

# Brunswik's original lens model

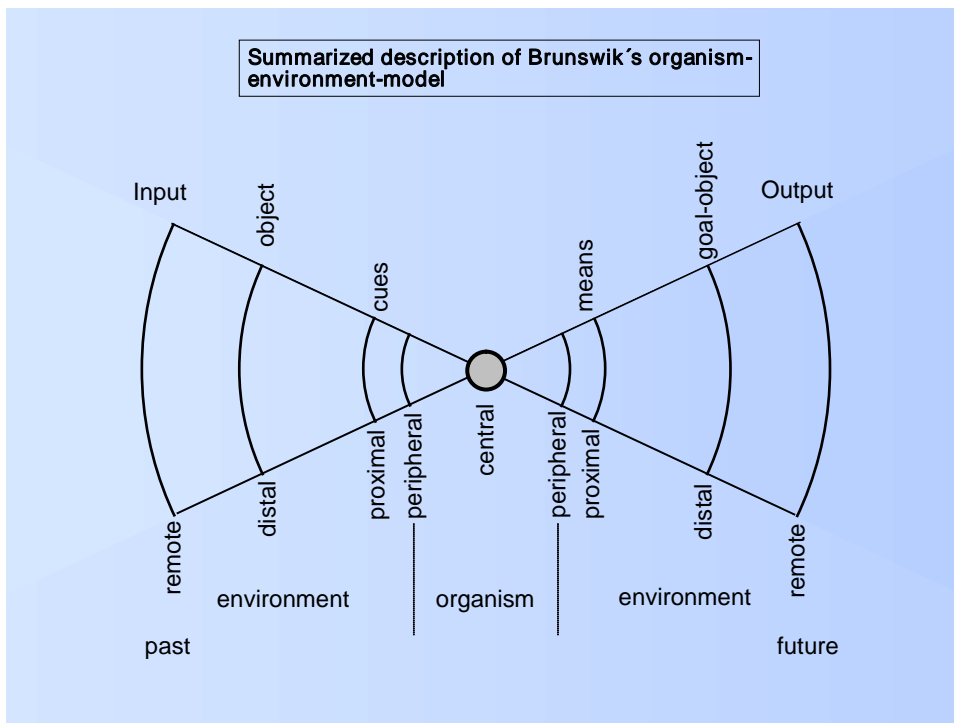
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The core idea of the lens model consists in ascribing the individual organism the critical ability to recognize a heterogeneous and intricate selection in the ecology on both the input and output side, by establishing new foci, or simply by ignoring some aspects. In the center of attention within this model is the selection of vital distal issues on the basis of cues, as handled by the "central unit of the organism".

In order to clarify the terms "input side" and "output side", the basic and neutral structural model by Brunswik (1939, 1952; Wolf, 2000) will be presented in a visual way (figure 1), as it categorizes both the organism and its environment.

Figure 1  
The structure model of organism and environment



The lens model should not be used independently of Brunswik's original intentions (1952, p. 20), but rather always on the foundation of all the process characteristics within his entire theoretical framework.

- In order for the lens to function, there must be non-determinist, probabilistic processes, or in other words some kind of dynamic activity.
- The organism therefore requires a lens (which in itself must be extremely open to various functions) in order to cope with the chaos of the environment.
- Without the lens, the web of equivocality would be incomprehensible; and even with the lens, it cannot be fully reduced to a simple univocality.
- In order to cope with the chaos, the equivocality, the mediation process itself must be flexible and tolerant toward ambiguity.
- The crucial achievement of the human lens consists in the ability to instrumentalize *vicarious functioning* (Wolf, 1999), that is the elaborate shifting between various different and influential contents and ways that are directed toward a single focus.
- The lens model affects both the divergent and the convergent parts (Brunswik, 1957, p. 22).
- In connection with the lens comes a stabilizing effect that works as a compensating balance and that is crucial for the ultimate goal: the survival (or any partial goal within this process) (Brunswik, 1943, p. 257f.).

### **The fundamental model of 1952: one lens**

The visual display of the (behavioral) processes within the lens contains:

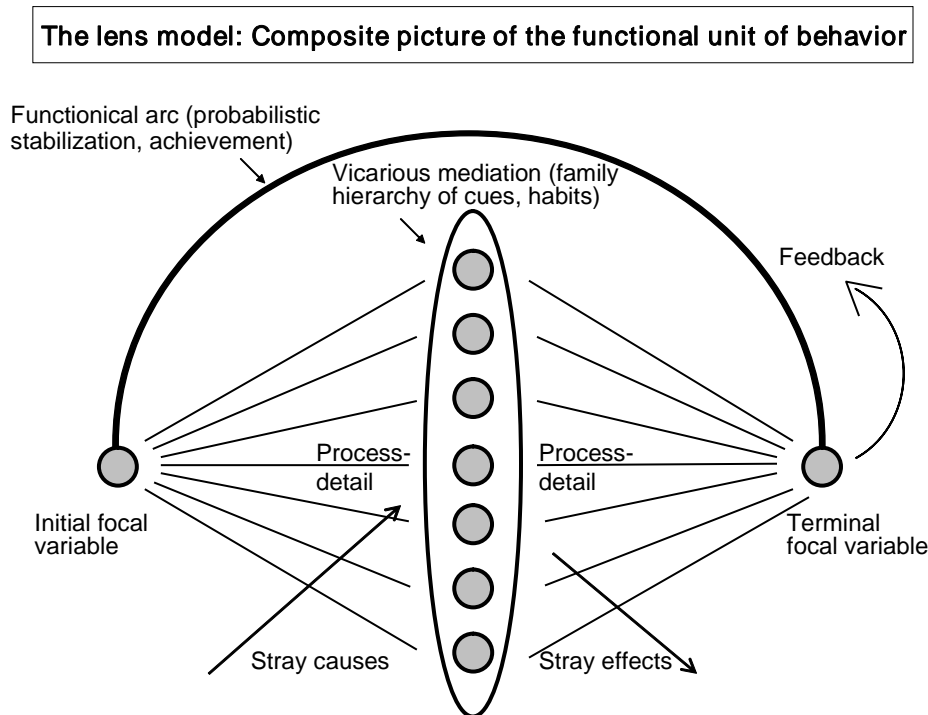
- The notion of focussing the given circumstances outside of the organism on both sides within the distal area (cf. Figure 1).
- The organism's concerted action to enable and maintain such focussing .

The core value of the lens consists in its ability to utilize various starting points, to then use interchangeable paths, and to finally reach one goal by following various strategies. *Vicarious functioning* and the lens model are connected in an inseparable way, because the lens represents a vital characteristic within this process (Wolf, 1999). The lens is the typical image for the organism's achievement.

The initial model which contained one lens shows the process of focusing within the distal areas on both sides of the organism and emphasizes the multi-layered process within the lens. Brunswik (1952, p. 20) describes his central depiction of the lens model (figure 2) with the following words:

„The total pattern involved, when viewed as a composite picture of numerous cases of individual mediation from initial to terminal focus, bears resemblance to a bundle of rays scattering from a light-source and brought to convergence in a distant second point by a convex lens. A generalized „lens model“ for stabilized functional units is shown (here) in figure 2. While correlation between the focal variables is assumed to be relatively high although in general not perfect, those of each focus with the single elements or chains of mediation may be low. A semicircular arrow is appended in the figure to the terminal focus to indicate that lens patterns do not stand in isolation but are apt to reflect back upon the organism in a future state in what is sometimes called a ‚feedback loop‘.“

Figure 2  
The original lens model (1952)



In this lens model, the contrast between the direct, univocal, functional arc and the multi-layered process of *vicarious mediation* is truly amazing: Both points of view lead to a double focus. Within the actual lens-process, the stray causes and the stray effects are striking. The feedback loop, which is only partly indicated, starts at the output-center and influences other regions of the man-ecology model; it is of great influence for the development of the lens-model. Hammond (1980, p. 6) also uses this basic model by Brunswik in his studies.

The following citations explain the importance of the lens model.

„Thus each class of behavioral achievement may be represented, when telescoped into a composite picture covering extended periods of time, by a bundle of light rays passing through a convex lens from one focus to another, with a scattering of the causal chains in the mediating layers (Brunswik, 1943, p. 258).“

„... the structure of the lens model as a ratiomorphic explication of achievement rather than merely ist reduction to physiology or physics. This model involves focal points, areas of unspecificity, mechanisms of substitution, and other devices of multiple mediation (Brunswik, 1955b, p. 237).“

„In terms of the lens model, this range (of vicarious functioning; B.W.) is comparable to the aperture of the pupil of the eye (Brunswik, 1952, p. 26).“

„Imperfections of achievement may in part be ascribable to the ‚lens‘ itself, that is, to the organism as an imperfect machine (Brunswik, 1952, p. 23).“

„We must reduce ‚from above‘, that is, starting from such high complexity functional units as the lens model (Brunswik, 1955b, p. 237)

Even before the succinct and impressive formalization of the lens model in 1952, this paradigm is used in an early study of perceptual psychology (Brunswik, 1949a, p. 191, figure 10). Even Brunswik’s postdoctoral thesis from his Vienna days 18 years prior to the „Conceptual Framework“ oeuvre (Brunswik, 1952) contains a preliminary prototype of the lens-model (Brunswik, 1934, p. 97, there figure 6).

### **Ecological validity – seemingly a deficit**

*Ecological validity* represents the necessarily extremely limited degree of the distal-proximal correlation on both sides of the organism (see figure 1). Brunswik introduces this concept in the following manner:

“The probability character of intra-environmental relationships, their limited ‘ecological validity’, becomes of concern in two regional contexts: on the reception or stimulus side as the equivocality of relationships between distal physical or social objects and proximal sensory stimuli or cues, and on the effectation or reaction side as the equivocality of relationships between proximal outgoing behavioral responses, or means, and their more remote distal results and effects” (Brunswik, 1952, p. 22).

“Ecological validity is a statistical concept based on the principles of contingency or correlation and requiring the coolheaded gathering of a representative array of information. In the general case it involves the integration of both positive and negative, confirming and disconfirming (misleading) instances of concomitance of the distal variable with the cue variable. Small wonder, then, that in the discovery of the limitations of ecological validity the more casuistic study of ‘exceptions’ to the rule comes first” (Brunswik, 1957, p. 16).

The correlation between proximal and distal variables, which is often rather low, can be used as an index for the ecological validity; it also shows the „insufficient evidence“ (Thurstone on perception) of every cognition.

The weak correlation coefficients are inconsistent with each constant-hypothesis between distal objects and proximal cues on the one side, and between proximal means and distal results on the other side.

The connections between the distal and the proximal parts (see figure 1), that is to say between the signified and the signifier, are so extremely ambiguous and contradicting that one must wonder if the organism should rightfully so use the proximal cue as its sole basis for the evaluation of the distal object. Cues and means can be misrepresented, artificially created and produced. One and the same distal object can present itself in various proximal events, while one single proximal event can express a variety of distal objects. Perception and – more broadly spoken – cognition are based rather on a contradicting than a univocal relationship between signifier and signified.

The main thought of the concept of ecological validity, that is the inevitable limitation, its preliminary character, as well as the fallibility of the interaction between man and his environment, was developed by Brunswik not only in a theoretical framework, but was also proven through a series of experimental studies. The human organism, however, tries to form the most possible smooth result within this situation of highly unfinished processes and the permanent existence of equivocality.

„Such a finding, if verified, would be in line with what should be expected on the ground of a perceptual compromise principle, since cues of low validity would then have to be given little weight by the organism in establishing the best bet. The writer is attempting an analysis of the environmental validities of the distance cues, present, absent, and misleading or contradictory ...“ (Brunswik, 1943, p. 260).

„A correlation between ecological variables, one of which is capable of standing in this manner as a probability cue for the other, may thus be labeled ‚ecological validity‘. The study of ecological validities, being bivariate correlational, defines what we may call a structural or textural ecology ...“ (Brunswik, 1955a, p. 199).

„It will be remembered that in our molar-functional view of organism-environment interplay, uncertainty is a feature of the relationships between the organism and the distal environment, to wit, of proximal-distal relationships in the case of ecological validity and of central-distal relationships in the case of functional validity“ (Brunswik, 1955a, p. 210).

The relationship between *ecological validity*, *vicarious functioning* (Wolf, 1999), lens, and its use can be outlined as follows.

“Vicarious functioning encompasses both the divergent and the convergent part of the lenslike patterns that characterize all achievement. In the field of cognition, it is the divergent part – ecological validity – which is ecological and the convergent part – utilization – which is organismic” (Brunswik, 1957, p. 22).

*Vicarious functioning* and *ecological validity* are connected in an reciprocal and inseparable way.

“One of the effects of this oversimplified picture of the ecology was a crippling of the scope of the problems of organismic strategy. These problems should be handled in close contact with those of ecological validity. Proper cognitive adjustment demands (a) that vicarious utilization of many cues be present when validities are imperfect, and (b) that hierarchy of utilization (relative strength in rivalry) follow hierarchy of validity. Neither vicariousness nor rivalry can thus be properly understood without the fact of limited ecological validity” (Brunswik, 1957, p. 22).

“In a perceptually well-adjusted organism or species, however, the rank order of utilization in what may be called the ‘or-assembly’ (cf. Brunswik, 1934: ‘Oder-Verbindung’ / “either-and/or” / “vicarious functioning) of cues, or the ‘cue family hierarchy”, should be the same as the order of their ecological validity” (Brunswik, 1949a, p. 190).

*Vicarious functioning* works as a means to cope with the problem of the low level of *ecological validity*.

“The low ecological validity of single cue variables is not entirely beyond remedy, however. It may be compensated for to some extent by the use of multiple systems of mutually substitutable, or ‘vicarious’, cues. (Brunswik, 1966, p. 488).

“Vicariousness is predicated upon limited ecological validity and in turn raises the problem of rivalry in utilization” (Brunswik, 1957, p.23).

“We had already encountered the purely ecological portion of the cognitive process when we spoke of the possibility of its equivocality and of the ensuing necessity facing the organism of having to compensate for this equivocality by the use of additional or ‘vicarious cues’. The degree of distal-proximal correspondence involved here may be labeled ‘ecological validity’. Just as the functional validity or correctness of judgment may be expressed by a correlation coefficient linking the central response variable with the distal variable, ecological validities may be expressed by correlations linking the proximal with the distal variable” (Brunswik, 1957, pp. 9-10).

One can assume that the environment in itself is faulty or in part unpredictable.

“Since the establishment of veridical distal environment relations is contingent upon the trustworthiness, or statistical validity, of cue-to-object relationships, and since this ‘ecological’ validity is in turn essentially limited by the erratic number of the environment, attainment of distal variables can never be better than probable. Environment-oriented objective functionalism thus is necessarily ‘probabilistic functionalism’” (Brunswik, 1949b, p. 60).

Even if the *ecological validity* is only of limited meaningful value, it still provides valuable clues regarding the relationship between man and his ecology. Within the limitations lays a great chance for the coping process of the organism.

„Extraction of semi-erratic yet stereotyped regularities of limited range of application and usually quite limited statistical dependability or ‘ecological validity’ is possible as a first approximation, thus saving on complexity and time at the expense of dependability“ (Brunswik, 1966, p. 488).

*Ecological validity* therefore does not describe a deficiency, but provides the organism with the valuable means for a successful interaction with the environment. The lens could not fully unfold its effectiveness without these imperfect, incomplete, and rather preliminary pieces of information.

### ***Functional validity* – the index of success, and the correct judgment**

The *functional validity* is an index for the performance by the organism, showing the complete, global extent of how the distal objects match both in the input and output area. The strength of the functional validity can be measured with the help of a correlation coefficient.

“It is for this reason that the concept of achievement or of cognitive ‘correctness’ must be defined in psychology in the generic terms of over-all statistical correlation between variables as classes rather than in terms of single hits or misses of judgment or of action. ‘Achievement’, in the sense of the probability for an initial focal event (say, a measured stimulus) to be followed by its terminal counterpart (say, the correct perceptual estimate), may, then, be defined as ‘functional validity’ and measured by a correlation coefficient” (Brunswik, 1952, p. 23).

„The wide-arching functional validity coefficient constitutes a generalized statement of the organism’s perfection in the attainment of a given distal variable“ (Brunswik, 1955a, p. 206).

The idea of a strong correlation-arc that connects and encompasses the distal foci on both sides by the power of the central unit of the organism (cf. figures 1 and 2) is typical for the concept of the *functional validity*.

„Its prime aspect would seem to bet he over-all correspondence between a certain distal and a certain central variable, so that the former could be considered successfully mapped into the latter. This first aspect we call cognitive ‚achievement‘ or ‚attainment‘, or also ‚functional validity‘ of the final response relative to the distal focus“ (Brunswik, 1957, p.8).

„A generic summary description of the degree of perfection of size constancy may again be sought in the correlation coefficient. This represents what may be called the ‚functional validity‘ or ‚achievement‘ (Leistung)“ (Brunswik, 1955a, p. 201).

However, the *functional validity* is by far not perfect for all cases.

„ ... such a probabilistic approach in terms of mapping of functional validities ist he only adequate approach to the problem of accuracy of achievement“ (Brunswik, 1957, pp. 28-29).

„ ... uncertainty is a feature of the relationships between the organism and the distal environment, to wit, of proximal-distal relationships in the case of ecological validity and of central-distal relationships in the case of functional validity; uncertainty is not seen as a necessary feature of intraorganismic processes“ (Brunswik, 1955a, p. 210).

„In an attempt at rational reconstruction of the ways of the quasi-rational, with ist reliance on vicarious cues each of which is of limited validity, one must best refer to a remark of Thorndike comparing the impressionistic or intuitive judge of men to a device capable of performing what is known to statisticians as multiple correlation. This is a device, related to what cyberneticists have called redundant communication, by which the probability of individual correctness may be increased but not perfected to the point of certainty“ (Brunswik, 1952, p. 24).

„However, while Brentano’s ‚intentional objects’ had to be classified above as derived from introspection and not checked by measurement, the ‚attained objects’ of thing-constancy research are independently constituted stimulus variables in the sense of physicists’ constructs which have been found statistically to correlate with the responses. It is in this manner that the old introspective-metaphysical question as to whether we ‚see’ the retina or the outside world can be given an operational meaning which is testable, in terms of ‚achievement’, by functional validity coefficients“ (Brunswik, 1952, p. 71).

Finally, we must consider the fact that an accurate localization of the object is limited by the preliminary character of the *ecological validity*, despite the chances and advantages of the equivocal mediation.

## Conclusions

- The starting point: Limitations due to the preliminary character of the ecological validity.
- At the same time: Richness due to the variety and the ideas provided by the same ecological validity.
- Thus: Within this contradiction lies both a weakness and a strength for the organism to unfold.

In every single individual and every organism the interaction of man and environment is regulated like a convex lens. On the one side, the way objects drift apart and scatter is maintained in its basic structure; on the other side, they are brought together in a way so that they are concentrated into focal aspects. The two most important focal objects lie within the distal input and the distal output, supplemented by the connecting focus of the “central unit of the organism”.

The achievement of the “central unit of the organism” to “activate” or to “generate” focal objects in the environment basically functions according to the scientific paradigm of the multiple correlation. However, other ways and research methods should be explored to explain the interaction with the environment and the various combinations within the individual. An additional approach could arise from applying Brunswik’s *representative design* (Wolf, 2005).

The process-characteristic “lens model” must be discussed in connection with the concepts of

- vicarious functioning,
- ecological validity, and
- functional validity



Today the label “lens model” is often used (and misused) in a great variety of contexts, in which the mechanisms and processes are partly or completely different from the original Brunswikian ideas (1934 – 1955) which were summarized here. These misinterpretations of the essence of the model must be avoided in the future. One should pay attention to the origins, to the basic ideas developed some decades ago if one wishes to understand and utilize the metaphor “lens” within the framework of 21<sup>st</sup> century research correctly. The “lens model” is still today a powerful concept but it must not be misused for unreasonable purposes, for “all and nothing”, at random. The process-characteristic “lens model” must be embedded into Brunswik’s general theory of probabilistic functionalism.

## References

- Brunswik, E. (1934). *Wahrnehmung und Gegenstandswelt. Grundlegung einer Psychologie vom Gegenstand her.* Leipzig und Wien: F. Deuticke.(Post-doctoral thesis).
- Brunswik, E. (1939). The conceptual focus of some psychological systems. *Journal of Unified Science (Erkenntnis)*, 8, 36-49.
- Brunswik, E. (1943). Organismic achievement and environmental probability. *Psychological Review*, 50, 255-272.
- Brunswik, E. (1949a). Systematic and representative design of psychological experiments. With results in physical and social perception (first 1947). In J. Neyman (Ed.), *Proceedings of the Berkeley symposium on mathematical statistics and probability* (pp. 143-202). Berkeley and Los Angeles: University of California Press.
- Brunswik, E. (1949b). Discussion: Remarks on functionalism in perception. *Journal of Personality*, 18, 56-65.
- Brunswik, E. (1952). The conceptual framework of psychology. (*International Encyclopedia of Unified Science*, Volume 1, Number 10.) Chicago: The University of Chicago Press.
- Brunswik, E. (1955a). Representative design and probabilistic theory in a functional psychology. *Psychological Review*, 62, 193-217.
- Brunswik, E. (1955b). In defense of probabilistic functionalism: a reply. *Psychological Review*, 62, 236-242.
- Brunswik, E. (1956). Historical and thematic relations of psychology to other sciences. *Scientific Monthly*, 83, 151-161.
- Brunswik, E. (1957). Scope and aspects of the cognitive problem. In J.S. Bruner, E. Brunswik, L. Festinger, F. Heider, K.F. Muenzinger, C.E. Osgood & D. Rapaport (Eds.), *Contemporary approaches to cognition* (pp. 5-31). Cambridge: Harvard University Press.
- Brunswik, E. (1966). Reasoning as a universal behavior model and a functional differentiation between "perception" and "thinking". In K.R. Hammond (Ed.), *The psychology of Egon Brunswik* (pp. 487-494). New York: Holt, Rinehart and Winston. (Originally paper at Montreal, 1954).
- Hammond, K.R. (1980). Introduction to Brunswikian theory and methods. *New Directions for Methodology of Social and Behavioral Science*, No. 3, 1-11.
- Wolf, B. (1999). Vicarious functioning as a central process-characteristic of human behavior. <http://www.brunswik.org>. Notes and essays.
- Wolf, B. (2000). The structure of the human world: Brunswik’s organism-environment-model. <http://www.brunswik.org>. Notes and essays.
- Wolf, B. (2005). Fundamental Principles of Brunswik’s Representative Design. <http://www.brunswik.org>. Notes and essays.

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