Alfred Binet and the Children of Paris

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Alfred Binet was born in 1857 to a wealthy but troubled French family. His father, a physician, and his mother, an amateur artist, divorced when he was a child, and he grew up in his mother's household. Family resources afforded him an excellent private school education in Nice and later Paris. He distinguished himself in French composition, but his academic record was otherwise unremarkable (Siegler 1992; Wolf 1964). Binet's career path appeared desultory and unpromising at first. In 1878, he earned a law degree from the University of Paris, but never expressed any real interest in the field. He would later call law "a career for those without any [yet] chosen vocation" (Binet 1904a, p. 14). Next he attempted a medical degree at the Sorbonne in Paris, but he was profoundly distressed by the trauma and gore he witnessed in the operating room, to which he may have been especially sensitive owing to a childhood experience in which his father forced him to touch a cadaver.[1] He suffered an emotional collapse and dropped out of medical school at age 22 (Fancher 1985).

Following his psychological breakdown, Binet spent considerable time resting and reading among the peaceful stacks of the National Library of France in Paris. While browsing books on psychology, he discovered some ideas in which he could at last become genuinely and passionately invested. He first became intrigued by psychophysical experiments involving tests of two-point sensation thresholds, and he replicated some of the published experiments using himself and some friends as subjects. He concluded from his own results that extant theories about sensation thresholds should be modified, and he published a paper outlining his suggested corrections (Binet 1880). The article was well written and cogently argued, but unfortunately it was also fueled by naïve enthusiasm. The ideas Binet put forth as his own had in fact already been published—in much more sophisticated form—by a respected Belgian physiologist by the name of Joseph Delboeuf (1831–1896). Delboeuf responded by publishing a humiliating critique of Binet's article (Delboeuf 1880; see also Fancher 1985; Wolf 1964).

Undeterred, Binet continued to read about psychology and to publish articles independently,

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[1] Binet told the story of touching the cadaver in 1911, indicating that this distressing experience had happened to one of his "friends." Compelling circumstantial evidence suggests that he was really talking about himself (see Wolf 1964, pp. 762–763).

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leading one biographer to dub him a "library psychologist" (Siegler 1992, p.180). He was most interested in English associationists like John Stuart Mill (1806–1873), Herbert Spencer (1820–1903), and Alexander Bain (1818–1903), but he was also influenced by Hippolyte Taine's (1828–1893) philosophical treatise *On Intelligence* (1870/1872) and Théodule-Armand Ribot's (1839–1916) treatments of English and German psychology (Foschi and Cicciola 2006). Mill was Binet's particular favorite, and he would later refer to him as "my only master in psychology" (Binet 1903, p. 68). Binet's second publication forwarded Mills' associationism as an all-encompassing explanation for the operations of the intellect (Binet 1883), but here again he was overconfident. Associationism was already beginning to lose its cachet, and prominent psychologists were routinely acknowledging its inability to account for motivational or unconscious influences (Fancher 1985). Binet eventually realized these deficiencies of associationism, but he never abandoned it completely. Indeed, his associationist roots would later be evident in his greatest achievement, the Binet-Simon Intelligence Scale (1905).

In 1883 Binet's independent means made it possible for him to volunteer his time assisting the eminent neurologist Jean-Martin Charcot (1825–1893) with his research at the Salpêtrière Hospital in Paris. Charcot was interested in hysteria, a baffling syndrome in which female patients experienced paralysis, loss of sensation, seizures, and memory loss, with no apparent neurological cause. Whereas some physicians attributed these cases to malingering, Charcot believed that the patients experienced these symptoms as real (Fancher 1985). Charcot's associated interest in hypnosis grew from the finding that some of the same "symptoms"—paralysis, amnesia, dramatic fits, and so on—could be induced through hypnotic suggestion. Therefore, the study of hypnosis offered promise in understanding the underlying causes of hysteria (Fancher 1985).

Binet assisted Charcot in hypnosis studies of hysterical patients. One particular responsibility was Blanche Witman, an intense and melodramatic young woman who was known in the wards as "The Queen of Hysterics." Ms. Witman could be relied upon to follow the three-stage hypnotic pattern of lethargy, catalepsy, and somnambulism that Charcot believed was definitive of major hypnotism. Charcot and Binet saw this easy susceptibility to hypnotic states and consistent pattern of responses as an indication of her underlying hysterical disorder. Indeed, Charcot believed generally that susceptibility to hypnosis was an indication of an underlying hysteria. This conclusion would later turn out to be incorrect (Fancher 1985).

In a series of related experiments with Ms. Witman, Binet and another of Charcot's assistants, Dr. Charles Féré (1852–1907), discovered that they could reverse or transfer Ms. Witman's behaviors under hypnosis simply by reversing the polarity of a large horseshoe magnet. For example, if Ms. Witman seemed to be paralyzed on her right side, they could transfer the paralysis to the left by reversing the magnet. They found that they could transform the expression of an emotion, such as sobbing, to its inverse (laughing) through the same mechanism. Binet and Féré were fully convinced by Charcot that deeply hypnotized people were not aware of their surroundings, so they did not consider the possibility that their patient might be attending to the magnet or related experimenter cues. In a series of articles (Binet and Féré 1885a, b, c), they attributed the magnet findings to the existence of complementary human emotions, akin to complementary colors which produce white or black when mixed (Fancher 1985).

Unfortunately for Binet, his first critic, Joseph Delboeuf, also had a side interest in hypnosis. Delboeuf respected Charcot and was ready to accept his theory of major hypnosis, but he was skeptical of the magnet findings—especially so when he saw Binet was one of the paper authors (Fancher 1985). Curious, Delboeuf visited the Salpêtrière hospital and saw immediately that Ms. Witman was aware of the magnet and was undoubtedly yielding—consciously or unconsciously—to the desires of Féré with whom she seemed to have a particular rapport. When Delboeuf undertook the same experiments under more carefully controlled conditions, he discovered that both the magnet

findings and Charcot's theory of major hypnosis were invalid (see Delboeuf 1886). Binet was at first reluctant to accept Delboeuf's evidence, and a heated public exchange ensued (Binet and Delboeuf 1886). However, Binet eventually acknowledged the "loopholes for error" which had "pervert[ed]" interpretation of his study results (Binet 1896/1977, p. 76). This proved to be an essential lesson for Binet, and he was ever afterwards aware that psychological tests will always contain some degree of error. His willingness to acknowledge and work within the constraints of this fact has been called by one scholar "[perhaps] Binet's greatest contribution" to intelligence testing (Kaufman 2009, p. 22).

Following this major career setback, Binet left the Salpêtrière, and it took more than a year to find another position. Fancher (1985, p. 57) notes that under the circumstances, it is not surprising that "prospective employers did not come flocking to his door." However, he eventually connected with the director of the new Laboratory of Physiological Psychology at the Sorbonne, and he willingly accepted Binet's offer to work there, as he had done at the Salpêtrière, without compensation. He served there as a researcher and assistant director and ascended to become the laboratory's director in 1894. He held this unpaid position until he died in 1911 (Fancher 1985; Siegler 1992.)

Binet's early career may be characterized as a series of productive false starts. He made mistakes, to be sure, but in the process he gained skills and dispositions that would prove enormously beneficial in his future intelligence work. From the hypnosis debacle, he learned the importance of careful attention to experimental controls. But he also learned to appreciate the advantages of the detailed case study approach to research. This distinguished him from contemporaries like Francis Galton (1822–1911) and James McKeen Cattell (1860–1944), who favored generalizations based on large sample sizes. This appreciation of the uniqueness of individuals convinced Binet that measuring psychological variables was a far more complex and nuanced process than other intelligence researchers had so far been willing to acknowledge (Fancher 1985). His time at the Salpêtrière also allowed Binet's passive associationist psychology to mature into a sophisticated theory that recognized the active role of human attention, as well as the importance of innate and hereditary factors in determining one's makeup (Fancher 1985).

Binet and Experimental Child Psychology

Binet's curiosity was unbounded, and he produced many other significant acts of scholarship while working with Charcot at the Salpêtrière. His publications during this time included three books and more than 20 articles exploring a wide variety of subjects. Among these were the psychic life of microorganisms (Binet 1887a), sexual fetishes (Binet 1887b), and the nature of human consciousness (Binet 1890a). He also developed an interest in the natural sciences, eventually earning a Ph.D. for a dissertation on the anatomy and physiology of the subintestinal nervous systems of insects (Binet 1894). The birth of his daughters, Madeleine (b. 1885) and Alice (b. 1887), provided an avenue to study child psychology, and in 1890 he published three articles describing experiments he conducted using his girls and their friends as subjects (Binet 1890b, c, d). This emerging interest in the psychology of children evolved into Binet's new career as an experimental child psychologist (Fancher 1985).

Binet derived his first experiments with Madeleine and Alice from Galton and Cattell's psychophysical tests of reaction times and sensory acuity, which up to this point in history represented the state of the art in intellectual testing. He noted that on average, his young subjects reacted to stimuli much more slowly than did adults but also that they were far less consistent in their performances; a child's reaction time might be on par with the typical adult in one trial and substantially slower in the next. Binet deduced that the salient difference between adults and children, then, was not really the reaction times but rather the children's limited ability to sustain attention during the trials. This insight about the importance of attention proved to be

fundamental to the eventual development of his intelligence scale (Fancher 1985).

Binet's psychophysical tests of color perception also yielded interesting results. Child subjects were much slower than adults in naming colors, and this outcome might have been used to support the hypothesis that children had less developed sensory acuity than adults. However, when Binet asked the child subjects to match colors, they were nearly as fast as the typical adult. From this Binet concluded that seeming adult-child differences in color perception were in actuality methodological artifacts resulting from differences in language development—the kids could see the differences; they just could not *say* them fast enough. Binet eventually lost faith in psychophysical testing as a reliable and valid measure of intellectual ability and determined that more complex, language-based tasks were needed to discriminate child from adult intellectual capacity (Fancher 1985).

Binet advanced his understanding of the importance of language development by asking his children and their friends to define common words. He discovered that children typically responded by providing concrete, functional examples of how the items were used rather than the abstract dictionary-type definitions most adults provided. For example, a knife was defined as "to cut meat." The definition of snail was "squash it." From this adult-child difference, Binet concluded that the ability to think in abstract terms must somehow be important to the development of human intelligence (Binet 1890b; see also Fancher 1985). He continued to study his children, retaining some of the Galtonian psychophysical tasks and also including tests of memory, judgment, imagination, and inkblot interpretation, as well as qualitative impressions about their temperaments and personalities. He published these results in book form in 1903 (Binet 1903).

Other aspects of human intellectual development also caught Binet's attention during these early years at the Sorbonne. He expanded his subject pool to include children in the local schools, undertaking studies of memory and suggestibility. He discovered that both accuracy of children's memories and their ability to resist the influence of experimenter suggestion improved with age (Binet 1900). He also initiated several in-depth case studies of people with extraordinary abilities and accomplishments, such as chess prodigies and mathematical wizards (Binet and Henneguy 1894) and eminent French authors (Binet and Passy 1895). From these, he determined some unanticipated facts about the human intellect. First, there are many ways of becoming extraordinary; the great writers and math and chess prodigies approached their cognitive tasks in a variety of ways. Second, for the most part, these extraordinary individuals were quite ordinary in domains other than one particular narrow area of excellence. Binet recognized these findings as important evidence of the complexity and heterogeneity of intellectual operations (Fancher 1985). The psychophysical testing that had dominated the field to this point would never be able to tease out these kinds of nuances. New methods for testing individual differences in intellectual functioning had to be developed.

Binet and Individual Psychology

However valuable the in-depth case analyses Binet cut his teeth on, he also recognized that these long investigations were not always practical. Psychologists needed to be able to compare intellectual functioning quickly along some standard dimensions, preferably in one sitting. His prior research had illuminated the vulnerabilities of psychophysical testing, so the relatively fast methods he sought would have to test higher-order cognitive processes. Binet and his research assistant, Victor Henri (1872–1940), identified 10 candidate variables for measurement: (1) memory, (2) imagery, (3) imagination, (4) attention, (5) comprehension, (6) suggestibility, (7) a esthetic sentiment, (8) moral sentiment, (9) muscular strength and willpower, and (10) motor ability and hand-eye coordination. The last two variables resonated with earlier psychophysical testing approaches, but as conceived they were more complex than standard tasks of that kind. The other eight variables were refreshingly origi-

nal in flavor (Fancher 1985). Binet named this new approach "Individual Psychology" (Binet & Henri, 1986).

In 1899, a young medical student named Théodore Simon (1873–1961) contacted Binet and requested an opportunity to work with him. Binet did not need another assistant, and he was inclined to refuse the offer. However, Simon had recently obtained a medical internship working with approximately 300 abnormal children[2] at the Perray-Vaucluse asylum, near Paris, and Binet found the opportunity to apply Individual Psychology with this special population very attractive. He accepted the offer of help and trained Simon to use his testing techniques.

Simon returned to Perray-Vaucluse and spent the next several months engaged in psychological testing. These data would later become his doctoral thesis in medicine (Wolf 1961). Unfortunately, the results of Binet's Individual Psychology research program were largely disappointing. In a 1904 paper, Binet reported that they had failed to produce a valid and discriminating psychological test that could be administered in a short period of time. The in-depth case study, it seemed to him, was still the most promising approach to individual psychology (Binet 1904b; see also Fancher 1985). However, in short order Binet would be offered a challenge that would change his mind.

Binet Invents the Intelligence Test

By the early part of the twentieth century, French national laws had begun mandating public school education for all children, including children with mental disabilities, who had previously been excluded entirely or permitted to drop out early from schooling. In 1904, officials of the French government asked Binet to join a distinguished commission of experts who could provide insight and leadership regarding the education of these special cases. Binet's Individual Psychology research, his publication record, and his particular experience with Simon's institutionalized children uniquely qualified him for this undertaking. He immediately recognized the need for a diagnostic system that could identify those children who could benefit from special education classes and, just as important, prevent intellectually normal children from being misdiagnosed (Binet and Simon 1905a). One year later, he had one: The Binet-Simon Scale, the world's first modern intelligence test (Binet and Simon 1905b). In a 1909 book, Binet described the enthusiasm with which he approached this work:

> There is nothing like necessity to generate new ideas. We undoubtedly would have retained the status quo…if a matter of true social interest three years ago, had not made it mandatory for us to measure intelligence by the psychological method. It had been decided to try to organize some special classes for abnormal children. Before these children could be educated, they had to be selected. How could this be done?…It was under these circumstances that our devoted collaborator, Dr. Simon, and I formulated a plan for measuring intelligence. (Binet 1909/1973, pp. 104–105)

The definition of "intelligence" is a difficult thing to pin down even in the twenty-first century (Plucker and Esping 2014), and Binet and Simon were working from scratch. They began by looking for evidence of what might now be termed "face validity"—that is, by recruiting groups of children who had previously been identified by experts as being obviously intellectually normal or clearly subnormal in their intellectual functioning. Drawing on their earlier work in Individual Psychology, Binet and Simon administered a variety of tests to both groups, with the expectation that some of these tests might plainly differentiate normal from subnormal children. In choosing their tasks, the researchers were particularly careful to avoid items that might rely heavily on formal education, as they wanted their tests to show evidence of psychological functioning, not educational attainment. This remains an essential goal of intelligence testing to the

[2] The language used to describe intellectual and developmental disability in the late nineteenth and early twentieth centuries included the (now offensive) terms abnormal and feebleminded and the clinical labels moron, imbecile, and idiot. Binet preferred the term *débiles* ("weak ones"). The person-first language considered respectful in the twenty-first century (e.g., "persons with intellectual disabilities") was unheard of.

present day (Kaufman 2009). As one means of accessing higher-order processes, they chose to include some questions about typical life within the French cultural context. They believed that it was safe to assume that even poor children of normal intelligence would have reasonable familiarity with this kind of information (Fancher 1985).

Binet and Simon's first attempts at differentiating intellectually normal from subnormal children were unsuccessful. There were able to find important differences in average performance on the tasks, but they failed to find any set of items that only the normal children could solve. There was always overlap, with some normal children failing tests that some subnormal children passed. The "aha!" moment came when the researchers recognized one essential difference between the two groups: the normal children were able to respond to the tasks correctly at an earlier age than the other group. It was critical to take age into consideration when scoring (Fancher 1985).

Armed with this insight, the researchers created a series of tasks of increasing complexity. Some of the simplest test items assessed whether or not a child could follow a lighted match with his eyes, take a candy out of a wrapper, or shake hands with the examiner. Slightly harder tasks required children to point to various named body parts, repeat back a series of 3 digits, repeat from memory a 15-word sentence, and define words like *house, fork*, and *mama*. More difficult test items required children to state the difference between pairs of things, reproduce drawings from memory, and construct sentences from three given words such as *Paris*, *gutter*, and *fortune*. Some of the hardest items asked children to repeat back seven random digits, find three rhymes for the French word *obéissance*, state the difference between abstract concepts like *sad* and *bored*, and answer questions such as, "My neighbor has been receiving strange visitors. He has received in turn a doctor, a lawyer, and then a priest. What is taking place?" (Fancher 1985; Kaufman 2009).

The scale was revised in 1908 and 1911. The newer versions were developed with larger sample sizes, greater age, and socioeconomic ranges, and items calibrated such that they could be "located" at ages where typical children started to complete them successfully (Binet 1911; Binet and Simon 1908). For example, a 10-year-old child who completed all the tasks usually passed by 10-year-olds—but nothing beyond—would have a mental level that exactly matched his or her chronological age, 10.0. Children who attained a mental level 2 or more years behind their chronological age—e.g., a 10-year-old child with a mental level of 8—were generally diagnosed as being mentally subnormal, providing that they were otherwise healthy and motivated when they took the test.[3] This diagnosis was applied to approximately 7 % of the students who were tested (Fancher 1985).

The creation of the Binet-Simon Scale marked the development of a completely revolutionary approach to the measurement of human intellectual functioning. Rather than relying on simple measures of reaction time and sensory acuity, Binet and Simon's test purported to measure higher-order processes such as memory, language, and attention. In particular, however, the researchers believed that their scale measured the subjects' capacity to exercise judgment. Although conventional academic wisdom purports that Binet and Simon did not have a clear definition of intelligence guiding their work, they were rather clear about their conceptualization of the construct:

> [I]n intelligence there is a fundamental faculty, the alteration or the lack of which, is of the utmost importance for practical life. This faculty is judgment, otherwise called good sense, practical sense, initiative, the faculty of adapting one's self to circumstances. A person may be a moron or an imbecile if he is lacking in judgment; but with good judgment he can never be either. Indeed the rest of the intellectual faculties seem of little importance in comparison with judgment. (Binet and Simon 1916/1973, pp. 42–43)

[3] Binet and Simon were keenly aware that physical problems could mimic psychological ones. Their experience at the laboratory school they set up revealed that 5 % of students experienced academic problems merely because they could not see the blackboard (Binet 1907).

Mental Orthopedics

In 1905, Binet submitted a report in which he outlined his recommendations for special education pedagogy. He was optimistic about opportunities to help subnormal children improve their intelligence, and he strongly disavowed the popular notion that intelligence should be viewed as a fixed and immutable quality. He later stated the case this way:

> I have often realized, with great sorrow, the existence of frequent prejudice against the educability of intelligence. The well-known proverb that says: "When one is stupid, it is for long" seems to be taken literally by some teachers … they don't care about less-intelligent pupils, they don't nourish any liking or respect towards them … Intelligence is not a unique, indivisible function, a particular essence, but it's made up of the cooperation among all the minimal functions of discrimination, observation, retention, etc., whose plasticity and extensibility have been verified … As a consequence, intelligence is susceptible t development; through exercise, training, and, above all, method, one will be able to increase one's attention, memory, judgment, and to become literally more intelligent than before. (Binet 1909/1973, pp. 100–102)

Binet developed a series of cognitive exercises he called "mental orthopedics," which he believed could raise children's intelligence. A particular focus of these exercises was improving the subjects' capacity to pay attention, since this seemed to be fundamentally lacking in many children of low intelligence. For instance, he advocated for the use of fun games like "statue" in which children had to freeze until they were permitted to move (Binet 1909/1973; see also Fancher 1985). In 1907, he set up three experimental special education classes where mental orthopedics could be practiced. (The law mandating special education would not go into effect for 2 more years.) It is notable, however, that he also advocated for educating intellectually normal and subnormal children together. He believed that this practice would provide positive models for the slower-learning children and healthy opportunities for the faster-learning children to exercise virtues of duty and solidarity (Binet 1909/1973 Binet and Simon 1908; see also Foschi and Cicciola 2006).

The Binet-Simon Scale Comes to the United States

The ultimate popularity of the Binet-Simon Scale owes a large debt to the actions of the American psychologist Henry Herbert Goddard (1866–1957). One year after Binet and Simon published the first version of their intelligence test, Goddard accepted a position as Director of Research at the Training at a school for feeble-minded children in Vineland, New Jersey. The United States did not possess a uniform system for defining, diagnosing, and classifying intellectual disability, and most educators and physicians depended on a highly subjective and unreliable "we know it when we see it" approach. Goddard was fairly confident in his own judgment in these matters, and he was convinced that most people who worked closely with disabled persons could also be relied on to make "rather accurate" intuitive judgments (Goddard 1908b, p. 12). However, as a scientist, he would have preferred an objective method, had one been available. But the major steps recently taken in France had not yet made their way across the Atlantic (Zenderland 1998).

For the next 2 years, Goddard experimented with several unsuccessful approaches to mental testing. In 1908, he took an extended trip to Europe to seek counsel with experts there. On one of these visits, he met a Belgian physician and special educator named Ovide Decroly, who shared a copy of the Binet-Simon Scale. Intrigued, Goddard brought the test back to the United States and tried the tasks with the students at the Vineland school. He discovered that the mental levels of the children generally corresponded to the intuitive judgments made by himself and the other members of the Vineland staff, thus providing evidence of criterion validity (Goddard 1908a). Soon thereafter, the American Association for the Study of the Feeble-Minded tentatively adopted Goddard's classification system as "the most reliable method at present in use for determining the mental status of feeble-minded children" (Rogers 1910). With this adoption, Binet's

approach to intelligence testing became firmly entrenched in American society (Zenderland 1998). Over the next few years, Goddard distributed 22,000 copies of his English translation of the Binet-Simon test (Fancher 1985). It is an irony of history that the Binet test did not become popular in France until the mid-1900s, when a French social worker who had spent time in the United States brought a US version of the test back to France (Kaufman 2009; Siegler 1992).

The Binet Tests and US Immigration Restriction

Between 1890 and 1910, approximately 12 million immigrants attempted to enter the United States through the Ellis Island Checkpoint. Immigration critics warned that this generation was "less educated, more impoverished, and more culturally 'alien' than earlier groups of immigrants" (Zenderland 1998, p. 263). To allay fears, Congress passed an 1882 law prohibiting "idiots" and "lunatics" from passing through the gates. The law expanded in 1907 to include "imbeciles," feebleminded persons, and persons with physical defects that might prevent them from sustaining themselves through respectable employment (Zenderland 1998).

Goddard and his team were invited to Ellis Island to help enforce these regulations; the Binet-Simon Scale proved central to his task. The procedure Goddard developed in 1912 was a two-step process: one assistant would visually screen for suspected mental defectives as the immigrants passed by (using the intuitive judgment purportedly developed through close contact over many years). Those who appeared suspect would then proceed to another location where the other assistant would test them with a variety of performance measures and a revised version of the Binet Scale. The number of immigrants who were deported increased exponentially as a result of these screening measures (Zenderland 1998).

Binet's Influence on Future Intelligence Tests

Binet contracted an illness and died in 1911 at the age of 54. His premature death cut short a prodigious career in its prime. Even so, the legacy he left is staggering in its influence. Aside from the unparalleled accomplishment of the 1905 test and its subsequent revisions, Siegler (1992) notes the importance of Binet's willingness to discuss frankly the virtues and limitations of his scale, and his progressive ideas about the malleable nature of intelligence. These remain hot topics in the present day. His careful attention to empirical evidence—learned the hard way through embarrassing experiences in Charcot's laboratory—distinguished him from contemporaries, like Goddard, who were more comfortable trusting subjective expert judgment. The Binet-Simon Scale has been translated into dozens of languages and revised and adapted countless times by intellectual heirs who appreciated the originality and utility of the tasks. Even though more recent approaches to intelligence theory and testing vary considerably in their theoretical orientations and in their approaches to testing, many of the items on Binet's original scale have stood the test of time (see, e.g., the enduring popularity of the Stanford-Binet assessments) and would seem familiar to twenty-first-century test takers and psychometricians.

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