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Comments on Francesco Gori´s "Practice and Theory of Visual Representation"

1. I share the main idea of this paper: that there is a tight connection between the creation of drawings and the perception of drawings. Quote: *"to understand how perception works…[w]e need to observe the process that led to its creation".* I strongly support this idea. As a matter of fact, it is the essence of the motor theory of perception. It is a line of reasoning that started with Mach's "muscle sensation" and was continued by Münsterberg (motor theory of speech perception), Wertheimer ("good continuation"), Gelb & Goldberg (motor perception of linear drawings and handwriting), Köhler (describing "three curious figures as three movements"), Metzger (emphasizing the crucial importance for perception of handwriting not only movements but *direction* of movements), Merleau-Ponty (introducing "*motor intentional understanding")*, and Pinna (extending the concept of perceiving linear drawings as a movement to perceiving them as products of a variety of other physical actions: the "fritted" or "broken" or "nibbled" square).

2. I share the idea that perception creates a simplified presentation of an object. Quote: *"Perception uses millions of specialised neurons to deconstruct and rebuild the physical form of reality in a stable and simplified representation".*

3. Simplification is at the same time **generalization**, because it omits details, and, as a result, represents a class of stimuli, the Gestalt.

4. The author claims that the first step in perception (as well as in artistic presentation) is **selection of the figure**. It is an important point in image perception. The vast majority of computer models of image processing start with border detection (by calculation of the gradients) and proceed with object building, but this encounters a lot of problems. In reality, the known procedures pick up either too few borders (so, not all borders of an object are present) or too many. As a result, it becomes problematic to construct from them sensible objects. Until now, this has been one of the reasons for which computer processing of real images has not succeeded. I favor another way: first we find objects, and then find the borders (attention! Not abstract "borders", but "borders of objects",

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which make the choice much more sensible). In most real images, not all borders are visible, and sometimes objects have no borders (drop of water on pants). The author follows the right strategy: roughly find the object, and then define the gradient lines, which can be the borders of this object.

Here are two examples. After 100 msec of looking at the Fig. 1 ("The bearded man"), it is perceived with peripheral vision, i.e. at low resolution. As a matter of fact, we recognize the stimulus as a face without detecting the borders of the spots. We use this information to move our gaze to each of these spots for detailed analysis (including border detection)*. Missing this step – defining the parts of the whole – leads to a tragic mistake in introducing the global precedence: it was stated that the compound stimulus (Fig.2) is perceived as a whole (big letter H) consisting of parts (small letters H), but really we first perceive the blurred image (Fig.2b), and the parts of the whole are three bars. Only after this can we learn the details: the bars consist of small letters. So, we don't perceive the whole before its parts, and we don't perceive "the forest before the trees" – we perceive the whole before the details, which is trivial.

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* It is worth mentioning that in this case even detailed analysis will not find the borders of the face's parts: nose, eyes, mouth etc.

Fig. 1a
Bearded man drawing

Fig 1b
Bearded man in peripheral view

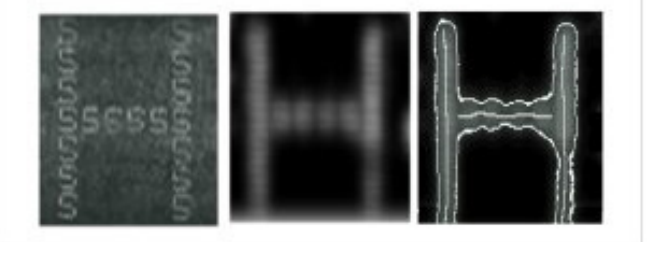

Fig 2 a, b, c
a) Initial stimulus (compound letter), b) Compound letter in peripheral view, c) Perception as "three straight lines"

5. Quote: *"According to neuro-aesthetics researchers, artists' work is an extension of perception and as such a way to study the process of vision from a privileged point of view".*

It is an interesting idea – to present the process of drawing as an extension of perception. If perception is a process of reconstructing the environment from sensation signals, then drawing is a process of reconstructing the perceived environment in another environment **according to the artist's vision**. Maybe with such understanding we are approaching the essence of visual art while still remaining on scientific ground.

6. Quote: *"Perception builds some clues from the bottom, the clues are completed by memory from above. Memory previews can be confirmed or denied from the new clues built up by perception".*

I would like only to add a reinterpretation: mutual adjustment between the whole and the parts can be initiated not only by the appearance of new parts, but also by reinterpretation of the parts of the whole (a program working on this principle is described in [Guberman Computer Vision and Gestalt Theory http://www.tandfonline.com/doi/pdf/10.2753/RPO1061-0405220489#.VKsKydLF-Fk

7.

Fig. 3a Gori, Fig. 7, Outlines

Fig. 3b Gradients (by PaintShopPro)

The presented outline of the figure (Fig. 3a) is not real: a) it is impossible to combine the long white lines from the set of initial lines – borders of areas of different brightness **without knowing** that it is the body of a man; b) looking at

the right image it is obvious that it is impossible to outline the head; c) the left leg is outlined arbitrarily (not based on real lines presented in the right image) and the inside edge crosses the body of the boy, which stays between the man's legs. In summary, the presented sketch doesn't correspond to the described procedures of perception.

8. Quote: *"Joining adjacent segments with similar orientation in longer lines, artists enact a conscious extension of the gestalt grouping laws of similarity, proximity and good continuity".* It seems to me that in this case these grouping laws don't work because: 1) all continuities are gradient lines, so they are all similar, 2) the outlines of the figure (in red) definitely don't create a closed geometrical figure, and 3) the leading grouping for connecting the gradient lines is "good continuation". But the "good continuation" rule is a local one. The local approach can't solve the problem. One example is shown in Fig. 4: in the bottom right corner of the fingerprint it is impossible to restore the lines by following only the good continuation rule. It demands the holistic Gestalt approach, i.e. the solution has to take into consideration the whole. From

Fig. 4 Part of a fingerprint.

the central part appears the pattern of curved almost-parallel not-intersecting lines, and at the bottom right site when restoring a line other lines have to be taken into consideration. Another example is much more complex (Fig. 5a). It is a chest X-ray photo. The same program that calculated gradients for Neptune's photo (see above) calculated gradients for the X-ray photo (Fig. 5b). One can see that it is hopeless to extract the ribs from the photo. To do so, an even more global Gestalt approach is needed. This was realized in a system developed by Gelfand *et al.* A notion of *field of parameters* was introduced. An example of such a field is a topographical map in geography: at each point it shows the elevation of surface above sea level. One of the fields used in this application is "width of rib" in the vicinity of each point. One can see the regularities of this field: applied to the image, the width is increasing from top to bottom. When this field is applied to the photo it picks up from all points with valued gradients such points as satisfy the pattern of the ribs' width (Fig. 5c). In Fig. 5d is shown the result of applying to the image another field – the field of directions of gradient

lines. Each point of the field shows the direction of the majority of gradients in the surrounding area.

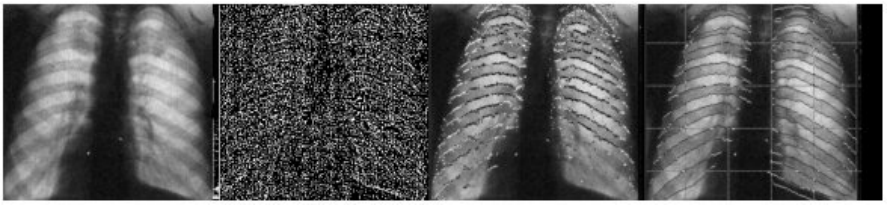

Fig. 5 **a** The chest X-ray photo **b** calculated gradients **c** "width of rib" field application **d** field "directions of gradient lines" application

9. Quote: *"The result of perceptual processing of form describes an object as a short relationship between few simple/linear units".* The "result of perceptual processing" is the Gestalt. The author's definition of Gestalt as a brief simple description is an extremely important statement. It contrasts dramatically with the rest of the known definitions of Gestalt as an open list of characteristics, which are themselves badly defined. But in a regular psychological experiment Gestalt is the description given by the subject in response to question "What do you see?" In the case of the image we are discussing it will be "Nude man". But the author proposed another answer: *a short relationship between few simple/linear units.* I see here a contradiction because it differs from the result which will be obtained in an experiment.

10. I don't agree with the analogy with Kanizsa's triangle. In the photo (Fig. 3), part of Neptune's left leg border is invisible because it is located **behind** the boy's body. We know that it is there but we can't see it. In Kanizsa's triangle we see an invisible border of an imaginable white triangle, because we locate it **in front** of other figures.

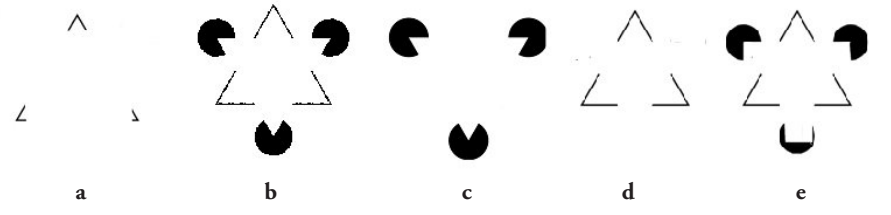

Fig. 6 a-e: Modifications of Kanizsa's figure

A year ago I published a paper which presents the imitation principle of Gestalt perception for communicative stimuli [Gestalt Theory, vol. 37, N 1]. It claims that the Gestalt, which we perceive, is a description of the process that generates this

stimulus. For the Fig.6b it is "three black circles and a drawn triangle covered with a white triangle". If we delete one part of the figure (the drawn triangle) we get Fig 6c: "three black circles covered with a white triangle". If we delete another part of the figure (the three black circles) we get Fig. 6d, and the white triangle is lost. It seems that there is not enough information to feed our imagination with data about the form of the white cover. It seems that our imagination needs a hint in the form of the line. In Fig. 6e, by changing one of the black spots we change the form of the imaginable white figure (now it is "T"), despite the fact that the drawn triangle remains the same.

Concluding remarks: The discussions between the author and reviewer were positive and productive. On a number of points one or another party admitted that it had expressed itself inaccurately, or was misunderstood, or even was wrong, and a common understanding was reached.

Summary

Gori's paper reflects the increasing attention of gestaltists to the imitation (or simulation) theory of perception, which was started by Mach (muscle sensation), continued by Wertheimer (good continuation), Gelb (reading by writing), and Pinna (shape meaning), and crowned by the discovery of mirror neurons. These comments are the result of discussion, in which both parties came to a consensus on some issues, but keep their positions on others, which is normal for a scientific debate.
Keywords: Perception, drawing, movement, imitation.

Zusammenfassung

Gori´s Artikel gibt die wachsende Aufmerksamkeit von Gestalttheoretikern für die Nachahmungs- (oder Simulations-) Theorie der Wahrnehmung wieder, die von Mach (Muskelempfindung) angestoßen, von Wertheimer (Gesetz der guten Fortsetzung), Gelb (Lesen durch Schreiben) und Pinna (Bedeutung von Formen) weitergeführt wurde, und einen Höhepunkt in der Entdeckung der Spiegelneuronen erreicht hat. Diese Anmerkungen sind das Ergebnis einer Debatte, in der beide Seiten in einigen Fragen zu einem Konsens gekommen sind, in anderen aber ihre Positionen beibehalten haben, wie es in einer wissenschaftlichen Debatte üblich ist.
Schlüsselwörter: Wahrnehmung, Zeichnung, Bewegung, Nachahmung.

Shelia Guberman, (b. 1930), M.D. in mathematics, M.D. in electronics, Ph.D. in nuclear physics, Ph.D in Artificial Intelligence. Head of Division at Institute of Applied Mathematics of the Russian Academy of Sciences (1966-1991). Chair Professorship at Moscow Open University (1989-1992). Author of first applied pattern recognition program (1962), D-waves theory of Earth seismicity (1975), algorithms of gestalt-perception (1980), technology of giant oil and gas fields exploration (1985). Worked in Artificial Intelligence from 1962 implementing principles of Gestalt perception in computer programs for geological data analysis, handwriting recognition, speech compression, medical imaging, oil and gas exploration. From 1992 he has lived in the US. Author of core technologies for five US companies. At the present time he is focused on investigating principles of Gestalt psychology.
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