Reliable data was obtained from people in four different age groups. Those less than 20 years of age, those between 20 and 40 years of age, those between 40 and 60 years of age, and those over 60 years of age. These pupil measurements were made on test subjects at three different luminance levels, 250, 50 and 2.5 candellas per square meter (cd/m^2).

The 250 cd/m^2 level corresponds to extremely bright illumination typically outdoors in bright sunlight. The 50 cd/m^2 is a mixed level which is found in both indoors and outdoors. Finally, the 2.5 cd/m^2 level is most typically found outdoors at night, usually in an uneven illumination situation such as night driving.

The results of these studies are given in the following Table I, which includes in addition to the average pupil diameter at three different illumination levels, the standard deviation in the diameter and the range associated therewith.

TABLE I

HORIZONTAL PUPIL SIZE

Illumination (candellas/m^2)	Average Pupil Diameter (mm)	Standard Deviation (1Σ)
LESS THAN 20 YEARS OF AGE		
2.5	6.5962	0.9450
50	4.3499	0.5504
250	3.4414	0.3159
20 to 40 YEARS OF AGE		
2.5	6.4486	0.8259
50	4.4843	0.6342
250	3.5040	0.4217
40 to 60 YEARS OF AGE		
2.5	5.4481	0.9787
50	3.6512	0.5692
250	3.0368	0.4304
GREATER THAN 60 YEARS OF AGE		
2.5	4.7724	0.6675
50	3.4501	0.5106
250	2.8260	0.3435

Taken in combination with this data are the determinations that have been made regarding real world human activity typically encountered under different illumination levels. At very high illumination levels, such as that represented by 250 cd/m^2, human activity is typically taking place outdoors in bright sunlight and requires distant vision tasks.

At a 50 cd/m^2 illumination level, activity usually occurs both indoors and out, and typical human activity is represented by both near and far visual tasks.

Finally, at low illumination levels represented by the 2.5 cm/m^2, the activity that takes place is typically outdoors at night and usually involves distant vision tasks, such as driving an automobile.

The corrective powers as a function of the distance from the center of the lens must be a function of the patient's specifically measured pupil diameter at varying illumination levels, or it can be readily determined from the above information based upon the age of the patient.

Moreover, ocular in vivo image quality measurement devices can be used to optimize the ocular image quality in the concentric annular ring designs to produce even more

improved designs. This is accomplished by using an in vivo image quality measurement device, such as an aberroscope or MTF point spread measuring device, to measure and decrease the sum of the aberrations of the combination of the lens and the eye system.

Obviously, many different embodiments of the present invention are possible, with alterations of the number of annular rings, the widths and arrangement of the annular rings, and the optical powers assigned to each of the annular rings.

While several embodiments and variations of the present invention for multifocal lens designs with intermediate powers are described in detail herein, it should be apparent that the disclosure and teachings of the present invention will suggest many alternative designs to those skilled in the art.

What is claimed is:

1. A multifocus, concentric annular ring lens, comprising:

a. said lens having a front surface and an opposite back surface, wherein one of the front and back surfaces defines a central area comprising a circular disc having a spherical surface corresponding to a basic prescriptive spherical distance optical power;

b. a plurality of annular rings surrounding the central area and having alternating spherical near optical powers and spherical distance optical powers;

c. at least one intermediate optical power annular ring, located in the outer region of the lens optic zone, having an intermediate optical power, intermediate to the distance optical power and the near optical power, to provide visual acuity at intermediate distances; and

d. the widths of individual annular rings are different to generate a power profile which varies to generate different ratios of distance optical power to intermediate and near optical power with increasing distance from the center of the lens.

2. A multifocus, concentric annular ring lens as claimed in claim **1**, wherein the intermediate optical power annular ring is the second annular ring from the outer edge of the lens optic zone.

3. A multifocus, concentric annular ring lens as claimed in claim **1**, wherein the intermediate optical power annular ring is the outermost annular ring which defines the outer circumference of the lens optic zone.

4. A multifocus, concentric annular ring lens as claimed in claim **1**, wherein the lens comprises a contact lens to be worn on the cornea of the eye.

5. A multifocus, concentric annular ring lens as claimed in claim **4**, wherein the contact lens comprises a soft hydrogel contact lens.

6. A multifocus, concentric annular ring lens as claimed in claim **1**, wherein the lens comprises an intraocular lens.

7. A multifocus, concentric annular ring lens as claimed in claim **1**, wherein the central area and the plurality of annular rings are formed on the rear surface of the lens to minimize flare and glare problems.

8. A multifocus, concentric annular ring lens as claimed in claim **1**, wherein the ratio of distance optical power to intermediate and near optical power increases with increasing distance from the center of the lens.

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