KISS 2025
A Balanced View

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Two ways to look

Many who think about vision seem inclined to two major perspectives:

1) Vision is one of a number of sensory inputs from the environment. In the case of vision, the sensory input is delivered primarily through light striking the retina which is then transmitted through various neural pathways to form some sort of image in the brain corresponding to the environment in which the organism finds itself.
2) Vision is a neuro-motor process where selected bands of radiant energy are captured and used to direct the actions of the organism in question.

Both perspectives hold some truth, but neither perspective fully describes Vision as an emergent—the term Skeffington used to describe Vision.

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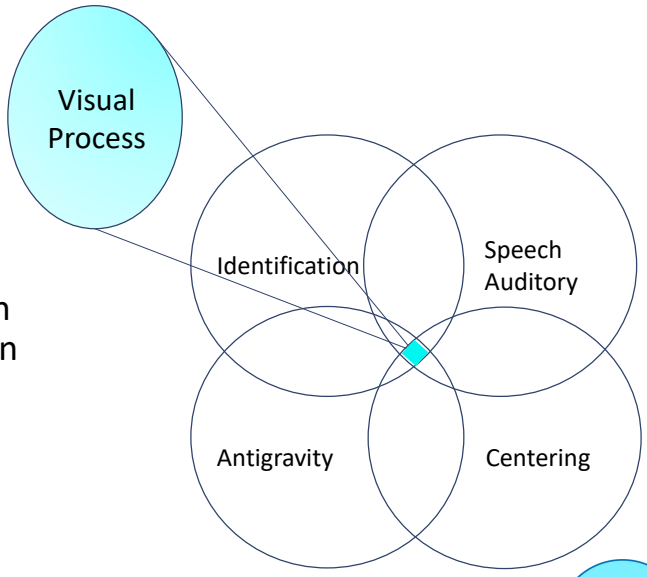
Emergent Vision

Our construction of the world with our ability to act within it and upon it is emergent vision.



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Going 'round in Circles

- Many of us have heard presentations about Skeffington's four circles.
- There have been those who said that there should be more circles.
- Some have said the circles should be spheres.
- There have been attempts to make one circle or another the direct equivalent of a measurable biological aspect of the visual process.
- But Identification ≠ Accommodation
  Centering ≠ Convergence
- Each of the four circles is itself an emergent which interacts to produce the emergent visual process

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Going 'round in Circles

- Our well-rounded discussions of the circles have been useful in some ways, but for the most part, we have ended up chasing our intellectual tails.
- It is a spirited pursuit, but we don't get very far.
- Few optometrists or visual scientists have said much about Emergent Vision.

https://papercards.com/get-well-greeting-cards/cd20132-dog-doctor-writing-prescription-stop-chasing-your-tail-get-well-card/

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Active Vision

- More than one third of the human brain is devoted to the processes of seeing —
- We have the subjective impression of an immediate, full detail, pictorial view of the world. We are prone to forget that the impression is, in a very real sense an illusion."

Findlay, J. M., & Gilchrist, I. D. (2003). *Active vision: The psychology of looking and seeing.* Oxford University Press. https://doi.org/10.1093/acprof:oso/9780198524793.001.0001

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Active Vision

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- We have the subjective impression of an immediate, full detail, pictorial view of the world. We are prone to forget that the impression is, in a very real sense ~~an illusion.~~ a construction.
- The idea of construction is especially important because emergent vision is the result of an active continuous interactive process.

Findlay, J. M., & Gilchrist, I. D. (2003). *Active vision: The psychology of looking and seeing.* Oxford University Press. https://doi.org/10.1093/acprof:oso/9780198524793.001.0001

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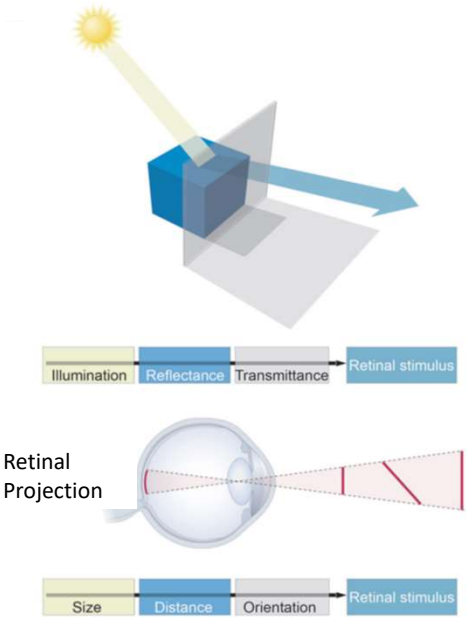
Perception and Reality

- …retinal images conflate the physical properties of objects, and therefore cannot be used to recover the objective properties of the world.
- Consequently, the basic visual qualities we perceive—e.g., lightness, color, form, distance, depth and motion—cannot specify reality.



Purves et al. Perception and Reality November 2015 Volume 9 Article 156

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Constructed Vision

- We “see” the world around us clearly and in vivid color even though we know the resolution of our eyes drops quickly away from the fovea and there are relatively few cones in the peripheral retina.
- We also “see” the world as a continuous reality extending all around ourselves—We are not surprised to see the world behind us is also clear and in color as we turn ourselves to look.
- We “see” ourselves as existing within a continuous dimensional universe.

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The Core Philosophy

“…if we are to use the word behavioral as an adjective to describe a particular aspect of our professional activities then we must certainly look more carefully at the resulting actions of the individual than we do at the specifications of the contributing parts.

If we are to continue to speak of vision as an emergent out of all the information processing systems, which influence it, the emerging behavior will be more important than the details of the mechanism. It is thus that the total is so much more than the sum of its parts, or the actions of *each* part.”

G. N. Getman, O.D. Transcript from the 33rd Annual Invitational Skeffington Symposium on Vision 1988

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The Core Philosophy

"…we must [also] realize that there can be no behavior to observe if the parts are not making the contribution each is designed and coded to make.

It is impossible to attend only to behavior without a degree of attention to its origins."

We must ask, why this particular behavior or syndrome came to be and what advantage does the result confer on the organism?

G. N. Getman, O.D. Transcript from the 33rd Annual Invitational Skeffington Symposium on Vision 1988

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Emergent

- The fundamental reason for having vision is that a person can get meaning out of the world that he must inhabit.
- …the visual process is a part of the organism, part of its total biochemical and biophysical make-up.

AM Skeffington FUNCTIONAL OPTOMETRIC PHILOSOPHY https://www.reinventingoptometry.com/

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Emergent

- Vision as an emergent applies to any level being considered.
- It is important to take into consideration the various strata of derivatives being utilized at any moment.
- Basically, vision, as a meaningful activity, is of necessity, a derivative of derivatives, each leading to a higher level.

Skeffington, A.M., Optometry & Visual Performance 21 Volume 8 | Issue 1 | 2020, March

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Emergent

- By level we can consider the emergent interaction at the biophysical level including neural transmission, humoral chemistry, and anatomy.
- We can consider any of the four circles, each itself deriving from complex interactions of the whole organism within its environment.
- Ultimately, we can consider the visual process itself expressed as emergent behavior.

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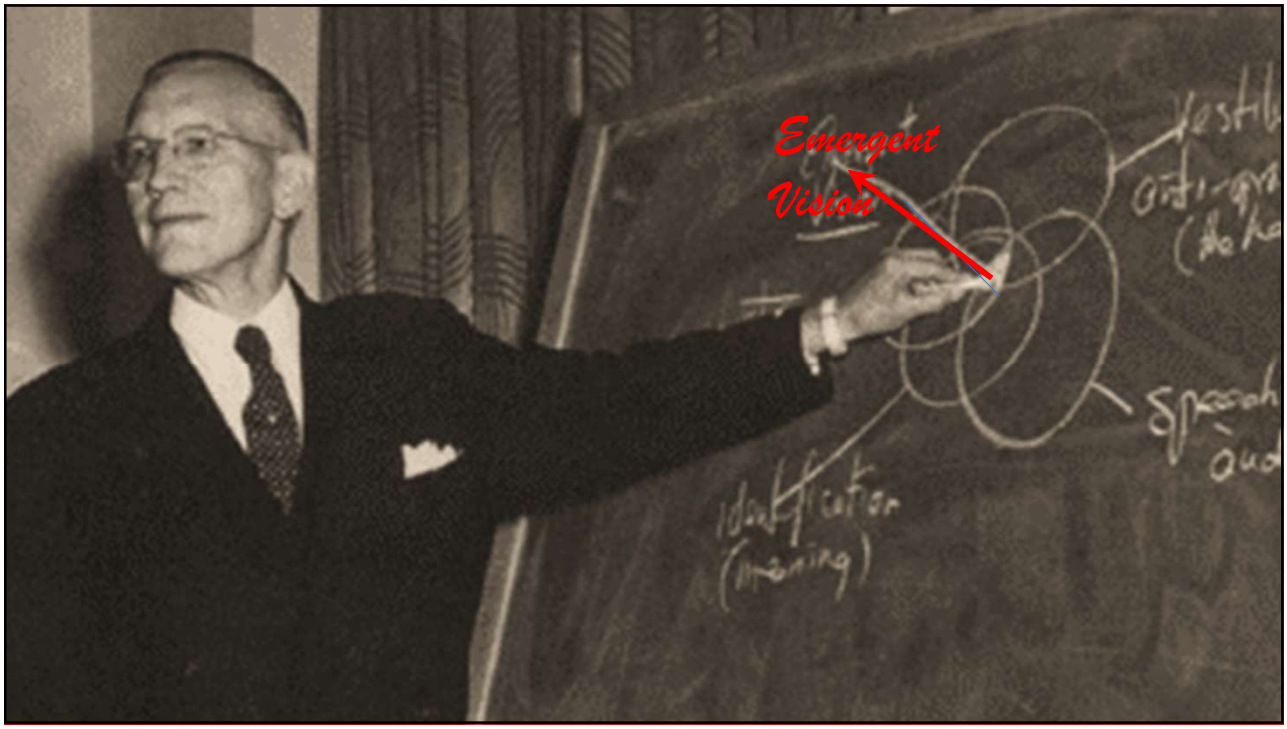

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What is an Emergent?

- Emergence is a fundamental property of complex systems and can be thought of as new properties or behaviors, which appear due to interactions within the system.
- Emergence occurs when a complex entity has properties or behaviors that its parts do not have on their own, and that emerge only when the constituent properties or behaviors interact to form a wider whole.
- An emergent property of a system is one that is not a property of any single component of the system but is a feature of the system only when considered as a whole.

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For Instance,

Na is a soft silvery-white metal that is unstable in its elemental form.

Cl_2 is a noxious yellow green gas and is a strong oxidizing agent.

If elemental Sodium (Na) and elemental Chlorine (Cl_2) are present in the proper concentration, they will readily combine in such a way that common table salt, NaCl, emerges from the reaction.

An unstable soft silvery metal and a corrosive green gas interact and a relatively stable white crystalline solid emerges from that interaction.

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Coming to Balance

- One of the key characteristics of emergence is balance or symmetry.
- In the case of NaCl, there will always be some elemental Na and some elemental Cl_2 that exist alongside the more stable NaCl depending on the environment.
- It can be said that the chemistry of the emergent NaCl comes to a dynamic energetic balance with the environment in which it finds itself.

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Reciprocity

- An emergent is naturally in dynamic balance or symmetry in the environment.
- This means there is a continual pattern of interactive dynamics that creates and maintains the emergent.
- In order to maintain equilibrium within the environment, the dynamics of the emergent interaction must be reciprocal in nature.
- Elements of the interaction may be, and often are, discontinuous, or non-linear, but the total interaction, and thus the emergent, remains in balance with the environment.

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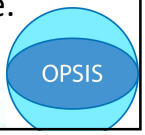
Predictability and Emergence

- There are properties that are additive (or subtractive) and so may be at least approximately predictive:
- If there is less of either Na or Cl_2, there will be less NaCl.
- The mass of the emergent NaCl will be essentially equivalent to the sum of the original combined masses of the Na and Cl_2 that interact to form the NaCL.
- There are new emergent properties that result from the interaction and are not predictable based on an understanding of the Na and Cl_2.
- There is no way to predict the salty nature of NaCl based on one's knowledge of either Na or Cl_2, no mater how extensive that knowledge.



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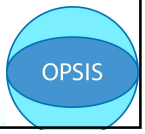
What elements do we consider?

- In the example of NaCl, we could consider not only the constituent chemicals, but the proximity of the elements, the temperature, pressure, and the relative nature of the environment. e.g.,
  - Above 801 degrees C, the NaCl melts and the resultant emergent changes as well.
  - When in water, the nature of the interaction between the Na and CL is changed and the emergent is different.
- In each case, the change in interaction produces a different emergent with different qualities—still the same elements and still in balance with the environment, but qualitatively different in character.



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Creation

- What emerges from the interaction is not predictable and is created by the interaction between the elements within their environment.
- If one learns about the nature of the emergent, one might predict similar results in similar circumstances, e.g., KCl,or NaI, but that is due to learning about the nature of the emergents of similar interactions.
- Emergence is not the sum of separate elements but is a new creation.

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So Far

1. Knowledge of the individual interacting elements may be profitable but cannot predict the nature of the emergent.
   Without the interacting elements, the interaction stops.
2. Emergence is the product of a continuous interaction between elements and the environment.
   Without interaction, there is no emergent.
3. The environment is an important element of the emergent.
4. An emergent maintains a balance or symmetry with the environment in which the interaction takes place.

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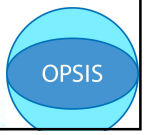
So What?

- Our clinical knowledge and approaches seem to be heavily directed towards anatomical and reductionist understandings, hoping that somehow, we can intellectually reconstruct the emergent by assembling the parts.
- Taking apart a clock does not tell us much about the nature of time.
- One of the key principles of emergence is that the emergent is not a product of the constituent parts, but is a new creation based on the dynamics between the elements that interact.



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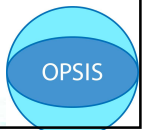
So What About Myopia?

- Current clinical approaches to myopia seem dedicated to poorly understood biology, equally flawed understandings of optics, as well as misinterpretations of visual behavior.
- Myopia tends to be treated from a disease model and the primary understanding is tied heavily to optical clarity at distance.
- At one point there was, and probably still is, a strong dependence on a relatively fatalistic dependence on genetics. If one has the right(?) genes, the eye will grow to be too long and so become short sighted.



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So What About Myopia?

- Missing from most descriptions of the cause of myopia is why the process takes place.
- Few ask how the development of myopia is of benefit to the person.
- What problem(s?) could myopia solve?
- If myopia is based on providing clarity at distance, why does myopia continue to develop once clarity at distance has been restored?

Photo from https://www.acbo.org.au/for-patients/about-vision/105-what-is-myopia

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So What About Myopia?

- The primary techniques employed to combat myopia involve using medication, the use of mechanical means such as ortho-K contact lenses, or unusual spectacle designs directed to aimed at providing a degree of in-focus light in the mid periphery of the retina.
- There is little thought that myopia is not a disease at all, but that myopia naturally emerges as an individual comes to the best possible balance of energy and results with their near environment.
- Myopia is a personal process, and while it may be argued that the particular environment is not natural, it is the environment within which the person is living.

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The Influence of Big Business

- Part of the environment is corporate economics.
- There is a larger population and a better understood visual health risk.
- Produces a larger market for products.
- Market forces drive the development of new products, but not necessarily optimal results or a better understanding of the complex processes involved in the development of the refractive change.
- Even more sophisticated approaches tend to focus more on how the visual mechanics are used than the visual process within which the mechanics are used in the way they are.

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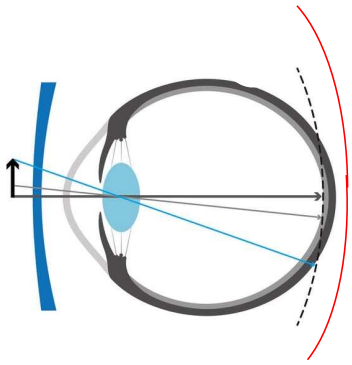
Where is the image on the retina?



- We tend to think of the eye producing an exact focus on the retina, even though we know this is not exactly so.
- It is common to see a 0.50 to 1.00 diopter lag of accommodation when a healthy person is doing near work.
- When the lag increases to 1.50 diopters or greater, it is commonly accompanied by asthenopia and/or reduced performance.

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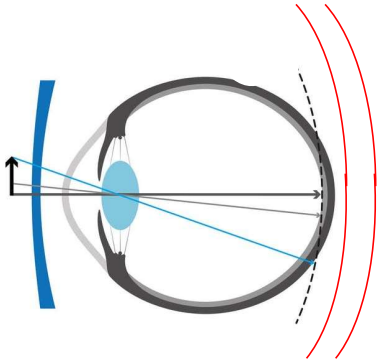
Where is the image?



- We believe that sustained/restrained performance that produces an increased lag for a prolonged period is a principal stimulus for the development of myopic refractive changes.
- Nearpoint fatigue produces a “hyperopic” refractive shift sufficient to trigger eyeball growth and increased axial length relieving the demand for near focus, but at the cost of distance clarity.

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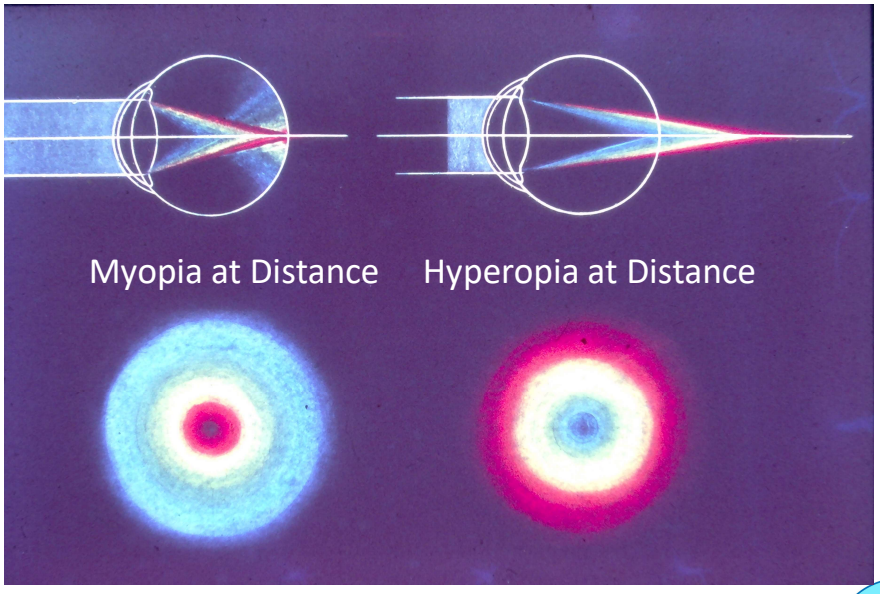
Optical Distribution of Myopia and Hyperopia



Picture courtesy DB Harmon

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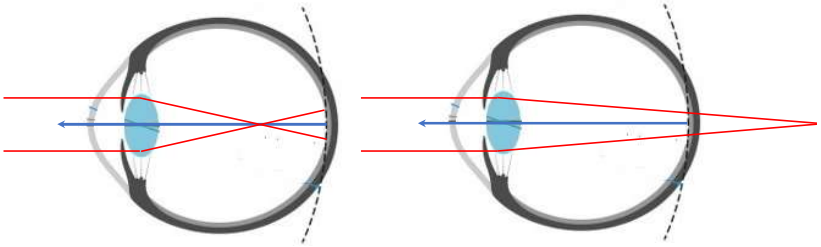
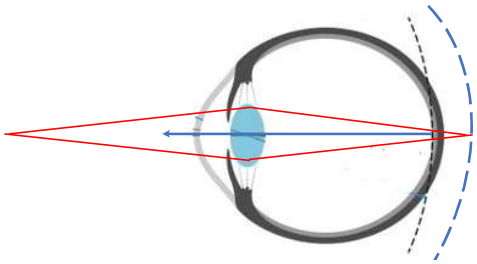
Optical Distribution of Myopia and Hyperopia



Myopia at Distance Hyperopia at Distance



Myopia is Emmetropia at Near

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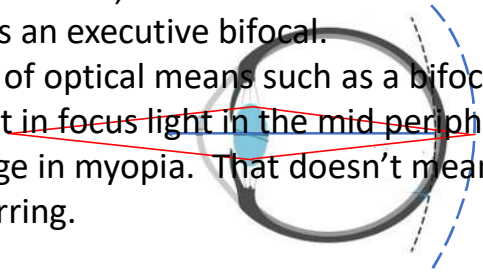
1. Although myopic eyes are longer, it is clear that longer eyes do not cause myopia.
2. Very few people become myopic before extended near work is an issue.
3. The major efforts at slowing the increase in myopia only rarely stop the process, but merely delay it.
4. Based on modern research, one of the most effective prescriptive tools in slowing myopia is an executive bifocal.
5. The thoughtful use of optical means such as a bifocal soft contact lens to provide sufficient in focus light in the mid periphery, will slow or stop the refractive change in myopia. That doesn't mean that near point distress is not occurring.



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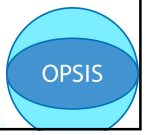
Question:

- When considering vision as an emergent, the entity is greater than the sum of its parts, or the sum of the actions of any part or parts.
- We also realize that each part and the interactions between the parts are the source of the emergent we see expressed; first as behavior and then as structure shaped by the balance between behavior and environment.

1. How do we, as careful clinicians and scientists, find an appropriate balance between the dual understandings of the visual process? For example, retinal defocus and axial length change in myopia compared with behavioral understandings that tell us why a complex process of change is triggered as a means of coming to the best balance available in the existing environment.
2. What is the clinical significance of that balanced understanding?



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