Find the Handout for this class HERE:

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Tackling the Eyecare and Safety Needs of Athletes

An Introduction to Sports Vision Opticianry

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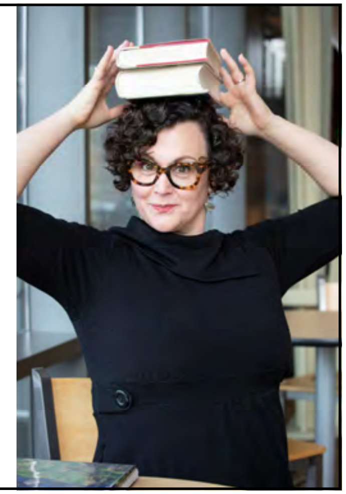
Cira Collins

1. **Professional Certifications**
   - Master of Ophthalmic Optics from the American Board of Opticianry
   - Certified Contact Lens Examiner by the National Contact Lens Examiners
2. **Industry Recognition**
   - 2024 Most Influential Women in Optical by Jobson
   - 2024 Game Changer by Eyecare Business
3. **Education and Experience**
   - Master of Public Health from Tulane University
   - 20 Years' Experience
4. **Diverse Background**
   - Worked in Corporate/Private, Optometry/Ophthalmology, Buyer/Vendor
   - Former Swimmer



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Course Overview

Subspecialties in Optometry
How have subspecialties developed in Optometry and how has Opticianry responded?

Optician's Role
What does an optician do?

Athletes' Visual Needs
How does an optician think about the visual needs of athletes by sport?

Eyewear Impact Factors
How do the following impact eyewear needs: Speed, Safety, Conditions, Focal Length, Visual Range?

Athletic Eyewear Products
What products address the specific needs of athletes?

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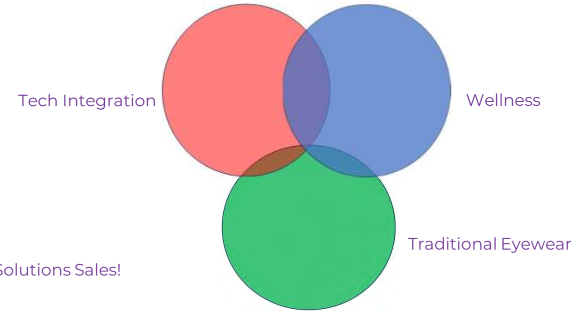
Why should we care?

20/20 Is Not Enough



Sports Solutions Sales!

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Name your Sports:

- Common Sports
  What sports are your patients participating in?
- Unique Sports
  What is the most bizarre sport you've been approached with?

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Becoming a SV Optician

Imagine:

Your JOB is to:

- Predict lighting in every venue
- Prepare players to maximize their vision at every game
- Keep a stock of extra contacts, ready to deploy
- Instruct players on lens changes during pauses
- Be a liaison with the SV Optometrist
- Ensure every players eyes are protected

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Pickleball

A fast-paced paddle sport combining elements of tennis, badminton, and table tennis.

Swimming

An aquatic sport involving propelling the body through water using coordinated movements

Ski Joring

A winter sport where a skier is pulled by a horse, dog, or motor vehicle.

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Challenges: 1) Speed

Speed in Visual Processing

Quick Decision Making

Speed in Movement

Most sports require speed.

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Challenges: 2) Safety

- **Vision Correction:** Ensuring athletes can see clearly during their sport activities
- **Eye Protection:** Safeguarding the eyes from potential injuries and impacts

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Challenges: 3) Conditions

Indoor/Outdoor

Wet/Dry

Wind

Debris

Color

Lighting Conditions

Humidity

Condensation

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Challenges: 4) Visual Range

Frame Selection Impact

Lens Design Choices

Combined Solutions

Visual range in eyewear is almost always limiting to the sport, but these limitations can be controlled through strategic choices in frames, lenses, and vision correction methods.

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1) Speed: Visual Acuity and Contrast Sensitivity

Visual Acuity and Contrast Sensitivity are needed to enhance visual processing.

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1) Speed: Visual Acuity in Sports

1. Exam Lane
   Perfect conditions, direct gaze, 100% contrast
2. Optician's Role
   Translate to lived conditions,
3. Sports Requirements
   Consider focal distance and motion
4. Right Lens
   Correct focal distance for athlete's needs

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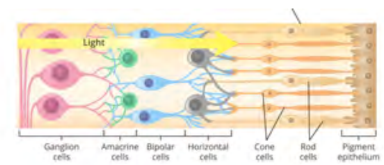
1) Speed: Contrast Sensitivity Basics

Definition of Contrast Sensitivity

Contrast Sensitivity is defined as the ability of the eye to differentiate between shades of grey or shades of color. Specifically, the ability to differentiate between brightness of the object and the background.

Where It Begins

It begins in the Retinal Ganglion Cells long before the image ever reaches the eye.



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1) Speed: Enhancing Contrast Sensitivity

Contrast Sensitivity in Athletes

Athletes have greater contrast sensitivity than non-athletes (see Dr. Mark Bullimore)

Using Colored Lenses

We can use colored lenses to make the most necessary colors appear more prominently

Key Elements for Opticians

Two elements opticians are concerned with:

- Light transmission
- Hue

Benefits of Enhanced Contrast

Enhanced contrast in the lens can increase speed as we simplify what the eye needs to do at the subcellular level

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1) Speed: Enhancing Contrast Sensitivity

Contrast Sensitivity:

- Decreases in low light (usually assessed with 30-70 lux)
- Decreases with both larger or smaller pupil
- Decreases with refractive error
- Decreases BEFORE ACUITY in many eye health conditions

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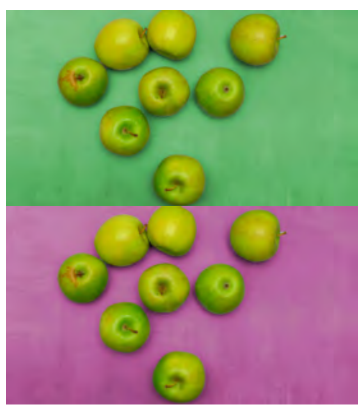
1)Speed: Contrast Senstivity, cont.

1 Light Absorption
Chromophores in the lens absorb light

2 Equal Absorption
Decreases light transmission, lens appears darker

3 Unequal Absorption
Across electromagnetic spectrum, lens appears tinted



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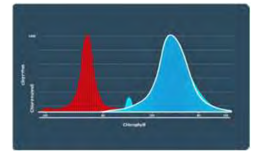
Example of Chromophore Absorption: Chlorophyll

Chlorophyll in Nature

Chlorophyll is the primary pigment responsible for the green color in plants, absorbing light for photosynthesis.



Absorption Spectrum

Chlorophyll absorbs light most efficiently in the blue and red regions of the visible spectrum.

Light Absorption Effects

The absorption properties of chlorophyll affect how we perceive plant colors under different lighting conditions.

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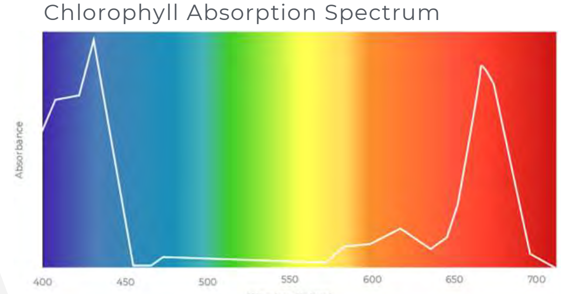
Reflected Light – Chromophore Absorption

Chlorophyll Absorption Spectrum



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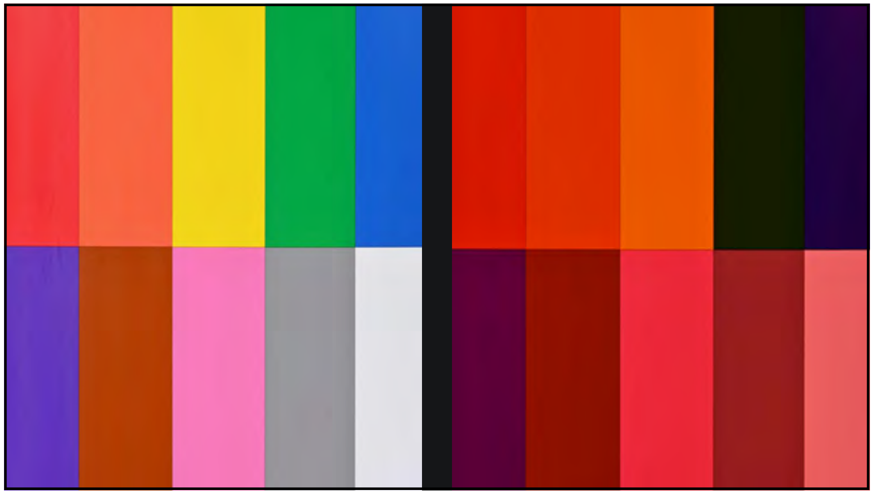

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2) Safety: Standards for Eyewear

Eyewear has multiple standards it must meet to be sold in the US.

Lenses and Frames have different standards.

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2) Safety: ANSI Standards

ANSI Standards

The American National Standards Institute sets recommended standards for **lenses**.

Good for Commerce

Standards are based on what is good for commerce

Manufacturing Capacity

Standards consider the capacity of manufacturers to produce lenses without undue spoilage

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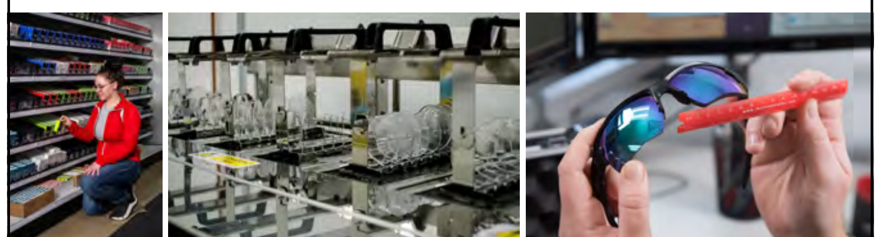
2) Safety: ANSI, Cont.



Laboratory Production

In the absence of requirements, laboratories consistently follow ANSI standards in lens production

Quality Validation

Opticians validate technical correctness using these same ANSI standards

Images courtesy of Cherry Optical

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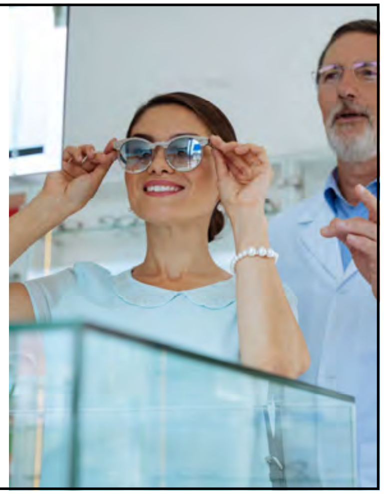
Many opticians believe that sport eyewear must adhere to Safety Eyewear standards set in Z87.1.

THIS IS NOT TRUE.



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Safety and the FDA: CFR 801.410

In the impact test, a 5/8-inch steel ball weighing approximately 0.56 ounce is dropped from a height of 50 inches upon the horizontal upper surface of the lens. The ball shall strike within a 5/8-inch diameter circle located at the geometric center of the lens. The ball may be guided but not restricted in its fall by being dropped through a tube extending to within approximately 4 inches of the lens. To pass the test, the lens must not fracture; for the purpose of this section, a lens will be considered to have fractured if it cracks through its entire thickness, including a laminar layer, if any, and across a complete diameter into two or more separate pieces, or if any lens material visible to the naked eyes becomes detached from the ocular surface.

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2) Safety: ASTM

ASTM INTERNATIONAL Standards Worldwide

ASTM

The American Society for Testing and Materials evaluates many industrial materials and develops voluntary safety standards.

F08

For Sport Safety, this is the F08 Division, responsible only for protecting the eye and the adnexa.

Standards are called Technical Standards and are available for purchase through the Vision Council

For example:

F3077-21 is the Standards Specification for Eye Protectors for Women's Lacrosse.

Indicators

Achieving ASTM standards is indicated by a hang tag or sticker on the frame and should be removed by the patient at dispense.

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2) Safety: ISO Standards

- International Organization for Standardization (ISO)

  While American Standards are often the gold standard for the world, certification by the ISO (CE for example) must be validated by that body.

- ISO Certification Requirements

  Many countries REQUIRE ISO standards be met.

- US Approach

  In the US we are guided by "Consensus Standards"

International Organization for Standardization ISO

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2)Safety: The Vision Council

- **ANSI Secretariat:** The Vision Council serves as the Secretariat for ANSI in Eyewear, playing a crucial role in setting and maintaining standards for eye protection.
- **Mike Vitale's Leadership:** Mike Vitale, Vice President of Membership, Government Relations & Technical Affairs, holds several key positions in safety standards organizations:
- **ASTM Co-Chair:** Co-Chair at ASTM for Sport Safety, contributing to the development of safety standards in sports eyewear.
- **ANSI Committee Chair:** Chair of the ANSI Committee for Eyewear, overseeing the creation and implementation of eyewear safety standards.
- **ISO Representative:** Technical Advisory Group Leader for ISO, where he represents ANSI, ensuring international alignment of safety standards.

THE VISION COUNCIL

3) Conditions and Environmental Factors

Indoor/Outdoor

Different lighting conditions and glare considerations

Wet/Dry

Moisture management and lens fogging prevention

Wind

Eye protection and lens stability in windy conditions

Debris

Shielding eyes from dust, dirt, and other particles

Color

Lens tints for optimal contrast and visibility

Lighting Conditions

Adapting to varying light levels and transitions

Humidity

Managing lens fogging and comfort in humid environments

Condensation

Preventing and addressing moisture buildup on lenses

Let's go back to our examples:

3) Conditions: Example: Pickleball

Indoor Pickleball

Can be played indoors, providing a controlled environment with consistent lighting and no weather interference.

Outdoor Pickleball

Usually dry conditions, but potentially some wind when played outdoors. Low debris and condensation risks.

Eye Protection

Some protection needed for players' eyes, especially when playing outdoors or in bright indoor lighting.

3) Conditions: Example: Swimming

Indoor Swimming Environment

Indoor swimming environments present unique challenges with controlled lighting and enclosed spaces affecting visual perception.

Outdoor Swimming Conditions

Outdoor swimming introduces challenges with sun glare, varying light conditions, and UV exposure requiring specialized lens solutions.

Lens Sealing Requirements

Proper lens sealing is crucial for underwater vision, preventing water infiltration and maintaining clear sight.

Humidity Control

The humid environment within swim goggles requires specialized anti-fog treatments to maintain visibility and comfort.

3) Conditions: Example: Ski Joring

Snow and Debris

Athletes encounter flying snow, ice, and debris, requiring specialized eye protection during high-speed activity.

Snow Glare Management

Intense reflection off snow surfaces creates significant glare challenges, requiring specific lens solutions for visibility.

Condensation Challenges

Temperature differences and physical exertion create lens fogging issues that must be actively managed for safety.

Dynamic Conditions

Athletes must adapt to rapidly changing weather and light conditions throughout their performance.

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4) Visual Range: Overview

135°

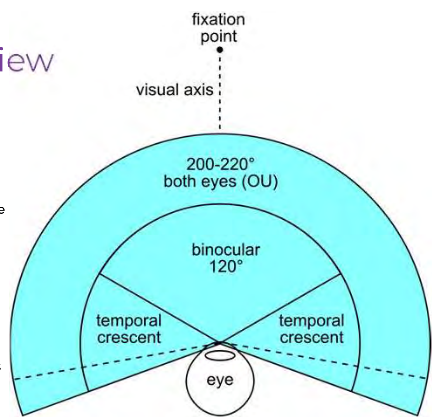
Per Eye Range

Typical horizontal visual range for a single eye

200°

Binocular Range

Total horizontal visual range using both eyes



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3) Visual Range, Cont.

Factors Limiting Visual Range: Eyewear, with the exception of contact lenses, limits that range. To what degree depends on:

- **Frame Fit:** The way the frame sits on the face can affect peripheral vision and overall visual range.
- **Lens Design:** Different lens designs can impact the field of view and visual clarity at various distances.
- **Prescription Strength:** The strength of the prescription can influence the extent of visual range limitation in eyewear.

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3) Visual Range, cont.

In order to maximize horizontal visual range, we need to be mindful of induced prism caused by wrapping ***even a plano*** lens. This concept was first discovered by Dr. Estelle Glancy in the 1920s at American Optical but not implemented regularly in wrap eyewear until the 1980s.

1. **1920s** – Dr. Estelle Glancy discovers induced prism concept at American Optical
2. **1920s-1970s** – Concept not regularly implemented in wrap eyewear leading to poorer quality or a tendency toward flatter frames.
3. **1980s** – Induced prism concept begins to be implemented in wrap eyewear
4. **Present Day** – Consideration of induced prism crucial for maximizing horizontal visual range

Photo Courtesy of the Optical Heritage Museum

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Formula for Induced Prism

Visual Range: Prism Compensations

Formula for Induced (Compensating) Prism in all lenses:

P = [tan Θ° (t / n) BC] / 10

Θ = Angle of Wrap Deviation
T = Thickness in mm
n = Index of Refraction
BC = Base Curve

1. Angle of Wrap Deviation (Θ)
   The angle at which the lens wraps around the face
2. Thickness (T)
   Measured in millimeters, affects the amount of prism
3. Index of Refraction (n)
   Optical property of the lens material
4. Base Curve (BC)
   The curvature of the front surface of the lens

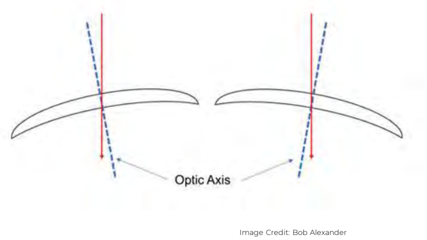

Image Credit: Bob Alexander

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Example: Induced Prism Calculation

Let's calculate the induced prism for a specific lens example:

1 — Initial Specifications

- Base Curve: 8.0 (plano poly lens)
- Wrap Angle: 15°
- Thickness: 2.0mm
- Refractive Index: 1.586

2 — Formula Application

P = [tan Θº (t / n) BC] / 10

Where:

- n = 1.586 (refractive index)
- t = 2.0 (thickness)
- θ = 15° (wrap angle)

3 — Where is the power?

Power is masked in this formula, Do you see it?

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Example: Prism Compensation

Poly — 8.0 Base Curve — 15°Wrap Angle — 2.0mm CT

P = [tan Θ⁰ (t / n) BC] / 10
Θ = Angle of Wrap Deviation
T= Thickness in mm
n= Index of Refraction
BC = Base Curve

Induced Prism = [tan(15) (2.0/1.586) (8.0)] / 10
Induced Prism = [(.268) (1.261) (8.0)]/10
Induced Prism = .27Δ

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Example: Prism Compensation

1. **Wrapped lenses induce Base Out Prism**
   The calculation shows the amount of prism induced by the wrap: .27D
2. **Compensation is necessary**
   To counteract the induced prism effect, ANSI tolerance for horizontal prism is .667 Total
3. **Compensation must equal that amount of Base IN Prism**
   To neutralize the Base Out Prism induced by the wrap

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4) Visual Range: Unwanted Astigmatism Caused by Wrapping

1. Wrapping a Lens
   Causes unwanted astigmatism
2. Affects Vision
   Not only in the periphery, but also in the central vision
3. Solution
   All prescription lenses should be digitally compensated, even if Rx is minimal
4. Result
   Produces the widest possible visual range

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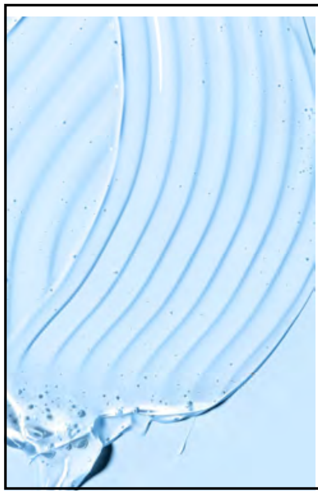

4) Visual Range: Correcting for Unwanted Astigmatism

Usually the position of wear is calculated in order of impact of the measurement:

1. Vertex
2. Pantoscopic Tilt
3. Wrap Angle

All of these are done in concert in the lens design calculator.

Wrap is significantly more important in a high-wrap frame. The same calculator is insufficient.

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Calculating Power in Wrap Frames

1. Martin's Tilt Formula for Wrapped Frames
   We use Martin's Tilt Formula to calculate the power of wrapping a frame.
2. Example Lens: -1.50,+1.50 @ 180
   Consider a lens with the prescription -1.50,+1.50 @ 180, wrapped 15°.
3. Vertical Meridian Power
   At the vertical meridian there is no power.
4. Horizontal Meridian Power
   At the horizontal meridian we have -1.50D of power.

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Calculating Unwanted Astigmatism

When calculating unwanted astigmatism in wrap lenses, we need to consider two key formulas: one for the new lens power and another for the induced cylinder.

1. New Lens Sphere Power Formula

   $$Ds = D\{1+[(\sin^2 \Theta° / 2n)]\}$$

   This formula calculates the compensated sphere power needed for wrapped lenses.

2. Induced Cylinder Formula

   $$Dc = Ds(\tan^2 \Theta°)$$

   This formula determines the cylinder power induced by the wrap, Dc.

3. Understanding Variables
   - Ds is the Induced Sphere Power
   - D is the Prescribed Power (or the power after other compensations have been performed) at the given meridian
   - Θ is the degrees of wrap
   - n is the Index of Refraction (in Diopters)

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Example: Astigmatism Calculation

Lens Specifications

Lens is a -1.50 at 180 and the material is Polycarbonate

Calculation Steps

1. Calculate Ds (Spherical Power)
2. Calculate C' (Induced Astigmatism)

Let's walk through the calculations for unwanted astigmatism in wrap lenses:

Calculating Ds (Spherical Power)

Ds = -1.50[1+sin2 15o / 2*1.586)]
Ds = -1.50[(1+(sin2 15o / 3.172)]
Ds = -1.50[1+(0.0669 / 3.172)]
Ds = -1.50[1 + (0669/3.172)]
Ds = -1.50(1 + .021)
Ds = -1.532

Calculating Induced Astigmatism

C' = Ds (tan 15°)^2
C' = -1.532 (.0669)
C' = -.10 Diopters of Cylinder

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5) Focal Distance and Accommodation

1 — **Amplitude of Accommodation**

The eye's remarkable ability to focus at different distances, like a camera lens adjusting its focus, enabling smooth transitions between near and far vision.

2 — **Age-Related Changes**

Over time, the lens becomes less elastic, similar to how muscles lose flexibility, impacting the speed and efficiency of focus adjustments between distances.

3 — **Daily Fluctuations**

Accommodation performance varies throughout the day, with decreased efficiency in morning and night hours, potentially affecting athletes' visual performance during training or competition.

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5) Focal Distance and Accommodation

Natural Visual Flexibility in Youth

Young athletes have a natural ability to accommodate, or adjust their focus, through various changes in focal distance. This flexibility allows them to maintain clear vision across different depths of field without the need for additional visual aids.

Age-Related Vision Changes

As we age, our eyes lose some of their natural ability to accommodate, a condition known as **presbyopia**. This means that older athletes often require specialized lenses to help them maintain clear vision at different focal distances during their sporting activities.

Solutions Through Sport-Specific Design

To address these challenges and enhance performance for senior athletes, we can consider designing sport-specific lenses. These lenses take into account the unique requirements of different sports and the visual needs of older athletes. By carefully considering the placement and focal distance of different areas within the lens, we may be able to speed up visual processing and improve overall performance.

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Example: Shooting Sports

Handgun

Frequently Indoors

Sight is at arms length

Range is usually beyond 20 ft, but not always.

Long-gun

May require viewing in a mounted sight

Always outdoors

Range always beyond 20 ft

Sometimes moving.

Eyewear is ALWAYS required

So we should make it as functional as possible!

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Example: Billiards

Varying Focal Distances

Players need clear vision at multiple distances, with the top of the lens optimized for viewing the entire table from 7-9 feet away. This enables accurate assessment of shot angles and ball positions.

Specialized Lens Design

Billiards lenses feature specific focal distances at the top for table viewing, while the lower portion is adjusted for closer examination of shots and ball placement.

Customized Solutions

Lens designs can be tailored to each player's height, playing style, and visual needs, ensuring optimal performance during gameplay.

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Example: Golf, Cycling, Fly Fishing

Golf

Focal Length: Addressing the ball, keeping score and spotting ball down-range all while being mindful of handed-ness.

Cycling

Focal Length: Cyclists need clear vision at various distances, from reading bike computers to looking at their gear rings to spotting road hazards far ahead.

Fly Fishing

Focal Length: Anglers require precise vision for tying flies, looking at their line and reel over their shoulders and spotting fish in the water.

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Designing Sports-Specific Lenses

Let's explore the key factors in creating optimal sports eyewear:

- **Speed:** Visual acuity and contrast sensitivity are crucial for fast-paced sports. Athletes need lenses that enhance their ability to track moving objects and react quickly to changing situations.
- **Environmental Conditions:** Sports are played in diverse environments, from bright outdoor sunlight to indoor artificial lighting. Lenses must adapt to these varying conditions while maintaining optimal visibility.
- **Safety:** Protective features are paramount in sports eyewear design. Each lens must meet rigorous safety standards while providing clear, unobstructed vision for the athlete.
- **Visual Range:** Different sports require varying fields of vision and focal distances. Lenses must be designed to accommodate these specific visual requirements for optimal performance.
- **Focal Distance:** Considerations must be made for the varying focal distances required in different sports.

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Accessing Lens Products

Talk to Product Companies

Ask product companies which labs they do business with to gain access to their lens products.

Consult with Labs

Speak directly to labs about which products you can access through them.

Facilitate Introductions

Make introductions from sport lens companies to your favorite lab to expand your product access.

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Special Considerations in Sports Vision

Height and Focal Length

The height of the athlete determines much of their focal length needs if the ground is involved.

Poker Player Eyewear

Poker Players need their eyewear to NOT reflect the color or count of the cards they are looking at.

Narrowing Visual Field

In cases where the visual field needs to be narrowed, frosting or lenticularization could be used.

WELLNESS and Color

WELLNESS and Color – It's coming!

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Your feedback is taken very seriously. Please evaluate this session.

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Reach out at

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