis)

Experience

2009 Entrepreneur-in-Residence, Foundation Capital

2009 Founder, Other Labs Developing supply and demand side energy solutions

2007 Co-Founder, OptiOpia, Inc.

2004-2007 Co-Founder, Makani Power, HowToons, Potenco, Instructables, Squid Labs

Honors

2007 MacArthur Fellow, 2007,

2003 Lemelson-MIT Student Prize for invention

several others

Patents include issued US Patent for lens molder

David Grosof, PhD, MBA Co-founder & President

Education

M.B.A. MIT. Focus on new venture development & finance.

Ph.D. Neurobiology. U. California, Berkeley. Electrophysiological, anatomical, behavioral and modeling studies of biological processing of motion, color and form

A.B. Harvard University. History of technology & social change; Neurobiology

Experience

2007 Co-founder & President, OptiOpia

2006 Project Manager, Squid Labs

2001-2007 Business development consultant to life science based start-ups

2004 Co-founder, Theregen, Inc. (cell-based therapy for heart)

1997-9 Research Scientist, NASA. Retinal & ocular image processing.

1993-6 Assistant Professor, Ophthalmology, Washington University School of Medicine (St. Louis, Missouri). Scanning laser ophthalmoscopy, clinical methods

Honors (selected)

National Research Council Senior Research Associateship, NASA Ames Res. Ctr.

NRSA Post-Doctoral Fellowship, NIH-National Eye Institute

National Science Foundation Graduate Fellow