

## Who had illusions?

### Alexander R. Luria's Central Asian experiments on optical illusions<sup>1</sup>

Eli Lamdan<sup>2</sup>

The ideas of the ruling class are in every epoch  
the ruling ideas.  
Karl Marx and Friedrich Engels  
*The German Ideology*

The history of the Central Asian scientific expeditions of Luria and his colleagues is an exciting history of science in action. It has all the elements that make the history of science such a fascinating field - science, ideology, politics, and human interest. On engaging with this story, my attention was particularly attracted by the experiments on optical illusions. I am not an expert in the psychology of perception, but as a neophyte historian of science with a scientific background, I prefer to commence any historical analysis of an episode of science with an analysis of its experimental component. The experiments were of particular interest to me here for the simple reason that here we have documented inconsistent results and a disagreement between the leading members of the expedition. In this article I will try to reconstruct this episode, as far as the documentation that we have allows. I hope that this will provide us with a foundation, upon which we can build in the future a more accurate reconstruction of Luria's Central Asian expeditions.

#### **A brief history of the Central Asian expeditions<sup>3</sup>**

The first evidence that Vygotsky and Luria had the idea of conducting an experimental study of mental processes in "primitive" peoples is found in letters of Vygotsky from 1929, written during his visit to Tashkent (Vygotsky and Puzyrei 2004). It seems that on this visit he undertook some preliminary experiments, about which we actually do not know anything. Despite earlier attempts of Luria to attract foreign scientists and organizations to the project, the first expedition led by Luria took place in the summer of 1931, with the participation of only Soviet scientists and with the financial support of only Soviet institutions (Yasnitsky 2013).

Luria and Vygotsky considered the results of this expedition as very interesting and promising. They saw them as a confirmation of their hypotheses regarding changes of mental processes under the influence of the social changes then taking place in the Central Asian society. Therefore, they immediately set about organizing another expedition. Luria tried, once again, to attract the attention of the foreign scientific public. He published an account of the expedition in a series of international scientific journals (Luria 1931a, 1931b, 1932a, 1932b) and continued personal correspondence with Western colleagues in an attempt to attract one of them to the second expedition (Yasnitsky 2013).

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<sup>2</sup> The Department of General History and the Program for History, Philosophy, and Sociology of Science, Technology, and Medicine, The Hebrew University of Jerusalem

<sup>3</sup> For more detailed description of the expeditions and their context see the articles of Anton Yasnitsky (Yasnitsky 2013) and Hannah Proctor (Proctor 2013) in this issue.

Luria was successful. The second expedition, which took place in 1932, was joined by the well-known German-American psychologist Kurt Koffka. Koffka was responsible for conducting experiments on optical illusions. The results of this second expedition were published with some delay and in a brief form in the Western scientific press, but despite the promises of the author, they were not subsequently developed further (Luria, 1933, 1934). Only in 1974 did Luria publish a book, *Ob istoricheskom razvitii poznavatel'nykh protsessov (The historical development of cognitive processes)*, in which he summarized the results of these two expeditions. According to the received wisdom, this long silence was the result of the political criticism directed at Vygotsky and Luria after these expeditions, which entailed that Luria did not have the opportunity to continue this line of research (Joravsky 1989, 364-367; Luria 1994, 66-69). Recent studies are beginning to challenge this version, however, and the present article is intended to make a further, modest contribution to the critical revision of this traditional story.

### **Studies of optical illusions - the structure of the experiments and their results**

We now turn to the analysis of the optical illusions experiments of the expeditions. Our analysis will be based on the following sources: Luria's foreign publications dealing, albeit briefly, with both expeditions (Luria 1931a; 1931b; 1932a; 1932b; 1933; 1934), a letter from Luria to Wolfgang Köhler of December 3, 1931, in which he informed Köhler of the results of the first expedition (archived handwritten document in German), and, finally, Luria's late book dedicated to this episode (Luria 1974).<sup>4</sup>

Description of the research methodology can be found only in the later publications, written decades after the expedition. Even here we have no exhaustive description, and we are left with many questions. In both expeditions the subjects were divided into five groups:

- (1) Ichkari women living in remote villages who were illiterate and not involved in any modern social activities. There were still a considerable number of such women at the time our study was made. Interviews were conducted by women, since they alone had the right to enter the women's quarters.
- (2) Peasants in remote villages, who continued to maintain an individualistic economy, to remain illiterate, and to involve themselves in no way with socialized labor.
- (3) Women who attended short-term courses in the teaching of kindergarteners. As a rule, they still had no formal education and almost no literacy training.
- (4) Active *kolkhoz* (collective farm) workers and young people who had taken short courses. They actively involved themselves in running the farms – as chairmen, holders of *kolkhoz* offices, or brigade leaders. They had considerable experience in planning production, in distributing labor, and in taking stock of work output. They dealt with other *kolkhoz* members and had acquired a much broader outlook than had the isolated peasants. But they had attended school only briefly, and many were still barely literate.
- (5) Women students admitted to a teachers' school after two or three years of study. Their educational qualifications, however, were still fairly low. (Luria 1974, 27)

In his book Luria explains how best to deal with participants on order to achieve adequate results:

As in any fieldwork with people, then, we emphasized preliminary contact with the population; we tried to establish friendly relations so that the experimental run-throughs seemed natural and unaggressive. Hence we were careful never to conduct hasty or unprepared presentations of the test materials.

As a rule our experimental sessions began with long conversations (sometimes repeated) with the subjects in the relaxed atmosphere of a tea house – where the villagers spent most of their free time – or in camps in the fields and mountain pastures around the evening campfire. These talks were frequently held in groups; even in interviews with one person alone, the experimenter and the other subjects formed a group of two or three, listening attentively and sometimes offering remarks. The

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<sup>4</sup> This last was partially published in the biography of Alexander Luria written by his daughter (Luria 1994) and in an article written by Anton Yasnitsky (Yasnitsky 2013).

talk often took the form of an exchange of opinion between the participants, and two or three subjects might solve a particular problem simultaneously, each proposing an answer. Only gradually did the experimenters introduce the prepared tasks, which resembled the "riddles" familiar to the population and thus seemed like a natural extension of the conversation. (Luria 1974, 28)

Such reasoning seems, at first sight, absolutely convincing; but further reflection generates some confusion and gives rise to a number of questions which, unfortunately, have no answers. For example, how is it possible to conduct a free and relaxed conversation with women who live according to traditional Islamic laws and do not come out of the women's half of the house (Ichkari)? For sure, Luria tells us that they were interviewed only by women, but how did they get in? With which excuse could they enter? How did "the husband and the master" look at all this? Again, and in relation to the second group, we can ask what was the attitude of the "independent farmers" to the scientists who came from outside? Were they not afraid of them? And to what extent could a casual conversation take place between them in the midst of collectivization when any one of these strangers might appear to the farmers to be a representative of the government, and as such an agent intent on driving him into the collective farm? I have the audacity to suggest that these circumstances do not meet Luria's statements as to the ideal situation for conducting research.

In addition, Luria writes about another condition for the successful completion of the experiments:

It would have been foolish to give them problems they would have regarded as pointless. Tests developed and validated in other cultures repeatedly produced experimental failures and invalidated our proposed study. Thus we used no standard psychometric tests, and we worked only with specially developed tests that the subjects found meaningful and open to several solutions, each indicating some aspect of cognitive activity. (Luria, 1974, p. 29)

Again, the principle looks very convincing. I admit that in many parts of the study it can be, and has been, successfully applied. But Luria did not explain to us, and for us it is a mystery, how one can give meaning, for example, to the experiments with optical illusions of geometric shapes. This raises the next question, what illusions were chosen for the experiments?

Here we transition from the one part of our story on which we have incomplete information to the other, where we have conflicting data. In this context it is appropriate to draw the reader's attention to two interesting facts. First, in later publications Luria cites his two expeditions in an undifferentiated manner, as a whole, and it is not clear which results were obtained when, i.e., during the first or the second expedition. Second, these publications do not mention the participation of Koffka in the second expedition, although his short report on the Central Asian experiments contradicts the supposed discovery that "the Uzbeks have no illusions," which is well known as probably the main achievement of the Central Asian research of Luria (Luria 1934). So which illusions did Luria and Koffka investigate in their experiments?

Western publications on the first expedition contain no experimental data, only a general hypothesis and a list of themes and participators (Luria 1931a; 1932a). The first source with some experimental data is the letter from Luria to Köhler of December 1931. In this letter Luria tells Köhler about the expedition in order to persuade him to participate in the planned second expedition. Luria describes in some detail the experiments with optical illusions and presents some of the data. What he writes shows that ten different illusions were worked with. Luria supplies a table with intermediate values and, in addition, the results of two experiments: Ebbinghaus illusion and the Müller-Lyer illusion (see Table 1).

Table 1 - Number of optical-geometric illusions (in %) from Luria's letter to Köhler

| Test group                  | Number of subjects | The intermediate value of 10 experiments | Müller-Lyer illusion | Ebbinghaus illusion |
|-----------------------------|--------------------|--|----------------------|---------------------|
| Women at teachers' school   | 38                 | 66.2                                     | 89.4                 | 92.1                |
| Collective farm activists   | 40                 | 65                                       | 100                  | 85                  |
| Women in pre-school courses | 20                 | 54.8                                     | 92                   | 64                  |
| Peasants                    | 25                 | 36.8                                     | 95.8                 | 26.6                |
| Ichkari women               | 10                 | 26.6                                     | 66.6                 | 33.3                |

In his later book, Luria introduces only nine kinds of illusions, but applies them in a way that makes their recognition very difficult. He presented certain optical illusions in the form of small numbered drawings (Fig. 1), without naming each of them in the text or in a table, where they appear by numbers (Luria 1974, 55). I have tried to identify these illusions, with varying degrees of confidence (Table 2).

Figure 1 - Optical-geometric illusions that have been used in the study. (Luria 1974)

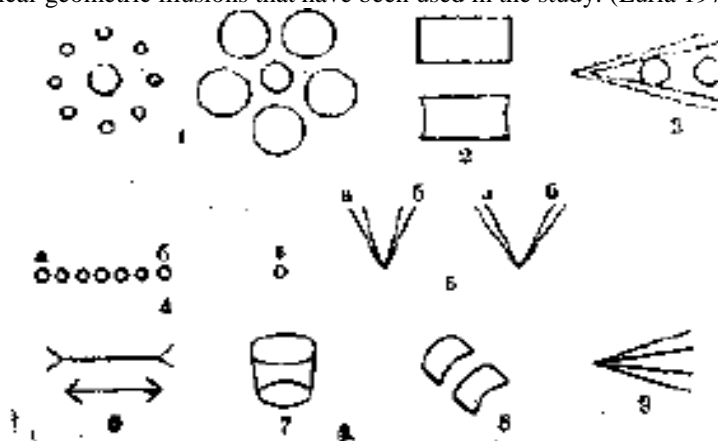
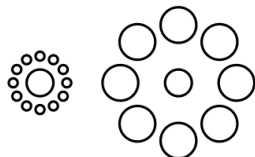

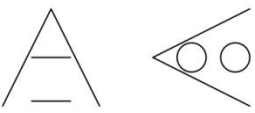

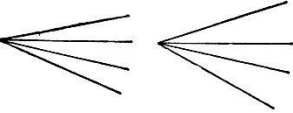
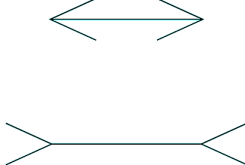
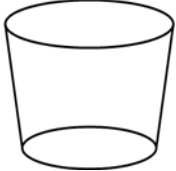
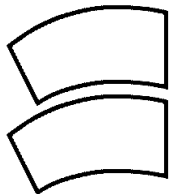
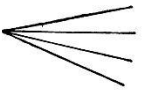


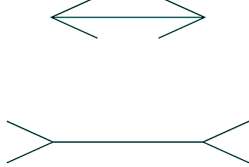
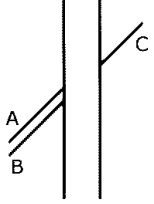
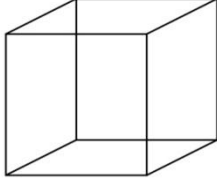
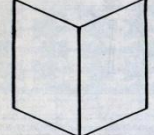
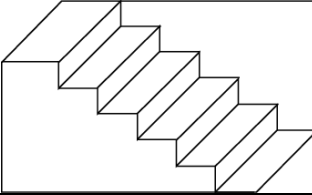
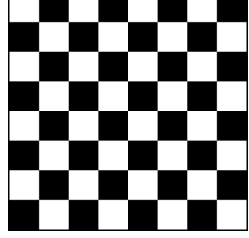
Table 2 - The illusions used in the studies according to Luria (Luria 1974)

| Number | The name of the illusion                     | Illustration   | Description  |
|--------|--|--|--|
| 1      | Ebbinghaus illusion                          |    | Two circles of the same size are surrounded by larger or smaller circles. The latter usually appears larger than the former.                               |
| 2      | No name                                      |     | The base of the rectangle appears larger than the horizontal side of the lower figure. This seems like the same effect as in the Müller-Lyer illusion.     |
| 3      | Ponzo illusion                               |    | Two identical objects are placed between divergent lines. That which is closer to the corner seems bigger.   |
| 4      | Oppel-Kundt illusion                         |   | The segment with the filled space seems longer than the blank segment.   |
| 5      | The illusion of external and internal angles |  | Two identical internal angles, one seems smaller because it is surrounded by two larger external angles.   |
| 6      | Müller-Lyer illusion                         |  | The segment limited by "head arrows" seems shorter than that limited by "tail arrows".   |
| 7      | Perspective illusion                         |  | Reversible figure, which produces the effect of perspective, like the Necker cube (see Tab. 3). You can look at the cylinder from "below" or from "above". |
| 8      | Jastrow illusion                             |  | In these two identical figures, the upper seem shorter, since its short edge lays in the proximity of the long edge of the lower figure.                   |
| 9      | The illusion of the inner angle              |   | The internal angle seems bigger than the objectively equal adjacent angles.  |

The report on the second expedition, in contrast to the first, was a little more detailed (Luria 1934). The part devoted to the study of perception was, , unlike the rest of the text, written personally by Koffka, and from it we learn that he used mostly other optical illusions in his

experiments (Table 3) and that his results refute those results of Luria which appear in his letter to Köhler and in his latter book. In other words, Koffka denies the mythological apophthegm "Uzbeks have no illusions".

Table 3 - The illusions used in the second expedition according to Koffka (Luria 1934).<sup>5</sup>

| Name of the illusion   | Illustration  | Description  |
|------------------------|---|--|
| Müller-Lyer illusion   |    | The segment limited by "head arrows" seems shorter than that limited by "tail arrows".   |
| Poggendorff illusion   |    | "C" is a continuation of "A", and not "B" as it seems.   |
| Necker cube            |   | One of the reversible figures: the front edge seems to be rear, and then again the front.  |
| Mach book              |  | Another reversible figure: this one can be regarded as a book opened toward the observer, or vice versa.   |
| Schroeder stairs       |  | Reversible figure, which depicts two stairs at a time. One rises from right to left. The second is turned on its head.   |
| Chess pattern illusion |  | The simplest of figure-ground compositions. In such compositions, the figure and the background can be changed, one color is seen as the background, and the other as the figure, and vice versa. In this case, we see either black squares on a white background or white on a black background. <sup>6</sup> |

<sup>5</sup> In addition to the study of illusions, Koffka mentioned in his report a "Kohts test" (Luria 1934). I think, without absolute certainty, that this refers to a test designed by Nadezhda N. Ladygina-Kohts, better known as a "sample to match method". This method was first used to evaluate the sensory abilities - such as the perception of color, shape, etc. Subsequently, it became more often used to test more complex mental abilities - generalization, abstraction, etc. (Zorina and Smirnova 2006, 72). Thus, it is possible that Koffka used this test as a control test to check the possibility of illusive perception, or went beyond his part of the study.

<sup>6</sup> In his report on the second Central Asian expedition, Koffka did not explain what he meant by "chess-board pattern" (Luria 1934). In the literature, there are many illusions which use a chess board. I chose this interpretation because it is mentioned by Koffka in an earlier article (Koffka 1922).

All these circumstances result in the following hypothesis: Luria, for whatever reason, did not accept Koffka's results. Therefore, when many years later he published the results of the expeditions, he simply ignored them and kept silent about Koffka's part in the second expedition. Thus, the results of the optical illusions experiments that we find in the book of 1974 are only the results of the first expedition, not of both of them, as is told in the "traditional" story. Before we proceed to consideration of the experiment's quantitative data, I want to point out one fact which supports our hypothesis. In his book, Luria mentioned L. S. Gazaryants and E. N. Mordkovich as researchers on the topic of perception (Luria 1974, 55). In fact, their names appear in this role in the original publication of the first expedition (Luria 1931a), but in the second expedition publications these names were not mentioned in this role; instead it is stated that the study of perception was made by K. Koffka and G. Ashrafi (Luria 1934).

We can now consider carefully the two versions of the quantitative data that we have, both of which belong to Luria. If we compare the data from the letter to Köhler (Table 1) and that which we find in the book (Table 4), we see some inconsistencies, although, in general, the results are very similar.

Table 4 - Number of optical-geometric illusions (in %). (Luria, 1974)

| Test group                  | Number of subjects | Illusion number |      |      |      |      |       |      |      |      | Mean |
|-----------------------------|--------------------|-----------------|------|------|------|------|-------|------|------|------|------|
|                             |                    | 1               | 2    | 3    | 4    | 5    | 6     | 7    | 8    | 9    |      |
| Ichkari women               | 9                  | 33.3            | 66.6 | 0    | 33.3 | 11.1 | 66.6  | 0    | 11.1 | 33.3 | 29.2 |
| Peasants                    | 25                 | 20.8            | 36.8 | 10.5 | 37.5 | 25.0 | 95.8  | 16.6 | 29.1 | 20.8 | 44.7 |
| Women in pre-school courses | 25                 | 64.0            | 60.0 | 24.0 | 60.8 | 36.0 | 92.0  | -    | -    | -    | 50.4 |
| Collective farm activists   | 40                 | 85.0            | 72.5 | 45.0 | 62.5 | 77.5 | 100.0 | 52.5 | 47.5 | 70.0 | 70.2 |
| Women at teachers' school   | 38                 | 92.1            | 68.4 | 39.4 | 81.5 | 71.0 | 89.9  | -    | -    | -    | 75.6 |

The differences between the two versions of the research report are as follows. First, in the first version we have ten optical illusions, while in the second nine. Second, the intermediate result of both versions is not the same: in his letter to Köhler, Luria used the median of ten different illusions, and in the book the arithmetic mean. Finally, there are groups in which the number of subjects varies, and the percentage remains the same, or vice versa.

The first discrepancy is easily explained. As we know from scientific practice, not all tests are used for publication, especially those that do not fit the working hypothesis of the researcher. It is therefore likely that Luria simply decided to drop one of the illusions and not to use it. In the same way the second discrepancy can be explained in principle: the scientist will always choose the methods of organization and the demonstrations of empirical material that he considers the most suitable. Although an attempt to recalculate the intermediate values gives us a different result.

In order to gain some understanding of the picture of the latter type of mismatches, I decided to see what number of subjects fit the results we have. In this case, I started with two assumptions. First, in a "field work" each subject was tested only once. Secondly, we are dealing with a binary outcome (i.e., there is or there is not an illusion). On this basis, one can calculate what percentage equates each subject for a given number of subjects in the group. Out of all this it appears that in groups where there was a discrepancy in the number of subjects between the two versions ("Ichkari" and "pre-school courses"), the result fitted the number given in the book, and not in the letter. In two other cases, where the number of subjects remained the same, and the result is changed, the conclusions are not unambiguous. In one group ("teachers' school") the difference between the two versions is insignificant, and both coincide with the number of subjects. In the other group, ("peasants"), neither version of the results is consistent with the number of subjects.

This allows us to arrive at two cautious conclusions. First, the data on optical illusions that appears in Luria's book are based only on the results of the first expedition. Second, the data were not manipulated in a clear way, the method of which is nowhere explained.

### **The theoretical roots of the Central Asian expeditions**

Everything described in the previous section requires explanation. The scientist never faces the object of his research without a theory, in other words, there is no a naive, unbiased, observation. Hence, the roots of the experimental differences are to be looked for in a theory, in a philosophy and in an ideology, in all those phenomena that are traditionally referred to as a world view. I cannot develop this theme here; the relevant in-depth analysis is beyond the scope of this article. But I consider it necessary to give a few remarks on the subject.

In 1930 Vygotsky and Luria's book *Etiudy po istorii povedeniia: obez'iana, primitiv, rebenok* (*Essays in the History of Behavior: Ape, Primitive Man, Child*) was published. The authors set themselves the task of relating the diverse explanations of the development of civilized man. According to the authors:

Our goal has been to outline the three principal lines in the development of behavior – the evolutionary, the historical, and the ontogenetic – and to show that the behavior of civilized man is a product of all three lines of development and may be understood and explained scientifically only by means of the three distinct paths out of which the history of human behavior has been formed. (Vygotsky and Luria 1930, 3)

But, despite their claims as to the novelty of their approach to the problem of the development of the human psyche, this work was written in the mainstream tradition of contemporary European thought, and the authors were not very pleased with the outcome (Yasnitsky 2011). At the beginning of the second essay, devoted to the historical line of development, the authors emphasize how little has been done in this area and define its object of study:

...one of the richest sources for this type of psychology is the study of the so-called primitive peoples. This term is commonly used, admittedly as a conventional label, to designate certain peoples of the uncivilized world, situated at the lower levels of cultural development.

*Primitive man, in the true sense of the term, does not exist anywhere at the present time, and the human type, as represented among these primeval peoples, can only be called "relatively primitive." Primitiveness in this sense is a lower level, and the starting point for the historical development of human behavior. Material for the psychology of primitive man is provided by data concerning prehistoric man, the peoples situated at the lower levels of cultural development and the comparative psychology of peoples of different cultures.*

A psychology of primitive man has not yet been created. (Vygotsky and Luria, 1930, pp. 58-59)

This essay, like the previous one, was of the character of a review, and I believe that the Central Asian expeditions were an attempt to perform the relevant work relating to the historical line of development: namely, and as is evident from the construction of the Central Asian studies, to



increase the resolution of the historical line of development and to demonstrate the steps between a primitive and a civilized man.

But the idea of development alone is not sufficient a platform upon which to build a significant research. There is a need also of a theory or a philosophy, which indicates the factors of development and helps to classify the different groups according to their developmental stage. Apparently, Luria found this theory in Marxism and, indeed, precisely in its vulgar form, which enjoyed popularity and party-state support during "the Great Turn".<sup>7</sup>

The influence of Marxism on the work of Vygotsky and Luria has been often commented upon (Joravsky 1989, 355-369; Yaroshevskii 1994; Graham 1998, 8-16; Eilam 2003). Theirs is usually described as a creative, sophisticated, complex or "academic" understanding of Marxism.<sup>8</sup> I cannot, and will not, deny this thesis here, and it is possible that the more mature Luria's work is fully consistent with this view. But I think that in this particular episode, it was vulgarly understood Marxism that has played the key role.

First, let's see how Luria defines the goals of the expedition in his foreign publications of the time:

The aim of the expedition was to investigate the variations in thought and other psychological processes of people living in a very primitive economic and social environment, and to record these changes which develop as a result of the introduction of higher and more complex forms of economic life and the raising of the general cultural level. (Luria 1931a)

This statement is largely consistent with the reality. We have two versions of the data on optical illusions, as presented in the tables above. These versions look like mirror images of each other. In one case the data presented from the most primitive category to the most cultural, and in the other in contrary order. This, apparently, is not an accident. If we look closer at the classification of the groups of subjects, two categories are immediately visible: primitives - "Ichkari" and "peasants" - living in the traditional socio-economic order, and those who are on the way to a civilized way of life that has already passed to the "socialist" form of social life. In each of these categories we can see a hierarchy. In primitive society, men, engaged in production, take a slightly higher position than women. In the second category, the more a person is involved in the institutions created during the "Great Turn", the higher his or her place in the scale of the transition from the primitive to the civilized person. To express this in Marxist terminology, changes in the socio-economic base lead directly and almost instantly to changes in mental life, which is a part of the superstructure.

In Luria's later texts devoted to this episode, this economic determinism is gradually replaced by the influence of "culture" and "education", though it is still present in the text to some extent (Luria, 1974, 19-28). In the "traditional" biography written by Luria's student, economic determinism is absolutely absent (Khomskaja 1992, 31-35). But such an account is not easy to understand, as Luria says that even those who are included in the most "progressive" categories have a very low level of education. Therefore, it remains a mystery, how such a low level of education influences, in a short time, complex mental processes.

Finally, a few words on statistics. The processing of statistical data presented by Luria does not meet the standards of statistical science. Of course, the statistics of the 1930s is far from that of today, but by the 1970s one could definitely do more than what Luria does. But at the same time we must remember two important points. First, statistics did not have a high position in the

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<sup>7</sup> By "vulgar Marxism" I mean the orthodox Marxism of the Second International, which is characterized by a mechanistic economic determinism. Its roots are mainly in the writings of K. Kautsky and G. Plekhanov. In Soviet Marxism, despite differences with orthodox Marxism, these ideas remained central. See the book on Marxism by B. Iu. Kagorlitskii (Kagorlitskii 2005).

<sup>8</sup> On the "academic Marxism" of the 1920s and 1930s, see the article by A. Dmitriev (Dmitriev 2007).

Soviet sciences of the 1930s. It is here sufficient to remember the criticism directed against standard tests in psychology and the use of statistics in genetics. Second, Luria himself often neglected the use of statistical analysis. As he writes in his autobiography, in his scientific approach were always present "romantic" elements together with "classical" ones (Luria, 1982, 172). Yet, as shown by Oliver Sacks (Sacks 1990), the "romantic" legacy was more important in Luria's scientific work. Luria preferred to see the objects of his research in all their diversity, uniqueness, and complexity; to acknowledge the impossibility of their reduction to something else or their quantitative understanding. It is in this context that one should consider Luria's attitude to statistics. In the letter to Köhler in December 1931, he wrote:

I write about these statistics (though I myself do not consider statistics very much) just because the results seem very remarkable to me.<sup>9</sup>

In his article, Sacks quotes from a letter that Luria addressed to him in 1973:

Frankly said, I myself like very much the type of "biographical" study, such as on Shereshevsky (*Mnemonist*) and Zasetki (*Shattered World*) . . . firstly because it is a kind of "Romantic Science" which I wanted to introduce, partly because I am strongly against a formal statistical approach and for a qualitative study of personality, for every attempt to find factors underlying the structure of personality. (Sacks, 1990, p. 184)

It is impossible to understand the experimental part of Luria's scientific work, without taking into account these words.

## Conclusion

Based on the foregoing, I conclude that Luria's experimental data on optical illusions does not hold water. The picture is not entirely clear, but it is obvious that both theoretical and ideological assumptions and specific scientific approach influenced Luria's attitude to the data obtained during the second expedition. Apparently, this attitude was the reason that the participation of Koffka in the expedition and the disagreements with him were glossed over, and why we received, many years later, a not entirely quite accurate version of the study.

We have not considered here the significance of the political criticism of the expeditions, and we certainly cannot completely deny its influence. But we can say with confidence that it was not the only cause of premature termination of this research project.

This small episode in the history of psychology shows us, once again, the extent to which science and ideology are closely linked. Not only in the case of so-called "pseudo-scientists", such as Trofim Denisovich Lysenko, but also in the case of recognized authorities of science, of which Alexander Romanovich Luria undoubtedly was and still is.

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<sup>9</sup> Original text: "Ich schreibe Ihnen über diese Statistik (obwohl ich selbst von der Statistik nicht sehr viel halte) nur weil mir die Resultate ganz merkwürdig scheinen."

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