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# Charlotte Bühler's pioneering experimental study of infants' attitudes to novelty

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**Abstract**

From among Charlotte Bühler's (1893-1974) contributions to child-psychology, psychology of adolescence, life-span, and later humanistic psychology, this paper deals with experiments conducted by her team in the Twenties in Vienna, and recorded in two articles on «Affective Effects of Impressions of Strangeness in the first year of life» and «Two Main Types of Life Processes», neither translated from the German.[1]
Research originated in a common observation: infants' fear towards strangers, unfamiliar objects, unknown sounds... and purported to translate intuition into scientific empirically-based discourse.
The experiments were conducted in 1926-27 at the Vienna Adoption Center on infants, who were exposed to distorted human voices and rabbit masks that gave totally unfamiliar, or partly unfamiliar, or transformed auditory and visual stimuli.

Here is a summary of the experimental findings:
Partly unfamiliar stimuli patterns (e.g. distorted voice coming from familiar face) induce greater negative reactions than do entirely unfamiliar patterns, but these negative reactions reduce with age.
A contrasting sequence of stimuli (first familiar, and then unfamiliar) provokes the greatest negative reactions, which even increase with age.
After familiarization, or with increasing age, an affect that was initially negative may gradually yield to a positive one.
Positive reaction to a familiar stimulus does not increase indefinitely. After optimal familiarization, pleasure turns to indifference and boredom. At that point, the infant will actively seek novelty.

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1. All material in German has been translated into English by the author of this article.

From the last finding, Bühler was able to challenge Freud's homeostatic model as she ascertained that change to positive affect is caused by intentional behavior creating active tension, and not merely reactive behavior.
Bühler had anticipated later research by Berlyne and others into novelty, discrepancy, intrinsic motivation, and habituation.

*Keywords*: Charlotte Bühler, Infant psychology, Intentional processes, novelty, perception.

From among Charlotte Bühler's (1893-1974) contributions to child-psychology, psychology of adolescence, life-span, and later humanistic psychology, this paper deals with the experiments conducted by her team in the Twenties in Vienna, and recorded in two articles on «Affective Effects of Impressions of Strangeness in the first year of life» (Bühler, Hetzer & Mabel, 1928)[2] and «Two Main Types of Life Processes» (Bühler, 1928),[3] neither translated from the German.

In 1924, upon an invitation from the Rockefeller Foundation, Bühler acquired in New-York behavioral techniques –then little practiced on the Continent. Her first research on infant behavior and observation of emotions (Bühler, 1927) departed from the traditional reliance on baby biographies: «[She] pioneered the controlled experimental observations of infants, and she seems to have been the first investigator to have completed an experimental study of children's social attitudes in the first and second year of life» (Cairns & Cairns, 2006, pp. 135-6).

Back in Vienna, besides her work on adolescents' diaries, Bühler set out to create a unified scheme of psychological development from birth to early adulthood. In the Vienna Adoption Center, Bühler and Hetzer made round-the-clock observations of the behavior of 69 infants which gave rise to their «Inventory of the first year of life» (1927).[4]

Bühler's team addressed the issue of infant sensory perception in several experiments (Bühler & Hetzer, 1928; Löwenfeld, 1927; Hetzer & Wislitzky, 1930), and noticed early differential responses to auditory and visual stimuli.[5]

2. «Die Affektwirksamkeit von Fremdheitseindrücken im ersten Lebensjahr» in collaboration with Hildegard Hetzer and Francis Mabel, in *Zeitschrift für Psychologie*, *107*, 30-49.
3. «Zwei Grundtypen von Lebensprozessen» in *Zeitschrift für Psychologie*, *108*, 222-239.
   Both articles were reprinted by Graumann in 1973 and he indicated that their relevance was only belatedly recognized and that they could be termed classic works. A good factual summary in English of the first article can be found in Magai and McFadden (1995, pp. 126-128).
   On Bühler's overall contribution to infant research, Magai and McFadden are even more enthusiastic than Graumann. They deplore the fact that Bühler's infant research remained relatively unnoticed, and give two reasons for this neglect: first, Bühler went on to study adolescence and life span, and also her experimental work on infant affect remained untranslated.
4. Inventar der Verhaltungsweisen im 1. Lebensjahres. In C. Bühler (Ed.), *Soziologische und psychologische Studien über das erste Lebensjahr*. Jena: Fischer, 1927. There is an English translation from 1930: *The first year of life*. Magai and McFadden give an excellent brief presentation of the Inventory, on pages 124-126.
5. For all their experiments they used three behavioral categories which took affect into account: spontaneous; negative (i.e. movements away from stimuli); and positive reactions (i.e. movements toward stimuli).

Her ideas on the reactions of infants to familiar and novel stimuli originated in common observations: infants' fear (or interest) towards strangers, unfamiliar objects, unknown sounds... More specifically Bühler wanted to test William Stern's (1927) hypothesis that fear of novelty results from the conjunction of the unfamiliar with the familiar. Her research goal was to translate these intuitions into scientific empirically-based discourse.

The experiments on affective effects of impressions of strangeness were conducted during the 1926-27 winter semester in the City of Vienna Adoption Center on a population of healthy working-class children: groups of 2½ to 4½-month-olds; of 4½ to 6½-month-olds; and of 6½ to 8½-month-olds.

The unfamiliar stimuli were acoustic (distorted human voice) and visual (three-dimensional rabbit mask). These stimuli were chosen by Bühler's team because their own previous research had shown that the human voice and the human face bring forth specific positive reactions, e.g. the 'social smile', as early as the second month of infancy (Hetzer & Tudor-Hart, 1927). An additional advantage was the possibility of presenting the novel stimuli alone or in combination with the familiar ones: falsetto voice and normal voice; human face and rabbit mask. There were two other considerations: the stimuli must not be intrinsically frightening (no human mask, no loud voice) and they must still be recognized as novel by 8-month-olds.

In the Inventory were recorded categories of negative affect (and their objective indexes): expressions of fear (startled motions, twisted limbs, clenched fists...); signs of negative surprise (eyebrow movements, eyes and mouth wide-open, vocalization indicating displeasure...); active signs of displeasure (crying, frowning, restless movements of body and head...). Categories of positive affect (and their objective indexes) were: expressions of positive surprise (opening eyes and mouth...); signs of interest (head or eyes turning toward object or sound...); expressions of joy (smiling...).

In a first series of experiments, the children were exposed to a single unfamiliar stimulus, while the experimenter remained unseen: distorted human voice from behind a screen or rabbit mask held about 50 centimeters from the child's eyes for 30 seconds.

Whereas experimental results had recorded mainly positive affective responses to familiar stimuli, the unfamiliar stimulus elicited either reactions of quiet perception or negative responses (43%, 31%, 26% depending on age, with a negative peak in infants between two and four months of age).

A second series of experiments was designed to observe the effect of a partly strange stimulus (i.e. a distorted voice along with a familiar face; a mask over the face of a known person). Results showed that negative reactions to these were twice as high as those elicited by completely strange stimuli, but decreased with age, though more slowly.

A third series of experiments purported to answer a question raised by Hetzer and Mabel: What affect will be generated when the novel stimulus contrasts with a previously encountered familiar stimulus?

The study was conducted by covering the familiar face of the experimenter with a mask or turning the familiar voice into falsetto or bass for 30 seconds.

Results showed that unfamiliar stimuli presented after familiar ones have a far greater effect than simple unfamiliar stimuli, and the negative reactions even increase with age up to 8 months.

What exactly causes then those heightened negative reactions? Is it the sequence from familiar to strange? Or does change as such induce conflict?

To answer the question, other experiments were devised. In one, a familiar stimulus was followed by an unfamiliar one, and then a familiar stimulus. In another, unfamiliar was followed by unfamiliar, and then by familiar.

The findings showed that the altered experiments also caused heightened negative reactions, which would seem to indicate that change in itself is bewildering. Decrease with age did not occur. Bühler drew a tentative conclusion: younger children can process only one stimulus, and older ones apperceive transformation.

Further experiments tested the following hypothesis: Any object or event encountered for the first time will often elicit negative affect, but, through habituation, the novel stimulus will become familiar and cause positive affect.

In a protocol of reactions that are typical for the behavior of six-month-old children exposed to a falsetto voice in four successive exposures lasting 30 seconds each, a reaction expressive of negative affect yields gradually to a positive reaction.[6] Bühler pursued that if change from negative to positive reactions results from familiarization, then such a change cannot take place at a developmental stage when the child cannot 'learn' as yet, i.e. when unfamiliar stimuli remain unfamiliar. Failure to elicit positive reactions when she repeated auditory stimuli led Bühler to conclude that infants up to 1½ or 2 months of age can process only those stimuli into memory that relate to feeding situations.

Bühler and her team drew the conclusion that at the first encounter with a strange stimulus the psychophysical system seems to be overwhelmed. With repeated exposure to the unfamiliar stimulus, or with maturation and increasing experience, entirely new stimuli occur more rarely as the infant has become acquainted with more objects and situations. Ever more intense stimuli are needed to elicit strangeness or a disturbance in equilibrium.

Then comes an interesting reversal. The familiarized stimulus, now too easily assimilated after repeated exposures, gives rise to boredom, and at that moment curiosity and interest are redirected towards slightly novel stimuli. Infants would seem to strive for an intermediate level of novelty, i.e. 'partially unknown stimuli' (Bühler, Hetzer & Mabel 1928, p. 48; Bühler, 1967, p. 58).

In the second article, «Two Main Types of Life Processes» (1928), Bühler set out to demonstrate that two opposite processes are at work almost from the beginning of life: a 'reactive' life process (best observed in experimentations with sensory stimuli) and an 'intentional' one (best observed in exploratory behavior). Bühler saw the infant not as a passive recipient of stimuli

6. 1st exposure: cry of fear, movement indicative of displeasure lasting 35»; 2nd exposure: movement and vocalization indicative of displeasure (20»); 3rd exposure: listening, no vocalization that would indicate displeasure, signs of attention (15»); 4th exposure: interested gaze in the direction of the sound (15»).

from within itself or from the outside world, but as an active, discriminating organism.[7] She gives an illustration of intentional life processes by recounting an anecdotal experience. Once some attention-absorbing work is finished, people are left in a state of emptiness for a while. They «experience boredom urging towards activity, a specific unrest linked to non-fulfillment, to searching» (Bühler, 1928, p. 228).[8] Such behavior suggests that there must exist an intrinsic need for challenging tasks, a manner of 'curiosity drive' that impels to learning and action.

This is not to deny that external stimuli play a part, but for 'active tension' this part is secondary, as shown most clearly when environmental stimulation is actively sought. The child's behavior is selective and directed. The same holds for perceptive activity: infants master a situation through their intentional relation to the object. «They apprehend the stimulus in directing their attention to it and doing so, they transform the stimulus event into an action» (Bühler, 1928, p. 229).

Where can we see the two life processes at work with unfamiliar stimuli? The 'reactive process' appears best when an external stimulus weighs on the child who shows fear and tries to reduce tension by habituating to the stimulus. The 'intentional' process is best shown when the child recognizes the stimulus at the point of transition from unfamiliarity to familiarity, and when repeated encounters with known patterns of stimulation lead to boredom and to a positive interest in new variations.

Bühler further assumed in «Two Main Types» that just as this conversion from negative to positive reaction can take place through habituation trials, it can also result from development along with increasing age. So, she compared the four phases that are shown through habituation to the falsetto voice with the stages that occur in infant development. These stages had been noticed by Löwenfeld (1927), who had observed the reactions of seven-day to eight-month-old infants to various unfamiliar sounds (rattle, tuning pipe, hand clap, bell), all of medium intensity in the range of a human voice.

In Löwenfeld's experiments on first month infants as well as in Bühler's first habituation trial, there is evidence of shock reaction where the stimulus disturbs organic equilibrium, a process Bühler calls arousing 'passive tension'. With second month infants, or second trial, some relief of tension is achieved, and equilibrium is partly restored through familiarization. In the third month of life, or after the third trial, the eye movements of infants show that they actively search for the source of the sound. Such orientation of attention is 'active tension', which Bühler defines as «unrest linked with interest, an effort to apprehend, explore and somehow master its object» (1928, p. 225). Duration of reaction culminates at this stage. There is yet a fourth stage, starting at the fourth month of life, or after an additional repetition, when 'active tension' dissipates after the infant has gained playful, pleasure-inducing mastery of the

7. Bühler's work on thought processes (Bühler, 1918; and Bühler, 1919) undertaken in the ambit of the Würzburg School of Denkpsychologie had taught her that perception and action are twin aspects of intentionality. So, unlike the behaviorists of her time, she could infer that infant perception is not simply reactive, but intentional.
8. Karl Bühler used the term 'function pleasure' to denote the pleasure associated with tension in play behavior. Motivation is inherent to the activity itself (Bühler, 1924, [first ed. 1918], pp. 454-458).

stimulus. But, just as positive affect is reaching a peak, duration and intensity of interest are already decreasing since the stimulus is assimilated too quickly. So, the pleasurable phase (at which point Bühler's habituation trials were discontinued) is only short-lived, as it lies between the unrest of the third phase and the phase of boredom (observed by Löwenfeld) which will follow as soon as the task has become too easy. At about eight months, duration of reaction drops to its lowest level and affective reaction becomes neutral.

'Passive tension', which arises from external stimuli, is to be distinguished from 'active tension', which arises from intentionality directed towards a stimulus. The two forms of tension result in very different modes of affect. 'Passive tension' causes displeasure, which habituation can turn into relief of tension. 'Active tension' induces unrest, which turns into pleasure as soon as the stimulus is mastered. The very notion of 'active tension' is a challenge to Freud's drive-reduction model, where affect originates in the internal tension aroused by stimulation, and is experienced as displeasure, and discharge of tension is experienced as pleasure. Bühler does not seek to refute Freud's model, which she shows is at work when the infant's tension is soothed through habituation to the stimulus. But she adds that the build-up of 'active tension' can also lead to «pleasure obtained through mastery» (Bühler, 1928, p. 227).

Evidence of a 'curiosity drive' is clearest when 'active tension' arises out of boredom, and the child strives for novelty. Löwenfeld's experiments, which extended when Bühler's had left off, yielded additional experimental support to her contention that Freud's homeostatic drive-reduction model cannot entirely account for the child's play, curiosity, and exploratory behavior. Löwenfeld observed that pleasure diminishes after exposure to an optimum of familiarization, and then sinks to absolute indifference. At that point, «a hitherto unknown complication to the familiar stimulus, a new sensory impression, can rekindle the child's interest» (Bühler, 1928, p. 236). For instance, a child is bored listening to individual sounds, but will pay attention to bars of melodies.

How is one to account for novelty being sought for as a source of pleasure? Lessened vulnerability, habituation, and growing familiarization with stimuli can indeed explain why negative affective responses diminish and eventually become neutral; but these factors cannot account for the rise in curiosity for the unknown. That is why Bühler posits the existence of an independent positive factor she calls 'vitality'. 'Vitality' denotes non-reactive activities seeking novel stimulation directed towards mastering the environment and exploring a stimulus.

Thus an intentional process is superimposed on the reactive process. As long as the stimulus overwhelms the system and before intention is directed toward it, the dominant mode is reactive. To the extent that the infant's intentional behavior toward the stimulus increases, the system is no longer shocked by the stimulus but finds it appealing and actively seeks it. Both life processes take place simultaneously, but with increasing age the reactive process will be more and more replaced by the intentional process.

As behavioristic learning theory lost its status as the dominant theoretical system in psychology, there was in the late Fifties and early Sixties a renewed interest in internal processes that mediate experience and in the cognitive and perceptual processes of infants. An exponent of the new tendency, Berlyne, took Bühler's studies on infants (Bühler, Hetzer & Mabel, 1928)

as support for his own 'discrepancy theory' and as experimental confirmation of the intrinsic motivation of behavior change. In *Conflict, Arousal, and Curiosity* (1960), he set out to show that exploratory behavior, visual or manipulatory, is the expression of intrinsic motivation.

How much of this had been foreseen by Bühler?

According to her, a high degree of 'active tension' and the resulting pleasurable experience depend on a medium level of stimulation, between initial unfamiliarity and too well established familiarity with a given stimulus pattern: «after reaching an optimal level of familiarity with the stimulus, pleasure decreases» (Bühler, 1928, p. 236).

From finding an optimal level, Bühler might have extrapolated a discrepancy hypothesis of attention and affect. Hadn't she already pointed out that a sudden change in an otherwise familiar stimulus (such as the situation of infants confronted with a familiar caregiver speaking in a falsetto voice or wearing a rabbit mask) elicited intense negative reactions? And hadn't she already suggested that the «familiar in conjunction with the unfamiliar seems to be bewildering» (Bühler, Hetzer & Mabel, 1928, p. 24)? But Bühler went only so far as to form the notion that incongruity or discrepancy might be the basis for infants' negative reactions. Only much later did Berlyne give the notion a definitive formulation: In the case of a novel stimulus pattern, not novelty in general, but «novelty in comparison with a particular set of previous experiences [...]» entails 'subjective uncertainty' since the reaction which the novelty pattern arouses «includes some of those associated with the familiar patterns as well as other reactions with which these are incompatible» (1960, pp. 21-22).

As Berlyne commented on Bühler's studies, passing from negative to positive affective reaction is linked to previous learning that built up experiences, since the child has formed more and more familiar schemata with which any auditory or visual stimulus can be compared (Berlyne, 1960, p. 205).

Berlyne also relied on Bühler to find support for findings about extreme discrepancy. Bühler's 'partially strange' stimulus patterns create incongruity and elicit higher degrees of fear or negative surprise, since they are both familiar and discrepant enough to prove incompatible with past experience. Even more severe fright reactions were observed by Bühler's team when a sudden change in stimuli occurred as noted in the first series of experiments.

So, there are, as we can see, interesting continuities between Bühler's and Berlyne's approaches to novel stimuli. Berlyne's idea of an intrinsic motivation inherent in 'subjective uncertainty' or 'incongruity' due to information processing arising from 'collative variables' seems related to Bühler's 'active tension' resulting from the infant's engagement with the world or with relatively novel stimulus situations. 'Active tension' is the arousal produced by intentional processes, such as seeking stimulation or processing moderately novel stimuli. This build-up of tension can be pleasurable, and, with maturation and increasing perceptual and cognitive experience, infants can thrive on increasing amounts of novel stimuli.

Pleasurable 'intrinsic motivation' corresponding to Bühler's 'active tension', and with reference to her, was posited as inherent in exploratory activities (Berlyne, 1960, p. 176 and pp. 204-5), in information processing and action (Hunt, 1963, p. 84), in activities involving effective interaction with the environment (White, 1959, p. 315). Intrinsic motivation is also

present in a particular affective state known as 'flow', namely the experience of joy that accompanies a challenging activity (Csikszentmihalyi, 1975). All these approaches reacted against the limitations of the homeostatic drive-reduction model, where all activities are viewed as aiming at reduction of drives.

The suggestion that infants' intentional solving of perceptive novel tasks is associated with the build-up of active tension, was something Bühler herself later developed in arguing for 'expansive activity' as one of her four motivational tendencies which shape the course of human life (Bühler, 1951, pp. 322 and 327; Bühler, 1959, p. 565).

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