

**Reflections on Real Presence by a Virtual Person**

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submitted for publication consideration to the journal of Presence: Teleoperators and Virtual Environments*Perfectly mediated sensory stimuli do not automatically induce continuous presence.*

Presence research has emphasized engineering the senses more strongly than engineering the mind. We look for ways technology can more closely approximate human sensory experience, then examine the impact of those technologies on presence, extending understanding of human perception and technological capacities to create realistic sensory stimuli. Sensorial realism is certainly an important influence on presence, but there is more to the story. Even a simulator which perfectly mediated sensory perception would not automatically induce a strong, perpetual sense of presence because reality does not induce a strong continuous sense of presence.

I had the opportunity to experience the U.S. Space and Rocketry Center's Space Camp in Huntsville Alabama as part of baseline research toward creating a virtual Space Camp. Space Camp is normally reserved for 5<sup>th</sup> graders, but a group of 12 adults from Michigan State University, Apple Computer, and ETI Entertainment got to pretend to be fifth graders and go through several of the mission experiences.

Approaching Space Camp by cab, what appeared to be a collection of distant church spires turned out to be Titan rockets. Walking under a Space Shuttle and through Rocket Park, the visceral impact of the size of these space objects sends bolts of realization and shock. They are enormous! You don't realize how big from watching a launch on television. I was able to climb around in the Enterprise space shuttle capsule, peek inside myriad storage drawers, wonder at the thousand buttons along the walls and ceiling in the cockpit. But even though I was physically on a real shuttle, with my usual auto-stereoscopic full field of view, complete passive haptic feedback, photo-realistic texture

mapping, and natural navigation (walking, climbing, sitting, bending, touching), I did not particularly feel like I was there.

*Expectations, cognitive schemas, and familiarity impact presence.*

I was physically inside of a space shuttle, but I did not feel what I imagine it would be like to experience being on space shuttle. I knew both too much and too little to feel strongly present. I knew enough about space travel to believe there must be a lot more to the experience than I was getting. Although real, my shuttle was inside a large building, not on a launch pad or up in space. I wasn't weightless or worried about blowing up or feeling discomfort of extreme acceleration. I couldn't look out the window and be awed by the oneness of planet earth or the vast emptiness of space. I also knew too little to feel as much presence as someone in the space program might have felt climbing around this shuttle. Such a person would know what the buttons do, how items stored in the drawers are used, and how the drama of space travel happens in a shuttle. The artifact of the shuttle might have triggered their mental model of the full ("in situ"?) shuttle experience, which I could only wonder about. Expectations, lack of familiarity, limited prior experience, and limited cognitive schemas dampened my sense of presence.

*Too much stress or boredom inhibits presence.*

We donned flight suits and met for our first mission briefing. Space Camp runs time synchronized group role-play simulations in which each group member is assigned a NASA role and title. For mission one, there were three locations: Mission Control, the shuttle cockpit, and passengers (scientists and payload specialists). Participants were given two notebooks for their position: one the complete time-based mission script with the lines they say and activities they perform highlighted, and one a background information notebook with details about their role and task. I was a mission scientist. Training was brief and the trainer talked too fast for taking notes. The simulation started with the countdown clock set to takeoff minus 10 minutes. During the first 8 minutes my scientist colleague and I were supposed to complete physical exams of the payload specialists and report results to the shuttle commander. It was hard to remember exactly where to find supplies and what to do, and it took a stressfully long time to take

temperature and blood pressure readings for two people with only one set of instruments as the clock ticked quickly down.

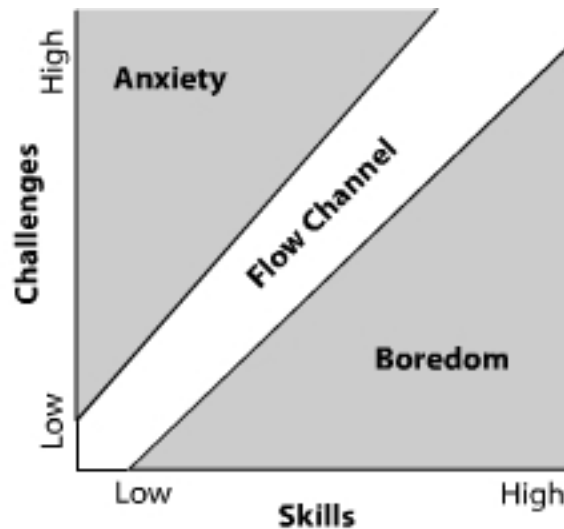
Shortly after we achieved orbit, it was time to let the EVA repair team out the airlock to go repair the satellite. We forgot one step in opening the airlock, causing the entire crew to get sucked out to their deaths. However, time continued and so did we, after noting that the entire crew had been killed once so far. We climbed the ladder into the cockpit and tried to locate and set the correct 12 switches (from among about 1000 possible switches) to prepare the science lab for our entry, then proceeded to the lab to conduct experiments in space. I spilled chemicals on the floor. My polymer did not harden the way it should have. I reassured my partner, whose experiment took longer than mine, that he still had plenty of time before landing. It turned out I was reading the timeline for the two hour mission, not the 90 minute mission. So, the shuttle landed without us having returned to our stations or performed our landing tasks. (We died again.)

I felt like an idiot the entire time. The other participants had arrived the day before and had already completed two other missions. People said “join the club, we all feel like idiots.” This was not a club I wanted to belong to. But, the question is, did I feel present, did I experience a sense of being on a shuttle mission? It is possible my heart rate and skin temperature might have resembled that of an astronaut, but for the wrong reasons. My thoughts and emotions were stressfully focused on trying to accomplish my assignments correctly and on time. Many perceptual stimuli I would have liked to pay attention to had to be ignored to fulfill my assignment. I didn’t have time to feel much other than frustration. I had not achieved the kind of insights about shuttle missions I had hoped to experience.

Time pressured, stressful tasks pull attention away from other non-task related current sensory stimuli (virtual or real), potentially reducing the experience of physical presence. Assigning demanding or stressful tasks in a virtual experience may distract from feeling present in the environment. Does a demanding task contribute to or detract from the intended experience of presence? Is there a difference between feeling present in a task and feeling present in an environment or event?

*Highly focused attention on sensory stimuli yields strong presence.*

Csikszentmihalyi (1990) introduced the concept of flow, a common characteristic of optimal experiences. Flow occurs along a vector separating boredom and anxiety. People experience flow when they are sufficiently challenged to do their best, yet not challenged too much beyond what they can achieve.



Why complexity of consciousness increases  
as a result of flow experiences

*Adapted from Csikszentmihalyi, 1990, p. 74*

According to Csikszentmihalyi, flow occurs “when a person invests all of her psychic energy into an interaction – whether it is with another person, a boat, a mountain, or a piece of music... Concentration is so intense that there is no attention left over to think about anything irrelevant, or to worry about problems.” Presence is not synonymous with flow. A very strong sense of presence is likely to occur during flow experiences. However, unlike flow, presence is not always an optimal experience. One can feel present in unpleasant, unsatisfying experiences.

For the next, longer mission, I requested a less busy task that would allow me more time to observe. I was assigned to be at Mission Control in charge of communication with Space Station. I had a few lines to read at specific points the script, but mostly I would watch the clock and send faxes to Space Station at key points in the mission informing them of a new unexpected disaster they had to deal with (such as meteor storms and alien viruses). During this mission I had time to reflect and observe as well as to participate. I

was able to shoot still photos and video of the other positions in Mission Control and Space Lab. I was amazed the extent to which space missions are driven by a mission critical clock, how busy people are, how much success and survival depends on many people working together, each responsible for very specific tasks. From moment to moment throughout the 2.5 hour mission I was aware of experiencing rich verbal, social, and physical sensory stimuli. I felt strongly and actively present.

*Presence is not experienced the same way, with the same intensity or same frequency by everyone.*

I flew to Alabama for 1.5 days with the express goal of understanding Space Camp well enough to develop a virtual space camp. It was imperative to acquire a big picture perspective in my limited time. If that had not been a pressing motivation, I might have been content to experience what it is like to be mission director or other positions. Personal goals, needs, and interests may influence the experience of presence. On a different day or with a different goal, I might have felt differently present and I might have attended to different stimuli during the same experience.

Someone else assigned to fax warning messages every 15 or 20 minutes might have felt bored and unimportant instead of feeling they had been granted a special opportunity to see the big picture. Someone else might feel more involved, more attuned to the simulated mission from moment to moment, if they were in the hot seat, acting out the role of Space Shuttle Commander. There are individual differences in how and when presence is experienced. The same individual may not always attend to the same sensory stimuli. Different individuals may pay attention to very different stimuli and may feel differently present than another person in the same circumstance.

*Individuals may experience drastically different amounts of presence in daily life.*

Ijsselstein and de Ridder (1998) found that the extent of presence experienced in a virtual environment changes continuously. Slater and Steed (1994) measured “breaks in presence” -- shifts away from feeling located in a virtual experience to being aware of the

physical world. What is the normal human experience of presence in everyday life? How often and for how long do we feel present in a typical day?

Are there pronounced individual differences in how much presence people experience in normal daily life? The Meijers-Briggs personality test types people as being dominantly Sensate or Intuitive. The majority of people (close to 85%) are sensory types who are “more at home in the physical material world” (Keirse, 1998). According to Keirse, sensate types “focus on what is happening in the here and now” while intuitives focus on “the abstract, conceptual world of ideas-inferences, theories, daydreams, musings, speculations, symbols.” Intuitives and sensates are differently aware of the physical world. Is presence for an intuitive more conceptual, while presence for a sensate is more perceptual? Or are sensates more present more of the time than intuitives? I am strongly intuitive, with very low sensate scores. When I think about presence, I think of those relatively rare periods when my usually unrelated-to-the-world-around-me train of thought is most closely tied to current sensory input. Different members of the research community have different personality types and are more conscious of their physical surroundings more of the time. Our personal experiences of presence are not the same, contributing to different conceptualizations.

### *How much presence is enough?*

Although the subjective feeling of presence appears to vary from moment to moment, presence is often measured as if it were a static long-term internal state. Researchers expose subjects to a mediated experience that may last anywhere from minutes to hours and then ask “how present did you feel?” For example, Lessiter, Freeman, Keogh, and Davidoff (2000) developed the ITC-SOPI scale for cross media presence using 44 strongly agree-strongly disagree items which factor into physical space, engagement, naturalness, and negative effects. The items ask about presence overall, e.g., “I had a sense of being in the scenes displayed” or “I felt involved (in the displayed environment)”. What if the scale were changed from strongly agree/strongly disagree to very often/never? How much presence is enough? Is it better to achieve numerous moments of moderate presence, or one or two peak moments of extreme presence? How frequent and strong a sense of presence do each of us experience throughout a typical day

in unmediated life? How different is the average duration, frequency, and intensity of presence experienced on a beach in the Caribbean compared to a bus ride crossing the U.S.?

Are we always present somewhere, and it's just a question of localizing whether we feel present in the real or mediated world? Waterworth and Waterworth (2001) say no. They write about several kinds of breaks in presence: shifting *locus* between real and virtual world; shifting *focus* between attending to stimuli present in real or virtual world versus not attending to stimuli in either. They describe the presence-absence focus of attention as a balance between conceptual (abstract) and perceptual (concrete) processing, likening it to a two room house with a single light capable of shining into only one of the two rooms at a time. They characterize presence as “a conscious emphasis on perception of currently present stimuli rather than on conceptual processing” (p. 211).

*Presence can include conceptual AND perceptual processing.*

Is presence exclusively perceptual or can conceptual processing occur as part of feeling present? The Space Camp mission sense of presence I described earlier felt stronger when there I engaged in more conceptual processing. Metzger's (1974) gestalt perspectives on phenomenology and experience define a *percept* as an organism's “reactions to the impingements coming through the senses.” Reactions can be conceptual or concrete. The impingements coming through the senses may be real or virtual. Metzger (Brandt and Metzger, 1974) explicates four definitions of reality. Metzger's third definition relates best to presence: *real3* is “what is encountered, found, or produced” whereas *unreal3* is “what is merely thought, imagined, conjectured, foreseen, conceptually known, planned, and//or intended.” Humans encounter not only external stimuli but also their own “feelings, moods, aspirations, inclinations, etc.” Applying these perspectives, presence can encompass both concrete and abstract thought, so long as it is closely tied to current impingements to the senses. Presence happens in real time. Presence involves encountering, finding, or producing (imagining) impingements that come through the senses and then reacting to them.

*Presence requires a context.*

Presence requires a context. Although the duration of feeling present may be very short, presence is dependent upon a context larger than that moment to comprehend the experience before you can feel present in it. What if my physical body was magically transported to an entirely different situation half a second, then transported back. For example, I am sitting at a desk using my computer. Suddenly for half a second I am at the table in a darkened restaurant. Then back at my desk. Let's say I really was physically present in the restaurant for that half second. Would I have felt present? Probably not. There was no time to comprehend what was going on within or around me. How much context is needed before the feeling of presence occurs? How much sense-making precedes feeling present? It depends on the complexity of the experience.

*More complete sensory input is not always better.*

The impingements on our senses are fragmented and incomplete (McCloud, 1993). We “commit closure, mentally completing that which is incomplete based on past experience.”



(Note: this cartoon would require permission to include.)

Are we more present when we need to work to understand, to actively commit closure?

Are we more present at a play than a movie? Do we need to be attending to all current



impingements to the senses to feel present, or can one focus attention on a particular perception (such as the voice of someone on the telephone, or one particular actor on the stage)? Is presence stronger when attention is focused or diffused across more stimuli and more senses? We notice the anomalies, the bumps in the road, more vividly than we experience expected and repetitive sensory input. Do we feel more presence on bumpy roads than on smooth roads?

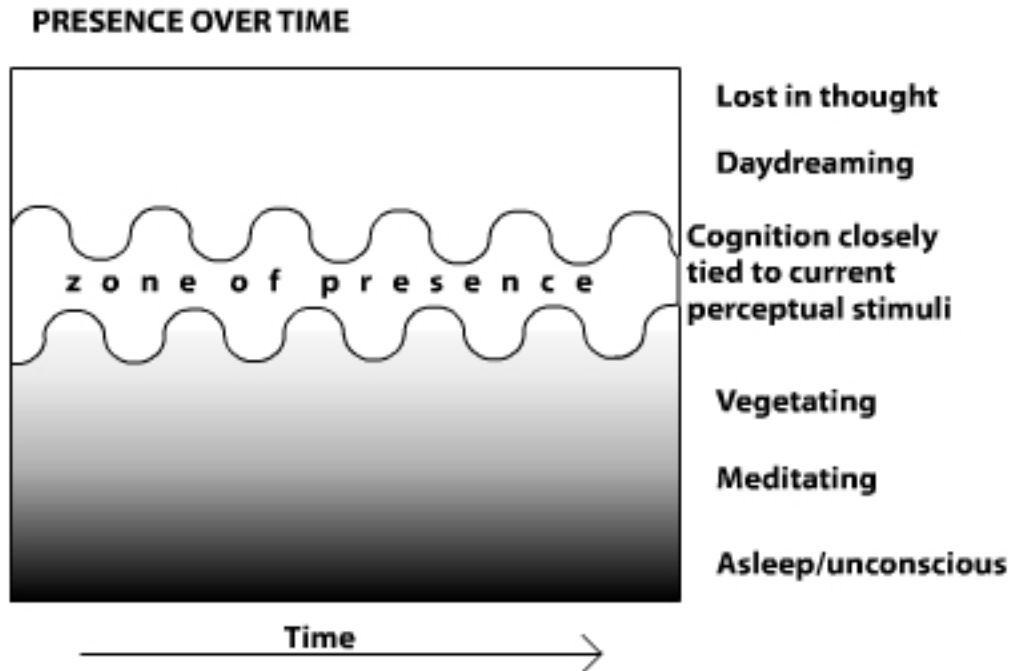
*Presence can be voluntary and learned.*

Is feeling present an art? Is it voluntary or involuntary? Can it be learned? McCloud (1993) describes the comic book audience as a silent collaborator, filling in change, time, and motion between frames. Other media require similar audience participation. The expression “to be present in the moment” refers to experiencing, participating in, fully appreciating what is happening now. The (new age) book, “Present Moment, Wonderful Moment” contains “verses for waking up to ’24 brand new hours,’ taking a shower, answering the telephone, and starting the car.” (<http://www.villagebooks-mtshasta.com/presmomwonmo.html>). Being present in the moment described in these books as a learnable skill (remembering to stop and smell the roses...).

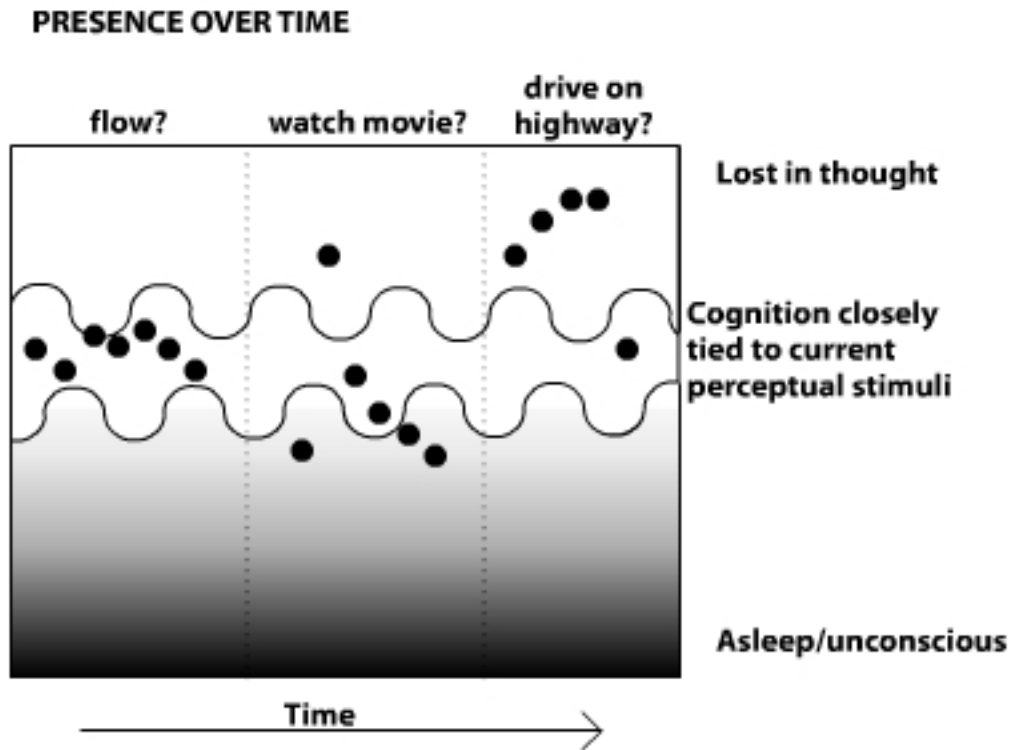
*Presence occurs during periods when cognition is closely tied to current perceptual stimuli...*

Presence occurs during periods of time when cognition (processes such as perception, attention, learning, thought, and affect ...) is closely tied to current perceptual stimuli. A conscious effort or task-oriented need to stay focused on the moment facilitates but is not required for the state of feeling present. Reacting to an immediate danger would also encourage close attention to current sensory impingements. Complex, compelling, or intense stimuli that change over time facilitate but are not required for the state of feeling present. Presence requires a context and can be enhanced by familiarity, prior experience, and a rich cognitive schema. The perceived potential for interaction (affordances) acting upon or being acted upon may increase presence. Presence varies in duration, intensity, and complexity.

In the chart below, the vertical axis shows how closely cognition is tied to current perceptual stimuli. Around the center is the “zone of presence,” where cognition is most tightly tied to current stimuli. Going down from the center there is less and less conscious cognition, either lulled into boredom, intentionally tuning out through mediation, or being asleep. Going up from the center cognition moves further and further away from current stimuli, day dreaming, problem solving about something unrelated to current stimuli, lost in thought. Time is the horizontal axis.

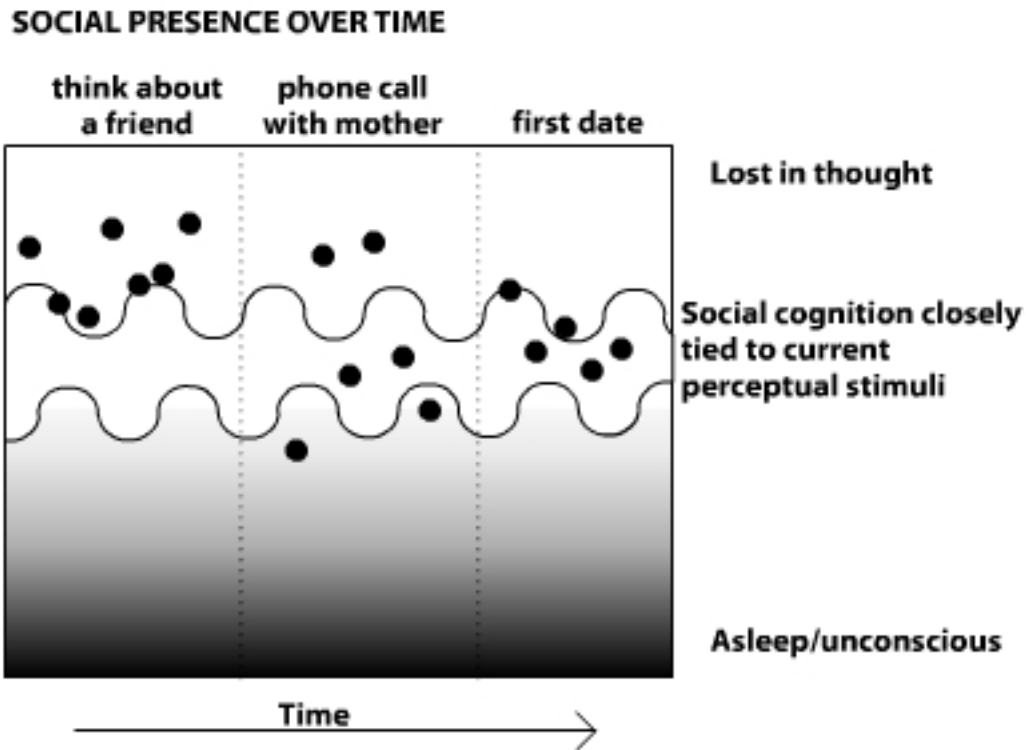


Next are three hypothetical examples mapping cognition on this chart for flow, watching a movie, and driving on a highway. By definition, flow is an experience with very strong presence. Each dot represents a discrete measurement of the association of current cognition with current perceptual stimuli. The frequency of measurement is unspecified – more research is needed! Throughout a flow experience, cognition is almost always within the zone of presence. Compare this to watching a movie. There are boring parts where the mind is not processing much at all. Compelling moments either due to content or visual and auditory gimmicks to wrench cognition into synch with current stimuli. Some of the time the movie content initiates day dreams about somewhat related topics. Finally, driving on a highway is long periods of being lost in thought, combined with moments of danger (or navigation) drawing cognition quickly into synch with current perceptual stimuli.



*Social presence occurs during periods when social cognition is closely tied to current perceptual stimuli*

As a demonstration of the robustness of this definition, consider a parallel definition of social presence. Social presence occurs during periods of time when social cognition (processes such as perception, attention, social judgments, affect, expectations, thought, and connectedness... (Forgas, 2001)) is closely tied to current perceptual stimuli. Three examples are shown below: thinking about a friend, talking on the phone with mom, and going on a first date. Thinking about a friend who is far away is by definition removed from current sensory stimuli (assuming you are not looking at a photograph or being reminded of the person by some current perceptual stimulus). Social cognition is not closely tied to current sensory stimuli. A phone call to mother likely involves some social cognition based on present stimuli, as well as some boredom and some thoughts wandering. A first date requires close attention to current sensory stimuli, with high stakes and lack of familiarity. Social cognition will be closely tied to current perceptual stimuli.



*Media can enable mediated presence and social presence.*

What does presence have to do with technology? Nothing. What does technology have to do with presence? Mediated presence is periods when cognition is closely tied to current mediated sensory stimuli. Mediated social presence is periods when social cognition is closely tied to current mediated sensory stimuli. We use technology to design experiences. Technology may or may not offer sufficiently compelling sensory stimuli to actively engage cognition. Engaging cognition is not simply a matter of accurately recreating real world sensory stimuli. The content of the mediated experience and opportunities for interactivity (just like in the real world) are other factors in presence. Technologies may have presence consequences such as focusing, limiting, amplifying, or extending normal sensory stimuli. The design parameters include engineering optimal levels of presence for a particular experience (described by Kim, 2001, as “tuning the level of presence”). Even when technology is involved, it is the experience itself (the mediated experience) and not technology alone that evokes the subjective experience of presence.

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