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Embodied Encounters with Virtual Reality in Geography Education

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Virtual reality (VR) constitutes a deeply embodied mode of communication that has gained significant interest and application in geography education and research. In this article, we engage with recent theoretical work to conceptualize VR as a communicative encounter and centralize the role of embodiment therein. We argue that different bodies experience VR in different ways, which raises questions about the potential inequalities of access and experience among users. To further articulate this, we draw on a qualitative study investigating the subjective experiences of participants engaging in a series of VR field trips to sites of difficult heritage. Through interviews and participant observation, we discuss the embodied dynamics at play in the course of VR field trips and how these media dynamics might affect equality of access and learning within geography curricula in higher education. By considering the various biases toward the bodies of particular users, our findings challenge assumptions that incorporating VR into geography education improves accessibility, and we conclude by providing suggestions on how encountering VR can become more inclusive in embodied terms. *Key Words:* communication, embodiment, encounter, inequality, virtual reality.


In the past decade, virtual reality (VR) has become ubiquitous as a subject, object, and means of geographical inquiry (Osbourne and Jones 2022; Roelofsen and Carter-White 2022; Bos 2024). Following the first production of immersive technology in the 1950s and a deflation of the commercial VR market in the 1990s, VR has seemingly reemerged as “new media” since the 2010s (Nakamura 2020; Messeri 2024). Its popularization of late has been further supported by significant monetary investments on the part of national and cabinet governments like the European Commission, and technology conglomerates like Meta (previously Facebook, Inc.), which develop and implement new immersive VR tools for entertainment, research, educational, and communication purposes (ECORYS 2021). Within the discipline of geography, VR has long been defined, theorized, and critiqued, both as a putative immaterial realm and as a digitally mediated material technology (see, e.g., Adams 1997; Fisher and Unwin 2002; Kinsley 2014). It is variously understood as an interactive human–computer

interface and spatial information technology that affords the creation and communication of three-dimensional (3D) content that is explicitly spatial—often in its geographic reference to “real-world” and fantastical places, objects, practices, peoples, and other “things” (Brodie et al. 2002; Kitchin and Dodge 2002).

Although VR technologies rely heavily on visual display and can include narrative and conceptual depictions of places and spaces in textual formats, these technologies do not necessarily privilege vision-based communication. What distinguishes VR from antecedent technologies of spatial representation, such as cartography, is its conveyance of content that is multidimensional, interactional, dynamic, multimodal, and increasingly networked (Jacobson, Kitchin, and Golledge 2002; Nakamura 2020). Moreover, much of today’s high-immersive VR technology is multisensorial, meaning that, in addition to its visual component, it is both contingent on and productive of its users’ haptics, locomotion, and hearing. It is also a location-aware

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technology that continuously tracks and traces the body's position and orientation in space, with the purpose of then (re)orientating the user spatially.

That VR is embodied and located is important to emphasize considering early discourses in popular media and academic scholarship that lauded the supposedly liberating potential of VR to, essentially, leave one's body behind while journeying to and through other realities. Such discourses relied on a Euclidean and primarily visual understanding of space to articulate the technology's potential to dislocate and disassociate the mind from the body (for a full discussion of this perspective, see Ash, Kitchin, and Leszczynski 2018). Feminist theorists have critiqued these fantasies of "disembodied being" through and in VR, which helped obfuscate the white, able-bodied male experiences, desires, and assumptions that structured virtual worlds (Messeri 2024, 111). Instead, VR has more recently been understood as demonstrating the transcendence of this very body-mind duality—popularly represented through the figure of the cyborg—with the potential to (re)configure understandings of the self and the world (Haraway 1990). Such thinking is reflected in the design of today's high-immersive VR technologies that aim to replicate embodied being, learning, and knowing through head-mounted devices (HMDs) and social networks. In order to generate empathy and "affective connections," some of these VR applications go as far as placing users in the shoes of marginalized, threatened, and even dying bodies, to problematically suggest that temporarily occupying the body of another is tantamount to "being another" (Nakamura 2020; de Jong 2023; Messeri 2024).

In our earlier work on geography learning and teaching with VR, we have argued that different bodies experience VR in different ways, raising the potential for inequalities of access and experience among users (Roelofsen and Carter-White 2022). The theme of this special issue provides an opportunity to reflect on the nature of VR as communication, and specifically on questions of inclusion and exclusion within a mode of communication that increasingly occupies the attention of university-level geography educators. If VR constitutes a deeply embodied form of communication, we might ask what *kind* of body VR technologies have in mind. Does VR offer all bodies the same "levels" of immersion and access to embodied cognition—and if not, whose embodied "communication" is assumed and

privileged? What are the possible embodied affordances and constraints embedded in VR, and how do users forge their own communicative capacities, against but also within the limitations of the medium? In this article, we develop a critical perspective on VR for responding to these questions, first by engaging with recent theoretical work to conceptualize VR as a kind of communicative encounter, and then by illustrating the implications of this framing for identifying and challenging inequalities of access, engagement, and learning with reference to our ongoing empirical research.

Encountering VR

At first glance, VR might seem an awkward fit with the idea of communication, at least when the latter is conceived in the conventional sense of "the transmission of ideas and information between places and between agents" (Adams 2017, 366). On the one hand, we might ponder with whom and about what individual users are communicating when they engage with 3D imagery on a computer screen or when they don a VR headset. At the same time, the interactive dimension that distinguishes VR as a digital technology potentially raises questions about its capacity to unilaterally transmit a coherent message to an audience, in the manner that might be attributed to, for example, literary or cinematic media. These doubts are somewhat deflated by Adams's (2017) claim that, in contrast to this increasingly anachronistic model of reciprocal exchange,

[c]ommunication is also an event in which two or more agents encounter each other and come away altered by the event, slightly or substantially. I would suggest an emerging paradigm of media/communication geography is the idea of a *metaphysics of encounter*. The encounters in question can occur between humans and other humans, between humans and non-humans, or exclusively between non-humans. (366, italics in original)

This vision of communication as a more-or-less transformative encounter between heterogeneous entities is productive for thinking about VR in a couple of ways. First, the shift in thinking articulated here—from conceiving of communication and media in essentially representational terms (the transmission and exchange of information) to a practice-based approach concerned with how subjects and

objects are brought into relation through media—is commensurate with contemporary worlds of unfathomably complex digital mediation in which human subjects are perpetually brought into contact with and under the influence of all manner of human and nonhuman actors (Richardson 2024). Not only does VR thereupon sit squarely within the purview of communication geographies; more important for our concerns, this theoretical framing helps to make sense of the visceral thrill and educational possibilities of VR technologies. Indeed, in his discussion of the cultural and digital geographies of VR, Bos (2024) claims that

[a] key aspect of VR is its ability to create a sense of presence for the user—as if it is “real”—and they are a part of the virtual world presented to them. This has encouraged work to consider the role of embodiment and how VR technologies are *encountered* and work affectively to cultivate immersion and a sense of presence for the users. (3, italics added)

The appeal of VR as a tool of geographical research, education, and communication lies not in the premise of (consciously) exchanging information and data, but rather in the promise of an *encounter*: the immersive feeling of plunging into a new experience, confronting a new world, fostering a new geographical imagination.

Second, the concept of encounter is useful because it pushes us to examine more closely what actually happens during user experiences of VR. One of the conditions of an encounter that is foregrounded by geographical research on affect, and that helps distinguish the concept of encounter from a one-way process of passive reception, is the mutual alteration that it entails. As Anderson (2016) writes, bodily capacities are not innate and do not preexist the relational configurations that they enter into: “how a body can affect and be affected continuously varies as encounters happen and capacities emerge, change and are realised” (80). Wilson (2017) makes the complementary observation that “encounters are about more than the coming together of different bodies. Encounters *make* difference” (44, italics in original). Translated to the context of VR, we can consider users of this technology as not simply exposed to a predetermined virtual “scene”; they are active participants, whose agency manifests and is invented anew in both conscious and instinctive movements, decisions, gestures, and adaptations that alter the unfolding of VR content. As Osbourne and

Jones (2022) put it, “it is the body driving the illusion that VR takes us *elsewhere*” (3, italics in original). At the same time, these embodied practices become a meaningful element of the encounter on the condition that they are legible to the VR mode of perception that transforms them into data (Caserman et al. 2019; see also Richardson 2024); or rather, as our previous research has indicated (Roelofsen and Carter-White 2022), that the user-subject alters their embodied behavior with a certain sense of “tact” (Duggan 2024) so as to *make themselves legible* to a specific machinic gaze. This is often achieved through effective manipulation of HMDs and remote controls, although different low- and high-immersion VR interfaces and materialities provoke different kinds of embodied responses, affects, and encounters (see, for example, Dittmer 2010; Detyna and Kadiri 2020). We might summarize these dynamics by suggesting that although users undoubtedly possess agency in driving and, to some extent, shaping and altering the multisensorial VR content, this agency is constrained by a nonhuman, technological form of perception that ultimately determines the meaningfulness of the user’s actions.

VR can therefore be understood as a genuine encounter: a mutually altering negotiation between the perception of the machine and the performance of the human that exemplifies and dramatizes Adams’s (2017, 366) “emerging paradigm” of communication geographies. And crucially, this encounter converges on the *body* of the user.

Embodied Performance

The emphasis on embodied performance in the preceding discussion should immediately caution against the assumption of any universal or given “user” of VR technologies, as it is established in the relevant geographical literature that different bodies “perform” in different ways. This can be understood both in terms of the differential habitual configurations and capacities that enable particular bodies to act and perform more or less “well” at a given task (see Bissell 2013), and in terms of the performative agency of the body as a locus of identity (Andrucki and Dickinson 2015) and a site of everyday and artistic expression (Longhurst and Johnston 2014). Importantly, the specificity of embodiment is no less pronounced on the machinic side of the VR encounter. Although it is essential to take the nonhuman

agency and perception of digital mediations seriously (Richardson 2024), humans are still integral to the design of VR technologies and bring with them assumptions about bodies that can be obscured by the apparent technical neutrality of the digital interface. As is, again, well-documented in geographical work, dominant groups in society set moral standards and norms around bodies in explicit and implicit ways, thus presupposing and reinforcing “a certain social order that is constituted according to assumptions about racial or ethnic background, geographical location, sexuality or able-bodiedness” (Simonson 2000, 8). This analytic readily extends to the contemporary digital world, as illustrated by Spiel’s (2021) detailed analysis of the bodily norms silently underpinning the design of embodied computing in general, which in the case of VR can be most obviously identified in the sexism of HMD designs that assume the physical proportions of an idealized male body (Osbourne and Jones 2022).

The particularity of embodiment similarly emerged as a latent theme in our previous investigation into the potential utility of VR for geography learning and teaching (Roelofsen and Carter-White 2022). Wilson (2017) notes that “the transformative potential of encounter is directly linked to its unpredictability” (457), and accordingly one of our main findings was that even a somewhat scripted VR experience could result in an unpredictable and highly differentiated set of user experiences, reliant on the embodied adaptations and improvisations of users to make them work. The implication for geography education was that, while the *need* for these adaptations might partially stem from inequalities in design that are deeply problematic, the *fact* of adaptation itself was something potentially generative for geography education, as it was in those heightened moments of bodily performance that new geographical imaginations and insights emerged. As emphasized by Anderson’s (2016) reflections on affective life, there is a need to appreciate the openness of embodied encounter while attending to the myriad ways in which such events are mediated, ordered, and differentiated, to some extent, by processes, relations, dispositions, and representations that might extend well beyond the space-time of encounter itself. It is the differentiated and yet unforeclosed nature of embodied encounter that has led our current empirical research in this area to focus specifically on embodied *difference* as a powerful vector of the VR encounter.

Method

In the remainder of this article, we focus on a small-scale study with seven geography students and one geography lecturer at Wageningen University, the Netherlands, and one volunteer participant recruited outside the university environment, who were randomly assigned to high-immersive VR field trips to one of three sites of “difficult heritage”; that is, sites associated with the historical representation of collective violence and death (see Logan and Reeves 2014): the Auschwitz-Birkenau State Museum, the Chernobyl Exclusion Zone, and the Hiroshima Peace Memorial Museum. These field trips took place in the WANDER XR Experience Lab at Wageningen University, using its existing VR infrastructure and technical support personnel, and following its ethical protocol.

As we have discussed elsewhere (Roelofsen and Carter-White 2022), we consider difficult heritage sites to be ideal spaces for investigating the embodiment of VR field trips, as the educational and moral value of conventional, physical field trips to such places—which are increasingly a mainstay of geography education (Maddrell and Wigley 2019)—is typically attributed to the intensely embodied experience of *being there*, inhabiting and witnessing the material space where traumatic events occurred (see, among many others, Knudsen 2011; Kidron 2013; Carter-White 2018). These are therefore sites where the success or failure of immersion as a goal of the VR encounter assumes greater prominence and significance. We chose to include three different difficult heritage sites to mitigate the potential idiosyncrasies of any single VR field trip, and it is important to acknowledge here that we do not consider the three selected sites to be equivalent or homogenous in terms of their geopolitical history, cultural and historical meaning, or heritage materialities. They are very different sites pertaining to very different violent histories, and for our project their significant commonality is that, as with all difficult heritage sites, their incorporation into a VR format puts the corporality of this technology under the greatest possible scrutiny.

Considering the previous theoretical discussion, it is also worth noting that the concept of encounter raises questions as to the inherent “difficulty” of any one of these heritage sites, considering that the impact of each on any single (virtual or material) visitor is highly subjective, and depends on a

multiplicity of factors including the personal biography, positionality, and indeed able-bodiedness of each individual. To return to Anderson (2016) once more, encounters “are mediated by forces that exceed their spatio-temporal location” (109), which is why no two visitors to, say, the material site of the Auschwitz-Birkenau State Museum would ever share the same experience or embodied response. Our methodological decision to include multiple sites was therefore driven by the aim of maximizing the potential range of embodied encounters among our participants, without any expectation that a “standard” response would emerge.

Having committed to working with a multiplicity of difficult heritage encounters, we selected the three aforementioned sites partly as a reflection of our areas of expertise. This allowed us to prepare the participants by providing them with an introductory reading about the history of the site and a brief description of the related VR experience as well as the available support and safety measures, in case participants needed them. Our selection was also partly driven by practicality: these specific VR tours each allowed some form of self-direction on the part of users, and their required use of an HMD and controllers provided a material anchor for our exploration of embodiment. While being mediated by an HMD (Meta Quest) and handheld controllers, VR field trips were rendered digitally on a computer screen, capturing the sensory and visual elements at play as the participants engaged with and moved along with their VR experience. This live-streamed video allowed us to observe the participants and make notes of their movements in this digitally rendered space, which later functioned as an “aide memoire” for participants to reflect on their embodied experience during the interview that followed the field trip. We acknowledge that this particular VR technology is specific in terms of interactional and multisensorial properties and does not stand in for the enormous diversity of VR hardware and software available.

The vignettes that are discussed in the following sections are taken from interviews conducted with each participant shortly after their VR experience with one of the three selected sites. The transcribed interviews and observational notes were collectively analyzed by both researchers, and the following results section is structured according to the two major themes that emerged in our analysis.

Considering the small sample size and narrow scope of VR technology used in this study, as well as the subjectivity of difficult heritage as a concept and the multitude of other differentiating and subjective factors, this discussion is not intended as an exhaustive account or representative sample of embodied responses to VR, nor does it seek to evaluate the “success” or “failure” of VR in replicating some anticipated embodied response to the “real” sites. We aim instead to provide some illustration of the diverse ways in which users’ bodies are differentially enrolled into, excluded from, and agential within a series of VR encounters, before a concluding reflection on the implications of these observations for inclusivity in geography education.

Unruly Potential

Despite the aforementioned allure of encounter that sits at the heart of VR, none of our participants acknowledged any sense of total or complete immersion in their respective virtual field site. Instead, when questioned on this theme, participants tended to linger on instances of incompleteness and failure in the VR encounter when the sense of immersion was interrupted. Revealingly, they articulated these moments with reference to their own bodies, and the illusion-shattering forms of bodily confusion, disorientation, and distraction that were prominent in their reflections.

When it was moving, it made me feel a bit woozy. ... I feel like I need to hold onto something because things are moving, but I am not. (Interviewee Rosa)

The worst thing is, when you look down, you can’t see your legs. So maybe it’s also my brain protecting me against this feeling “where have my legs gone?” It kept rephrasing in the back of my head that it isn’t real, and that I wasn’t there. (Interviewee Jacob)

In these instances, the body was both the source of interruption in the VR illusion (“it made me feel a bit woozy”), but also provided a medium for describing the more general sense of uncanniness that pervades and threatens to collapse the sense of immersion on which the VR encounter depends (“it kept rephrasing in the back of my head that it isn’t real”). Whereas in these quotations there is the implication that these users deliberately looked to their bodies for support in articulating the falling-short of their immersion (“where have my legs

gone?”), on other occasions our participants depicted their bodies as a subtly unruly force acting against their best efforts to participate in the encounter:

I tried to immerse myself more, I guess And then I hit the chair with my foot, that was so ... I thought, “oh yeah, the chair was there.” (Interviewee Rosa)

In these moments our participants gave the impression of a VR encounter that *was* succeeding, only to be punctured by physical sensations—particularly touch and sound—that inhibited their immersion and pulled them away. Bumping into furniture and overhearing distant conversations, the body was presented as an unwanted extension of the external environment that needed to be disciplined and suppressed to filter out irrelevant sounds and maintain a relative stillness.

What our participants also made clear, though, was that the disruptive force of the body could be harnessed “toward” the VR encounter, by using it to maximize immersion or otherwise make the experience of these very challenging sites more meaningful. This is encapsulated in the decision of one participant to match the bodily dispositions of three survivors who spoke directly to the camera during her VR tour of the Auschwitz-Birkenau State Museum:

When the first [survivor] Valentina was telling her story and she was standing then it felt weird to sit. Then when the other two were sitting then I sat down again. It felt nicer, to be at their height. ... I was aware that it was a video but I felt like we were interacting because she was very close. (Interviewee Vera)

Here we see that bodily adaptations to VR are not simply about finding a way to negotiate the physical effects of the interface. In this case there was an ethical component to embodied performance: the decision to match the eye level of the three survivors was among the embodied resources that the participant would have drawn on in a real-life communicative encounter to show these people empathy and respect, and the VR encounter was sufficiently immersive that failure to draw on this instinctive habit “felt weird.” And in a circular fashion, replicating her habitual embodied performance in response to an interaction with a VR representation helped to further solidify the sought-after sense of immersion and encounter. As the participant continued, “I wanted to give them the attention that they deserve.”

Alternately described as both a disruptive and productive influence on the VR encounter, our participants depicted “the body” as a kind of unruly potential that needed to be experimented with to establish what kind of bodily configuration “worked” with the VR encounter—whether that meant training the body to ignore or avoid environmental distractions, or realizing that certain bodily positions were more effective for generating an exploratory mindset or for developing a certain ethical relationship with the difficult heritage site in question. In short, the VR encounter was not something that just happened; it had to be worked toward and constructed, and the body had to be made to perform in service of this task.

Performance and Inequality

As previously mentioned, it is increasingly recognized in the critical literature around VR that the unspoken assumptions of designers about an ideal user “body type” present immediate barriers in accessibility for those who “deviate” from this ideal. Reframed in the theoretical terms of this article, these assumptions potentially mean that certain groups of people are disqualified from entering into the VR encounter; people whose performance is found wanting in advance and by definition. In our most recent empirical research we particularly sought to include the perspectives of potential users who might perceive themselves as deviating from the assumed body norms of VR, and although these interviews underscored the above critique they also indicated the range of embodied histories and capacities that individuals bring to this particular communicative encounter. In so doing, they again suggest that the “outside world,” as represented by the users’ histories of embodied adaptation, is less an encroachment on a self-contained VR encounter than it is a vital facilitator.

One of our participants, Maria, has been visually impaired since birth and was diagnosed as stereoblind at the age of six; one of her eyes does not function, meaning that judgment of depth of field and the combination of ocular images to create 3D vision is not possible for her. This form of visual impairment is perhaps the most direct form of deviation from the assumed VR user’s body imaginable (Jacobson, Kitchin, and Golledge 2002), as it short-circuits the type of visual immersion with which the

VR encounter is most commonly associated. Yet it was by drawing on her everyday embodied practices that Maria was nonetheless able to sustain the encounter. Over the years, Maria has developed spatial cognition and navigation skills in an autodidactic fashion, using projected reference points, audio cues, and textual signs to determine spatial direction and extent, and thereby compensate for her visual impairment. This is most heightened, according to her account, through the practice of playing tennis and becoming accustomed to the velocity and movement of objects by learning the relative measure of the tennis court with respect to the size of the ball and position and movement of her own body.

With tennis, I judge the speed of the ball in relation to its distance in relation to my body. It's quite difficult, I don't know what it's like to see depth with two eyes. ... It's an estimate, but I think that's also what it is like for someone with two functioning eyes. But if a ball is coming at me, it's harder for me to estimate the speed than for someone with two eyes. But this is how I learned to understand depth, through estimates.

Although the conventional VR illusion of 3D representation is destined to fail on Maria, she claimed that the images that she did encounter during the VR experience resembled the abstract spatialities she had previously internalized and constructed in thought, memory, and habit. In the absence of the intended 3D illusion, Maria was able to animate the VR encounter in her own mind through the mediation of her own embodied history and singular capacities.

There are limits to these kinds of adaptations, however. Another participant, Debby, has a different physical impairment that would similarly seem to severely inhibit her performance in the VR encounter, as she has had limited motion in one arm from a young age. The VR headset requires the use of two hands to put it in place, and the remote controls require bimanual and fine motor movements. Like Maria, she articulated workarounds that she would use in everyday life, but these involved seeking secondary assistance and ultimately refraining from certain elements of the VR experience:

The VR headset, getting it on is a bit challenging, sometimes. ... I have a disability in my right arm, so I always need someone to give me the controllers, because you can't really see it once you put on the VR [headset]. Well, I can put on the [headset] but I need both my hands so I need to put the controllers somewhere. (Interviewee Debby)

The controllers can only be in your left hand? (Interviewer)

Yes, I can use it in my right hand, a bit, but I think pointing and clicking, I could not do that. (Interviewee Debby)

The significance of the inability to perform point-and-click actions varies significantly between VR field trips—in the case of our study, it would have no effect on the Auschwitz VR experience at all, which follows a structured path through the heritage site that users are able to explore by simply turning their head. By contrast, the Hiroshima VR experience depends on the capacity of users to select which part of the museum they would like to explore next, by way of a precise remote control use from which Debby would be excluded entirely.

Conclusion

Although our brief empirical discussion can only begin to illustrate the embodied dynamics that unfold in high-immersion VR field trips, which are themselves only one of the many possible ways that VR might be incorporated into geography education as well as other forms of geographical communication, these vignettes do indicate that the experiences provided by VR technologies can be usefully understood as a form of encounter, with all of the interactions and alterations that this particular rendering of communication entails. What remains to be fully analyzed are the inclusivity implications of this conceptualization within the context of geography learning and teaching, but here we can state with some confidence that this remains a somewhat lopsided encounter. Although the interaction between human and technology that occurs via the VR interface does resemble a negotiation, with each party having to make sense of and respond to the other, our interviews suggest that the burden to make this a sustained and generative encounter, as opposed to an antagonistic, failed encounter, rests on the adaptations and concessions of human subjects, and particularly those with apparently “deviant” bodies. In short, at present there is no guarantee that incorporating VR into geography education is a way of improving accessibility, considering how fundamental an assumed bodily capacity is to the technology—or at least, to the forms that are readily available for use in the geography classroom. Clearly,

there is a need to include a greater diversity of body types into the design of VR interfaces and experiences, and geography educators who intend to use this technology have a responsibility to design their learning activities with the explicit awareness that this is not yet happening, and that as a result the communicative encounter of VR remains biased toward the bodies of particular users.

Looking forward, and more optimistically, we suggest there is a real opportunity for designers (both of VR technology and of teaching activities) to take the idea of encounter seriously, in terms of its open-ended, uncertain quality. The real potential of VR for geography education is not as a clumsy replacement for traditional field trips, but as a novel experience that makes of the unruly agency of the body—all bodies—an integral site for perceiving, understanding, and even critiquing spatial relations and processes (Roelofsen and Carter-White 2022). VR will become a genuinely relevant communicative tool for geography education at the point when this particular set of human–technology relations can be apprehended according to “the potential of technological encounters to incite new possibilities of thinking and relating” (Lapworth and Roberts 2023, 74), rather than in terms of how we can live with and accommodate its enduring forms of embodied inequality.

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