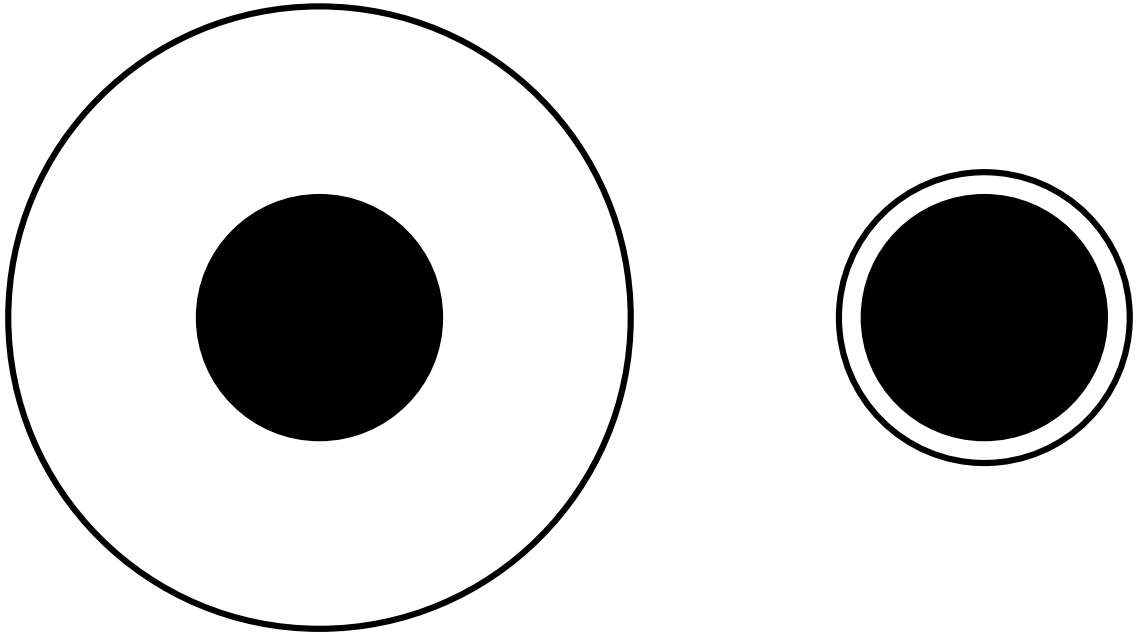
Delboeuf Illusion

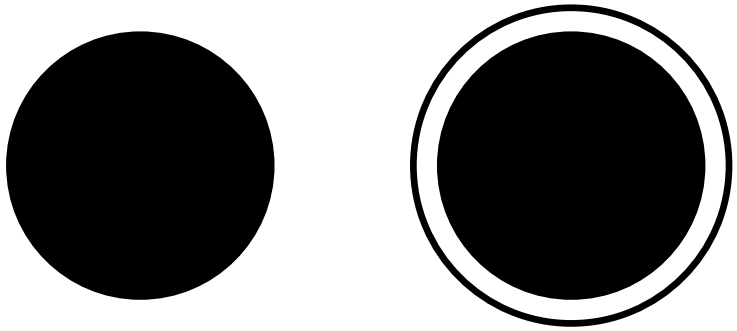


Assignment 1

DE 701: Visual Ergonomics and Human Perception

Dishant Mehlawat - 216450010

Delboeuf Illusion



The Delboeuf illusion is an optical illusion of relative size perception

The illusion was named for the Belgian philosopher, mathematician, experimental psychologist, hypnotist, and psychophysicist **Joseph Remi Leopold Delboeuf** (1831–1896), who created it in 1865.

According ti Delboeuf Illusion when two discs of identical size have been placed near to each other and one is surrounded by a ring; the surrounded disc appears larger as compared to the non-surrounded disc.

As the ring and the inner circle are too close, they are perceived as a pair and the inner circle is overestimated.

According to researchers the Delboeuf illusion uses both **assimilation and contrast** as elements in its perception distortion.

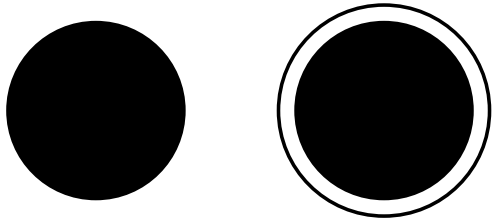


Fig 1a

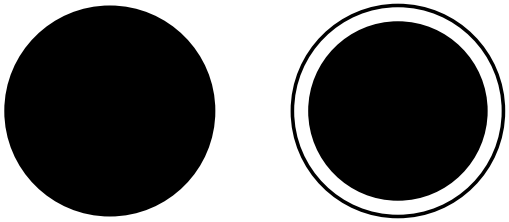


Fig 1b

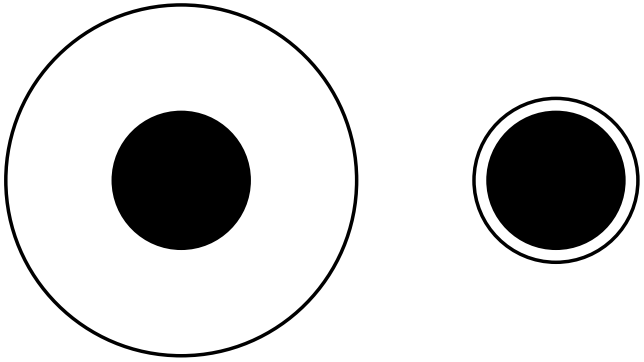


Fig 1c

Factors responsible for Delboeuf Illusion

Assimilation is the predominant factor in the disc with the outer ring (example on the right in fig 1a). The inner disc “tends to be overestimated” when compared to a regular disc without the additional concentric circle. As the two circles are so close, they are perceived as a pair and the inner circle is overestimated.

The circle on the right(fig 1b) however, will often appear smaller when compared to a simple circle of the same size. This is attributed to the **contrast effect**.

The distance between the circles causes them to be perceived as separate and contrasting. As shown in Fig 1c the larger-circumference ring dwarfs the smaller central disc and causes it to be perceived as smaller. The two discs are of the same size but, the proximity of the rings with the discs creates an overestimation or underestimation of the discs. The larger outer ring on the left disc increases the magnitude of Delboeuf Illusion as the disc with the closer ring is perceived even larger.

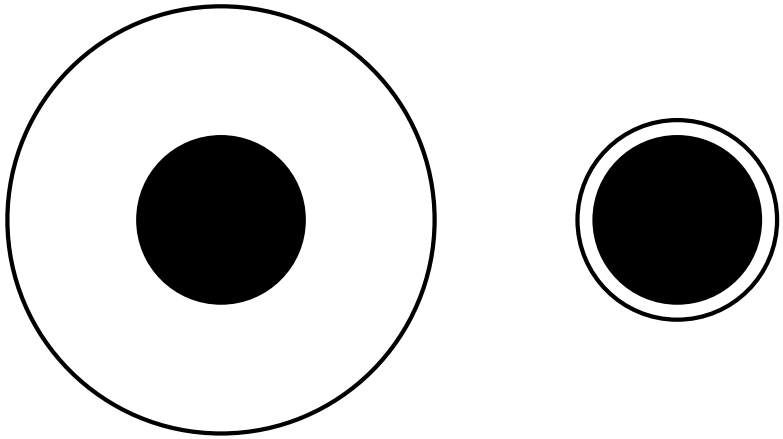


Fig 1.1

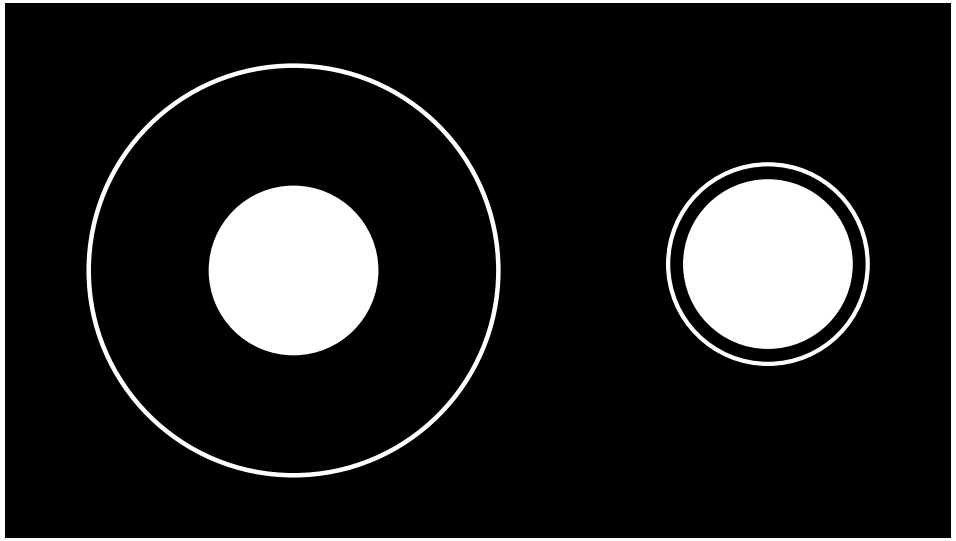


Fig 1.2

In fig 1.1 two discs of identical size have been placed near to each other and one is surrounded by a rings; the one surrounded by a larger disc appears smaller than the one surrounded by a smaller disc.

Even after inverting the contrast in fig 1.2 and changing colours in fig 1.3 the Delboeuf illusion occurs and the one surrounded by a larger disc appears smaller than the one surrounded by a smaller disc.

Explorations with Latin Alphabets

Fig 1.4

Fig 1.5

Fig 1.6

In fig 1.4 two lower case ‘a’ are placed next to each other. One on the right is edited and only the stem is made bolder. But, the counter of both the a’s look similar and delboeuf illusion cannot be observed.

Similarly in fig 1.5 two lower case ‘a’ are placed next to each other. One on the right is edited and the stem and terminal is made bolder. The counter of the ’a’ on the right looks smaller because of the delbouef illusion.

In fig 1.6 all the glyphs of the ‘a’ on right hand side is made bolder and the counter looks smaller.

Increasing the boldness of the strokes cause an underestimation of the counters in Latin alphabets given that the stroke width increases without effecting the counter size.

Fig 1.7

In fig 1.7 two lower case ‘d’ are placed next to each other. One on the right is edited and only the stem is made bolder. But, the counter of both the a’s look similar and delboeuf illusion cannot be observed.

Fig 1.8

Similarly in fig 1.8 two lower case ‘d’ are placed next to each other. One on the right is edited and the stem and bowl are made bolder. The counter of the ’a’ on the right looks smaller because of the delbouef illusion.

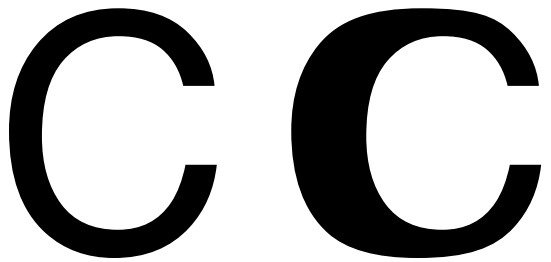


Fig 1.9

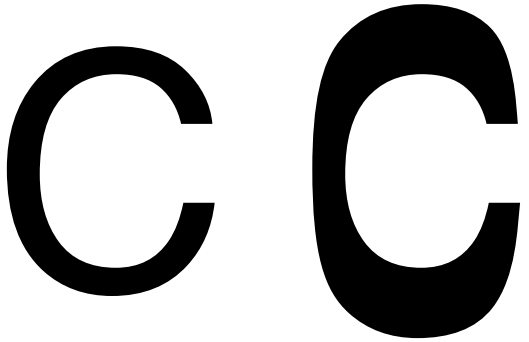


Fig 2

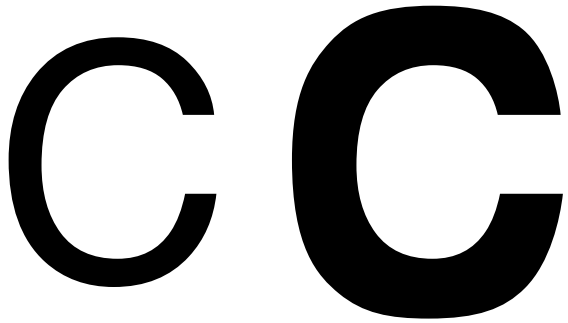


Fig 2.1

In fig 1.9 two upper case ‘c’ are placed next to each other. One on the right is edited and only the stem is made bolder. The aperture of the ‘c’ on the right side looks smaller because of the delbouef illusion.

Similarly in fig 2 two upper case ‘c’ are placed next to each other. One on the right is edited and only the shoulder is made bolder. The aperture of the ’c’ on the right looks smaller because of the delbouef illusion.

In fig 2.1 all the glyphs of the ‘c’ on right hand side is made bolder and the aperture looks smaller. The open aperture of the alphabet ‘c’ does not form a complete closed figure but, still delbouef illusion works well in all the three explorations.

Increasing the boldness of the strokes cause an underestimation of the aperture in Latin alphabets given that the stroke width increases without effecting the aperture size..

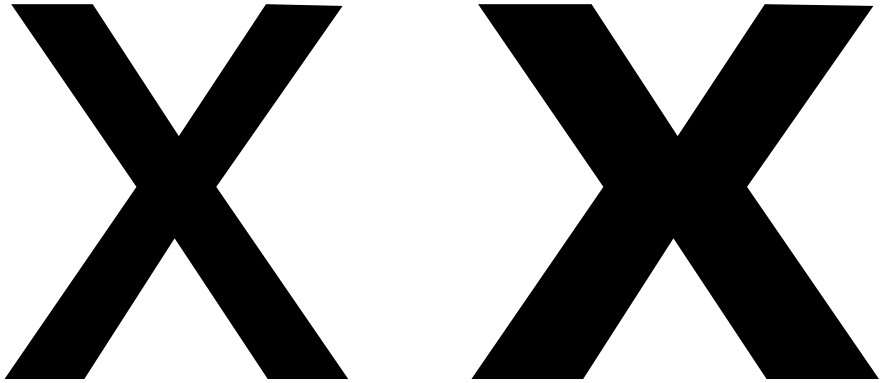


Fig 2.2a

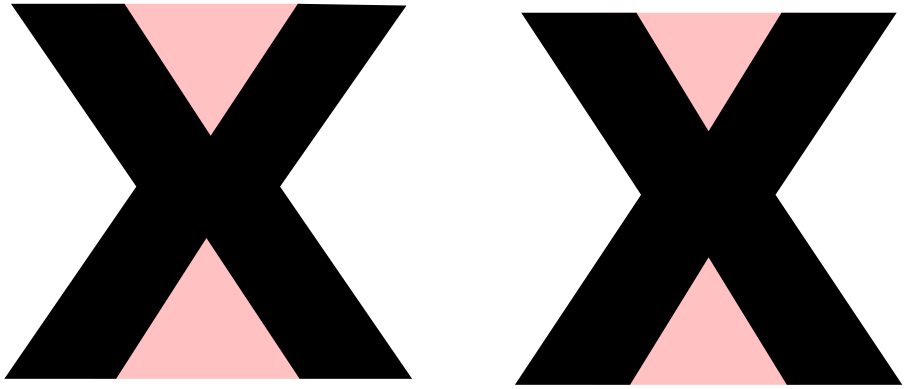


Fig 2.2b

In fig 2.2a two lower case ‘x’ are placed next to each other. One on the right is edited and only the strokes is made bolder horizontally. The area enclosed by the top and bottom apertures of the ‘x’ on right hand side looks smaller.

Increasing the boldness of the strokes cause an underestimation of the apertures in open aperture Latin alphabets given that the stroke width increases without effecting the aperture size.

In fig 2.2b two lower case ‘x’ are placed next to each other. The ‘x’ on the left has it’s stroke width increased horizontally which cause an underestimation of the area however type designers make the entire glyph bolder (as shown in the ‘x’ on right side). The area enclosed by the two ‘x’ is very different.

Fig 2.3

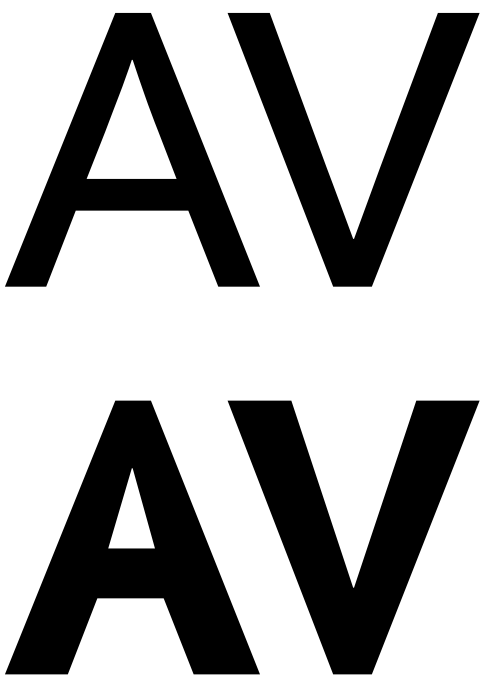


Fig 2.4

In fig 2.3 the words ‘AVATAR’ placed next to each other. One on the bottom is edited and only the strokes is made bolder. As the stroke thickness of the word is increased, the kerning between the letter looks reduced.

In fig 2.4 the space between the alphabets ‘A’ and ‘V’ is reduced as the stroke thickness of the alphabets is increased. Therefor typographers and font designers increase kerning between bold alphabets as the contrast effect plays a major role here.

Explorations with Devanagari Characters

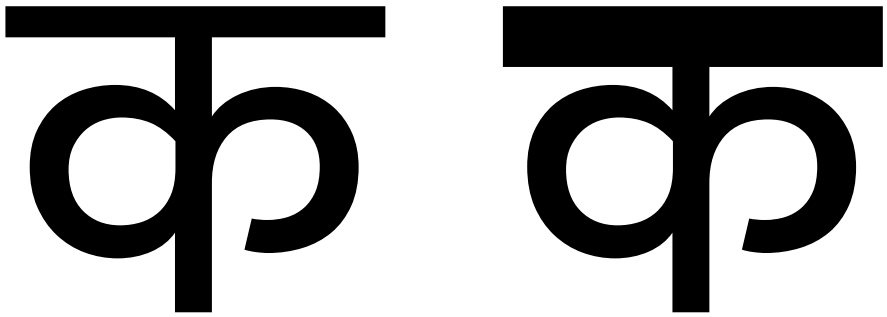


Fig 2.5a

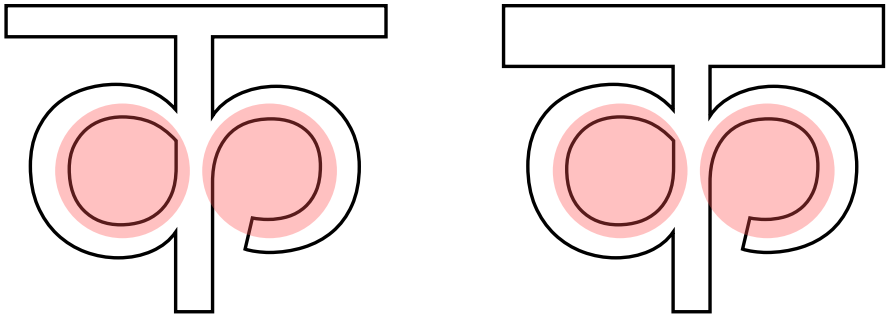


Fig 2.5b

In fig 2.5a two 'क' are placed next to each other. One on the right is edited and only the sherorekha is made bolder. But, the counter and aperture of both the 'क' look similar and delboeuf illusion cannot be observed.

Only increasing the boldness of the sherorekha does not have any affect on the adjacent counter and aperture(the red high-lighted area show that the counter and aperture look similar).

In fig 2.5b two outlined 'क' are placed next to each other. The highlighted area shows that the aperture and counter are not affected by the change in the boldness of the sherorekha.

Only increasing the boldness of the sherorekha does not have any significant affect on the adjacent counter and aperture(the red highlighted area show that the counter and aperture look similar).

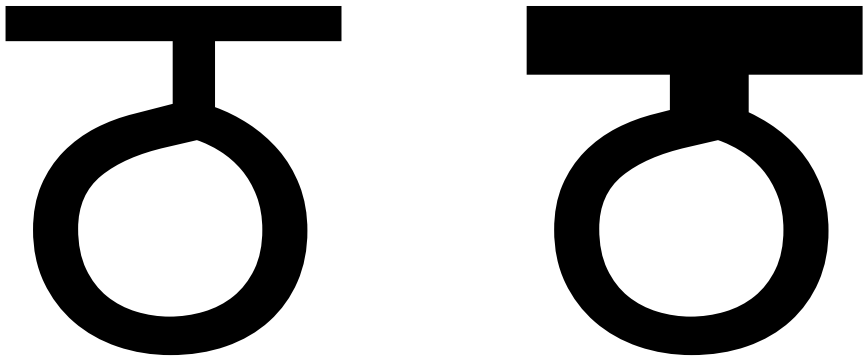


Fig 2.6a

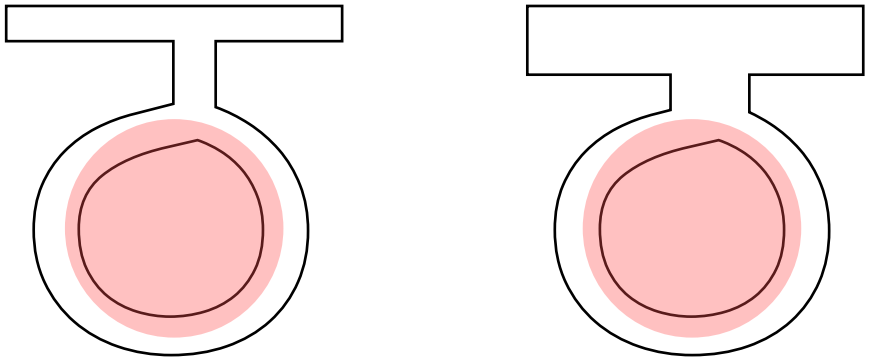


Fig 2.6b

Similarly in fig 2.6a two ‘ठ’ are placed next to each other. One on the right is edited. The sherorekha and the connecting stem are made bolder. The counter of the ‘ठ’ on the right looks similar and delboeuf illusion cannot be observed.
v

In fig 2.6b two outlined ‘ठ’ are placed next to each other. The highlighted area shows that the counter is not affected by the change in the boldness of the sherorekha or the connecting stem.

Only increasing the boldness of the sherorekha does not have any significant affect on the adjacent counter (the red highlighted area show that the counters look similar).

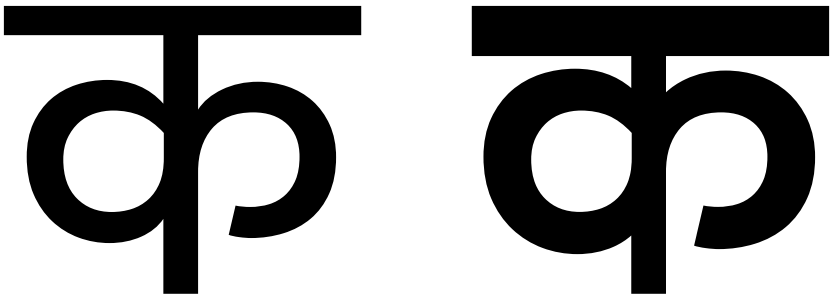


Fig 2.7a

In fig 2.7a two ‘क’ are placed next to each other. One on the right is edited and the sherorekha and the stroke width is increased. The counter and aperture of the ‘क’ on the right looks smaller because of the delbouef illusion.

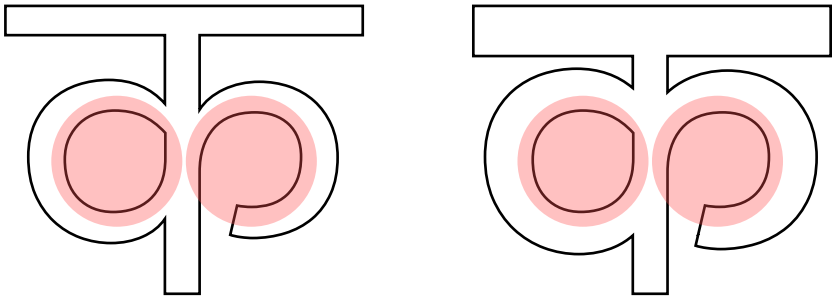


Fig 2.7b

In fig 2.7b two outlined ‘क’ are placed next to each other. One on the right is edited and the sherorekha and the stroke width is increased. The highlighted area shows the counter and aperture of the ‘क’ on the right looks smaller because of the delbouef illusion however, they are similar in size.

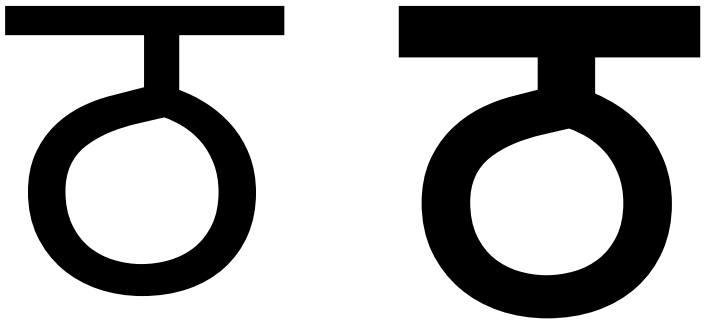


Fig 2.8a

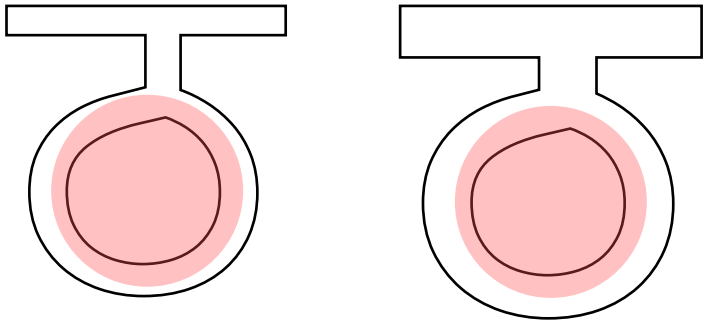


Fig 2.8b

Similarly in fig 2.8 atwo ‘ठ’ are placed next to each other. One on the right is edited and the sherorekha and the stroke width is increased. The counter of the ‘ठ’ on the right looks smaller because of delboeuf illusion however, they are similar in size.

Fig 2.8 shows two outlined ‘ठ’ placed next to each other. One on the right is edited and the sherorekha and the stroke width is increased. The highlighted area shows the counter of the ‘ठ’ on the right looks smaller because of delboeuf illusion.

Fig 2.8

In fig 2.7 two ‘क’ are placed next to each other. One on the right is edited and the sherorekha and the stroke width is increased. The counter and aperture of the ‘क’ on the right looks smaller because of the delbouef illusion.

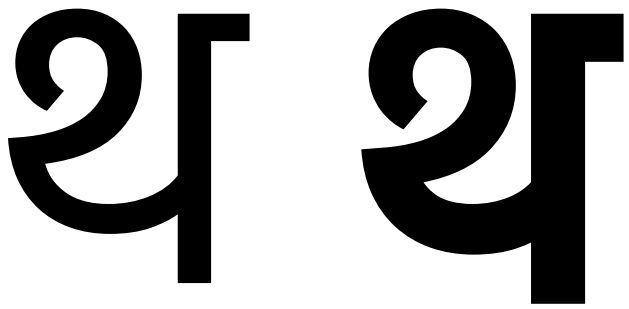


Fig 2.8

Similarly in fig 2.8 two ‘ठ’ are placed next to each other. One on the right is edited and the sherorekha and the stroke width is increased. The counter of the ‘ठ’ on the right looks smaller because of delboeuf illusion.

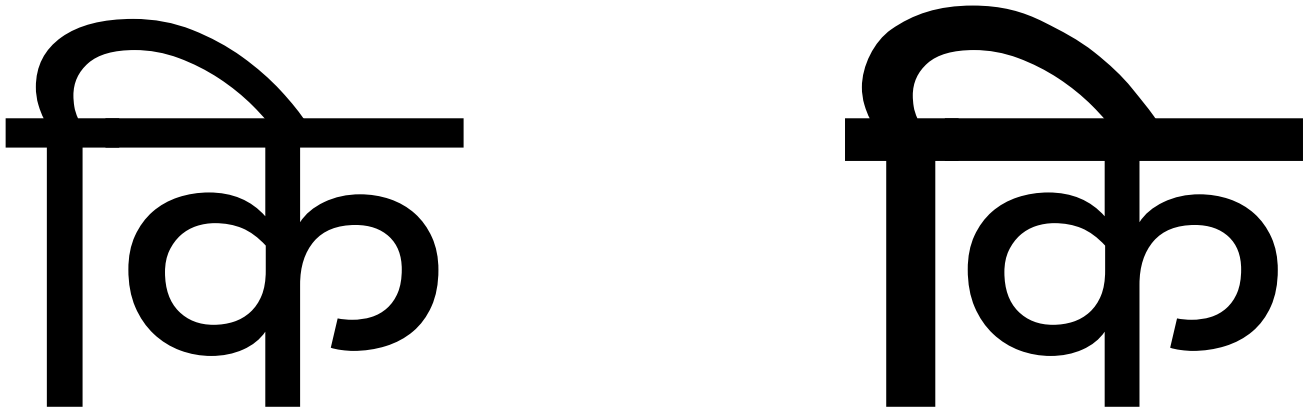


Fig 2.9

In fig 2.9 two ‘क’ with ‘इ’ matra are placed next to each other. One on the right is edited and the sherorekha and the ‘इ’ stroke width is increased. The counter of the ‘इ’ matra on the right looks smaller because of the delbouef illusion.

Increasing the boldness of the strokes cause an underestimation of the apertures and counters in devanagari alphabets given that the stroke width increases without effecting the aperture size.

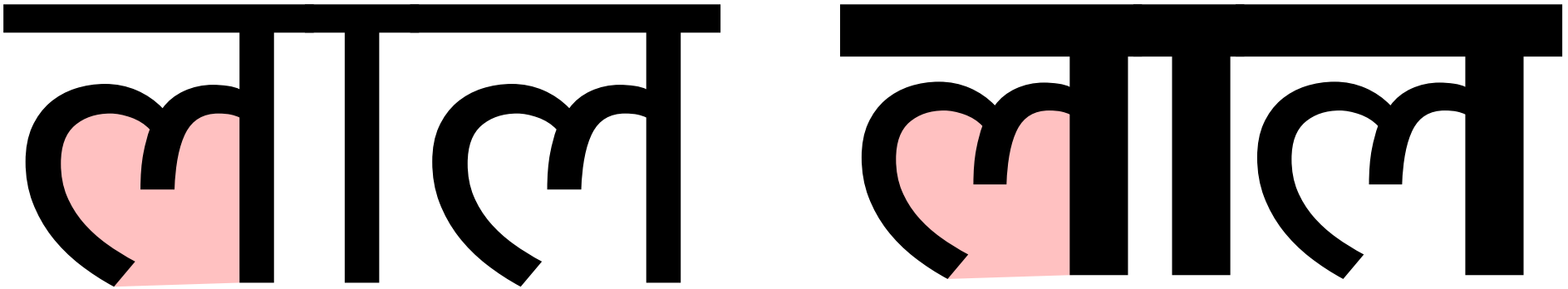


Fig 3

In fig 3 the word ‘ लाल ’ is placed twice next to each other. One on the right is edited — the sherorekha and the stem width is increased. The apertures of the word ‘ लाल ’ is not affected by this change and the apertures look similar. The highlighted area represents the open aperture of ‘ ल ’.

Increasing only the boldness of the sherorekha and stem width does not cause an underestimation of the apertures in devanagari words given that the stroke width increases without effecting the aperture size. However the kerning is affected.

Here the aperture of ‘ ल ’ (highlighted area) is too large for the delboeuf illusion to happen.

Explorations with Abstract/Display Characters

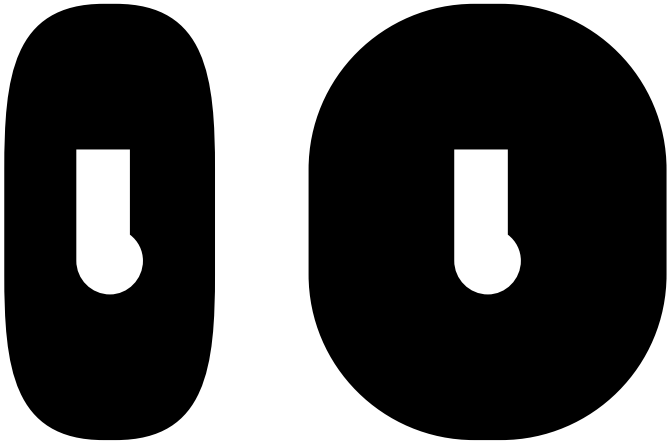


Fig 3.1

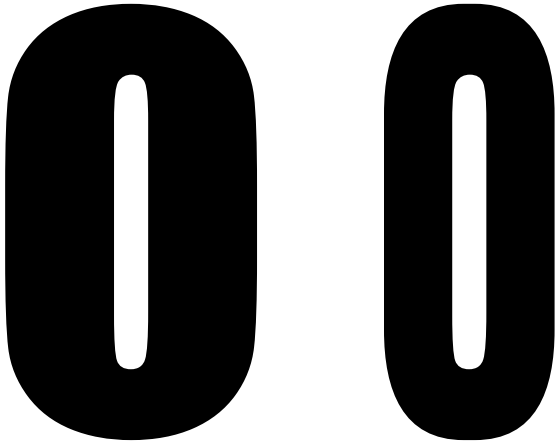


Fig 3.2

In fig 3.1 two ‘ O ’ are placed next to each other. The apertures of these two ‘ O’s ’ are unconventional. One on the right is edited and made bolder. Even after having an abstract shape as a counter, the counter of the ‘O’ one on the right side looks smaller and delboeuf illusion can be observed.

Interestingly in fig 3.2 delboeuf illusion can be observed by increasing the stroke width but the counter of the ‘O’ on the right side looks elongated whereas the size of both the counters are exactly equal.

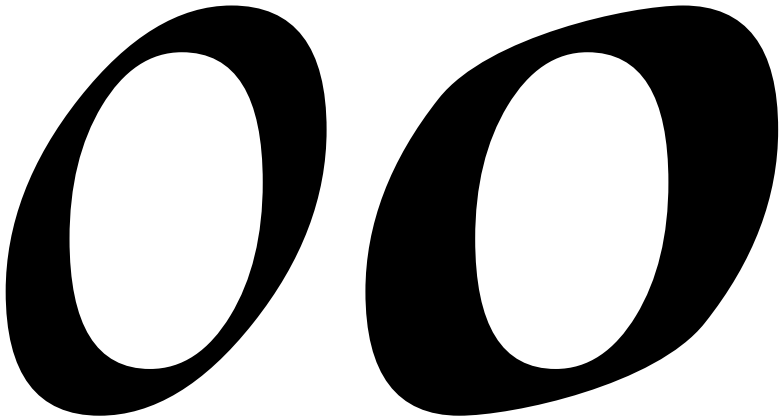


Fig 3.3

Fig 3.4

In fig 3.1 two ‘ O ’ are placed next to each other. The ‘O’ are calligraphic O’s and have contrasting stroke widths. One on the right is edited and made bolder. Even after having a contrasting stroke width, the counter of the ‘O’ one on the right side looks smaller and delboeuf illusion can be observed.

Interestingly in fig 3.4 delboeuf illusion can stbe observed in geometric oblique ‘ O’s ‘ by increasing the stroke width. The intentional 12° slant in the ’o’ does not affect the illusion.

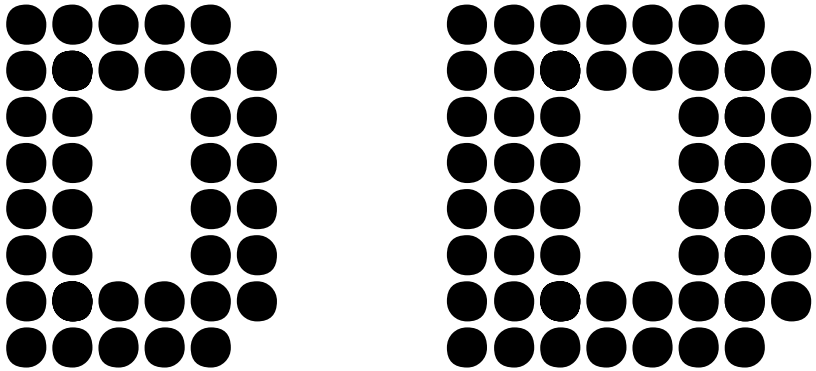


Fig 3.5

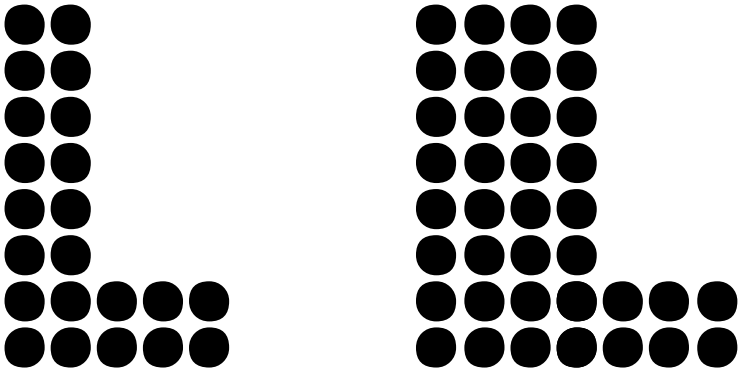


Fig 3.6

In fig 3.5 two dotted ‘ D ’ are placed next to each other. One on the right is edited and made bolder. But, here the counter looks exactly similar because we can count the small circles that form the counter forcing our brain to think more logically and eliminating any illusion.

Similar happens for the open aperture of the alphabet ‘L’ in fig 3.6 and the open aperture looks exactly similar because we can count the small circles that form the aperture forcing our brain to think more logically and eliminating any illusion.

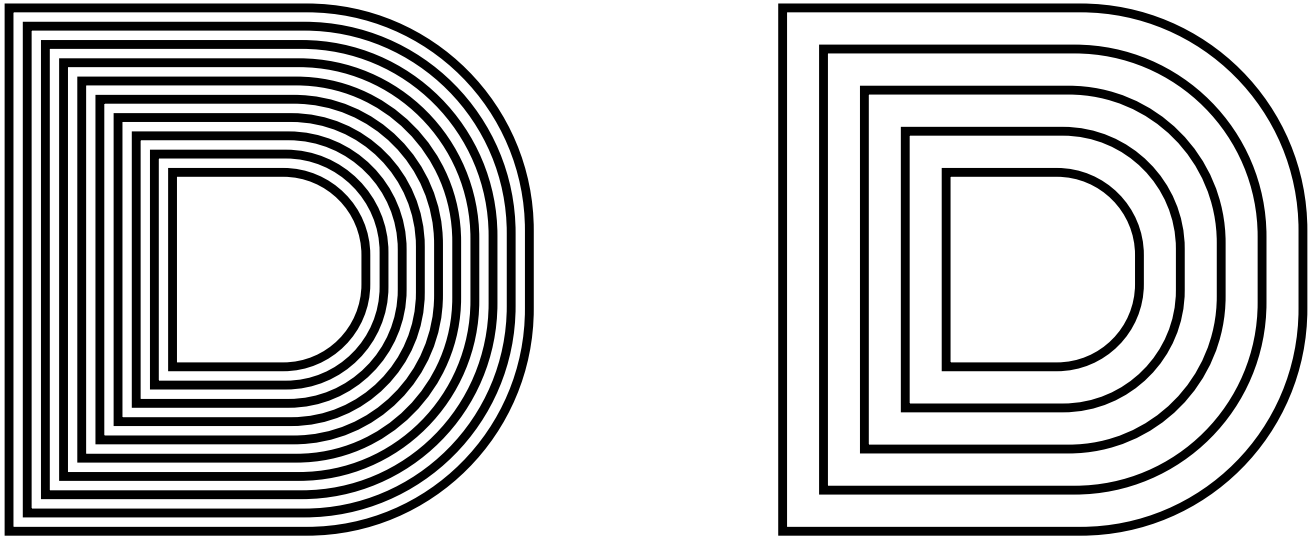


Fig 3.7

In fig 3.7 two ‘ D ’ made out of lines are placed next to each other. One on the left is made up of more number of lines as compared to the ‘D’ on right making it look much denser and bolder. The increased density of the ‘D’ on right makes the counter look smaller and delboeuf illusion can be observed.

Conclusions

The surrounding inducers cause an overestimation of the referent object size.

Delboeuf illusion is completely dependent on stroke thickness in typography: the perceived size of apertures and counters of closed or semi-closed figures depends on the stroke thickness of the glyphs.

The magnitude of the Delboeuf illusion is dependent on the contrast: the closed figures yield stronger illusion than the open figures.

Adjacent strokes, counters and apertures cause an underestimation of the referent open or closed figures to a certain extent.