

Designing For Data-Wisdom: Data For Whom, Of What, Towards What Ends?

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Abstract: Institutes of higher education continue initiating data science centers. K-12 public schools are committed to data-driven decision-making. School administrators and policymakers promote data literacy. But data of what? Data for whom? Data towards what ends? In this symposium, we argue that the learning sciences consider *data-wisdom* a guiding principle for ethnographic studies of how people learn and for design-based interventions that create and study new opportunities for learning. Our field has had much to say about data, information, and knowledge. Yet the notion and utility of wisdom has yet to be thoroughly explored. As our field collectively turns our commitments from generating knowledge about learning to knowledgeably enacting change *through* learning, we have to rely on wisdom to make sure research endeavors act on problems that matter toward more just futures for all learners.

Focus of the symposium

Institutes of higher education continue initiating new data science centers (e.g., Berman, 2016). K-12 public schools are committed to data-driven decision-making (e.g., Coburn & Turner, 2011). School administrators and policymakers promote data literacy (e.g., Poortman & Schildkamp, 2016). Researchers create data visualizations from big data sets. Social media companies vex individuals with seemingly endless data traces on our daily lives (e.g., Latour, 2007). But data of *what*? Data for *whom*? Data towards *what ends* (c.f., Philip, Bang, & Jackson, 2018)?

In this symposium, the authors argue that learning sciences consider *data-wisdom* a guiding principle for ethnographic studies of how people learn and for design-based interventions that create and study new opportunities for learning. Toni Morrison (2019) provides a helpful epistemic progression from data to wisdom. She writes:

We move from data to information to knowledge to wisdom. And separating one from the other...knowing the limitations and the danger of exercising one without the others, while respecting each category of intelligence, is generally what serious education is about (p. 15).

Learning Sciences has had much to say about data, information, and knowledge. Yet the notion and utility of wisdom—the tip of the Knowledge Pyramid (Ackoff, 1989)—has yet to be thoroughly explored. As our field collectively turns our commitments from generating knowledge *about* learning to knowledgeably enacting change *through* learning (c.f., Maxwell, 2007; Jurow & Shea, 2015), we have to rely on wisdom to make sure research endeavors are *personalized*, *historicized*, and *actualized*. By personalized, we mean that learning scientists connect and interpret data with the people whose lives the data purport to represent. By historicize, we mean that learning scientists contextualize data within a temporal narrative. And by actualize, we mean that learning scientists and the communities with whom they work, use data to *act on* problems that matter towards creating more just, loving, creative, and joyful futures for all learners. In this way, our work in the present has one foot in the past and another stepping into the future.

Relevance and contribution

Recent accountability pressures on schools, due to No Child Left Behind, mean teachers increasingly use student data to inform both classroom instruction and schoolwide improvement. Reading the first paragraph of a 2009 Executive Summary from the Department of Education gives a sense of the importance of data in schools:

The collection, analysis, and use of educational data are central to the improvement of student outcomes envisioned by No Child Left Behind. The use of data in education decision making is expected to span all layers of the education system—from the federal to the state, district, school, and classroom levels.

In a 2007 survey of 1,039 school districts across the country, the Department of Education found that 100% maintained a student information system with data points like test scores on statewide assessments, demographics, attendance and behavior. With programs like PowerSchool, Infinite Campus and Skyward – each charging more than US\$5 per child per month—these student information systems promise a one-stop shop for tracking all aspects of a district’s student and school data. Ideally, these systems help teachers to look at student data in teams, with other teachers and school leaders (e.g., Garner, Thorne, & Horn, 2017). But how teachers across various districts typically interpret, use or ignore data is still an open question. In some districts, teachers have required data literacy trainings that show them how to interpret student data and adjust their instruction accordingly. In other districts without trainings, teachers have no cohesive plan, no scaffolded wisdom, for what to do with all this data, making the big data endeavor seem pointless (e.g., Shepard, Penuel, & Pellegrino, 2018).

Teachers are not the only people awash in big data. Anyone with a smartphone, or making purchases on the internet, or driving through a city intersection creates digital data traces. This ubiquity of data has necessitated an entirely new field of scholarship and teaching: data science education (e.g., Berman, 2019). Across institutions, data science education prepares undergraduates or Masters students, pursuing a range of professions, to use and interpret data via statistical and computational approaches. Descriptions of five different programs contain words like “mining,” “cloud computing,” and “manipulating.” Only Berkeley’s Data Science Education Program connects to “real world problems” in their description. No descriptions say anything about wisdom, or being able to wisely build from data toward more just, loving, and creative futures for all people.

In our framing, we point toward four meanings or uses of wisdom. The first definition from Aristotle: the pursuit of the good life. The second definition from Socrates: knowing enough to inquire after what you do not yet know. The third usage from Toni Morrison who reminds us to poke at wisdom, because without proper and systematic investigation, it may “be just a hunch.” Ackoff defines wisdom as increasing effectiveness and value.

All of these uses share a common quality: action. Human agency is at its highest at the top of the Knowledge Pyramid. Wisdom compels us to make sound, informed judgments to carry out good works in this life. But how? Just collecting, examining, and synthesizing data into information and knowledge claims, we argue, does not get us there, but it is a necessary first step. In what follows, we offer empirical examples of personalizing, historicizing, and actualizing different data points toward enacting data-wisdom in four different education research projects.

Organization of the symposium

This symposium is organized around descriptions and analyses of four different education research projects happening in partnership with our institution. Following an introductory talk that frames the session, each author or set of authors—all emerging scholars in the Learning Sciences—will describe their project and how it connects to the theme of *data-wisdom*. Authors will pose questions at the end of their respective talks to prompt a concluding conversation with the audience. Our discussant will provide synthetic remarks that connect to the field more broadly. The session will use the 90 minute timeslot accordingly:

- 10 min introduction and framing of the symposium (Chair)
- Four 12-minute talks from emerging scholars in the Learning Sciences.
- 12 minutes for the discussant to provide synthetic and field-building remarks.
- 20 minutes for conversation with symposium attendees, based on questions authors posed at the end of their respective talks.

Paper 1: Experiential data-wisdom: Designing for (re)Engagement in the city

Over the last three years, we worked with undergraduate students (UGs) at the University of Washington in an education course where students collected ethnographic data by participating in, observing, analyzing, and reflecting on learning practices outside of classroom spaces. A major goal of our course design has been to transform students’ conceptions about teaching and learning as more than an isolated experience happening inside classrooms (e.g., Leander, Phillips, & Taylor, 2010). To this end, we organized small groups to conduct site visits (i.e., field trips) during class time to explore informal learning environments with local community members. We view the process of experiencing place as data in its own right—*experiential data* (e.g., Smith et al., 2009). Also, these visits often produced *student data* (i.e., field notes, digital photos, and videos) which they leveraged for in-class projects, activities, and discussions to visualize and characterize learning as a social practice across contexts. Throughout the course, students often showed evidence of personal transformation in relation to themselves, their

communities, and their conceptions of teaching and learning within classroom practices (Bell et al., 2019). Still, a tension within our course design remained with regard to the degree of reciprocity (or lack thereof) that occurred between students and the city spaces they visited. How could we support students to leverage their experiential data toward more reciprocal practices? Therefore we ask: *how can we redesign our course for emergent learning experiences where students' data-wisdom becomes the impetus for (re)engagement with community spaces they visit?*

We understand learning to be a social practice in which cultural, historical, and political elements of peoples' lives intertwine to produce social identities and institutions as a mutually constitutive process (Holland et al., 1998). In this way, learning is as much of a social transformation (Jurow & Shea, 2015; Taylor 2007) as an individual one (Lave & Wenger, 1991). Collecting qualitative data on teaching and learning activities is also its own area of research (Bang, et al., 2016; Barab & Squire, 2004; Taylor, 2017; Taylor & Hall, 2013; Taylor et al., 2018). We recognize that public, contemporary conceptions of "data" are often perceived as statistics, algorithms, or analytics rather than qualitative documentation of experiences unfolding *in situ* (Pardo et al., 2015). This work positions UGs as emerging social scientists who are developing data literacy skills to extend notions of "data" beyond digital media. We define experiential data as the outcome of an embodied process of interaction; people are instruments of data, where their whole selves are brought into relation with the activities in which they are observing and participating. Therefore, our work supports UGs in developing knowledge, skills, and dispositions about the use of data to (re)consider what constitutes data and how it may be used through personal and collective experiences in communities around the city in which they live.

In our design of a UG course about learning across and within settings, we strived to scaffold students into social science research practices. Part of this process was understanding how to collect, analyze, and interpret data from their personal experiences. We asked students to visit locations of their choosing (i.e., community centers, local businesses) in the city. They did this in small site visit groups (SVGs), and a graduate student mentor (GSM). GSMs wore mobile cameras to record learning activities. Review of our video data included techniques from interaction analysis (Jordan & Henderson, 1995) and discourse analysis (Gee, 2005) to identify moments when students signaled they were impacted by an environment they visited and sought to re-engage with the community space. After identifying these moments, we conducted short follow-up interviews with individual students to see how they re-engaged with the community spaces they visited. Our data corpus included student reflections and digital artifacts from each of their site visits. Also, students produced (re)presentations of their visits as a culminating course project at the end of the quarter. We used multimodal analysis (Sakr et al., 2016) to triangulate findings across video data and student-produced work.

We identified three instances that exemplify student (re)engagement with community spaces based on their own experiential data. One student, Dariya, went to Seattle Boulderling Project (SBP) to rock-climb during her group's site visit. In her post-interview, Dariya expressed she was "too scared to go back to the climbing place before, but then [she] had this little interview... with a woman who goes there regularly." Dariya discovered that the woman she interviewed "also felt like she was alone there" but the community was "really nice," and they were good at "working together." Indeed, Dariya returned to SBP, and "it was so much fun!" Dariya now sees a possible future for herself as a climber, and has been welcomed into the community. Another student, Macy, participated in an instructor-organized walking tour of successful sites of resistance (e.g., protests, monuments) around our urban campus. This included viewing "Blocked Out," a public art project and the university's only monument dedicated to marginalized people. "Blocked Out" is located on a major campus thoroughfare, but the monument's significance is not commonly known. Learning about "Blocked Out" was a moment of epiphany for Macy. In her interview, Macy explained she knew the school's history "was kind of problematic," but she "didn't know the extent of it." Before the walking tour, Macy "was on campus and [she]'d just walk past it." However, now she has "a new perspective." For Macy, "being able to talk to other people while [she] was learning about it was insightful." And, she continues to share her experience through "conversations with friends about 'Blocked Out.'" A third student, Ali, was also an employee at the University's Ethnic Cultural Center (ECC) where she gave a tour for her SVG. She explained how the building environment was constructed, focusing on cultural representations in murals and the naming of rooms for ethnic groups or associated activities associated. She also discussed programs offered at the ECC that supported marginalized identities within the university community. After their visit, Ali's SVG prepared a re-enactment of their tour for their classmates during which she offered an open invitation for all of her peers to visit.

Preliminary findings suggest that a number of our UGs have employed experiential data-wisdom by going back to the community spaces they have visited in our course. In the three examples we highlight above, we see that students were working to develop more reciprocal forms of participation by re-engaging with the places they visited. We have continued to design more explicit course objectives and activities for students towards this end. In the most recent iteration of our course design, each SVG is directed back to the same

neighborhood throughout the quarter, guiding them toward the use of experiential data within this community. We are also implementing curricular designs for students to more deeply reflect on their site visits, to re-engage with their data (e.g. final course projects), and to share their findings with people living in their respective communities. A future goal is to facilitate community members' direct involvement in the development of student submitted work. As educators and researchers we continue to look for innovative practices to support emergent learning experiences that identify community strengths and recognize transformations of students' relationships with their neighbors for future work beyond their college experiences.

Paper 2: Data-wisdom: One size fits all?

Considering Ackoff's (1989) claim that data-wisdom involves the ascription of value to data, approaching data with wisdom is a tricky business. It requires that we ask ourselves whose values are being used in determining the wisdom of our data. It also requires us to consider whether there are more ways than one to be wise about the same data. In this project, I have attempted to explore these questions by considering how the sociohistorical narratives (Lave & Wenger, 1991; Holland & Lave, 2009) researchers and participants carry with them into a setting impact how and why certain pieces of data are ascribed value while others are not. I also investigate the possibility of being wise about the same data in different ways.

To explore my questions, I offer a case study in which Connor, an undergraduate college student enrolled in an education course exploring learning across settings, is making sense of a piece of art in his university's fine art museum. This particular art installation includes a set of 25 photographs depicting the loosely connected story of a group of people in a rural Australian town. The artist designed this piece so that there is no specific beginning, middle or end to the story, requiring the observer to determine for himself/herself the chronology of the storyboards and the story being told. During Connor's sense-making, he is videotaped walking between the various storyboards, orally narrating to a graduate student mentor (GSM) his version of the story.

Within the undergraduate course in which this study was located, learning activities happen across multiple contexts and settings. Students are on-the-move (Leander, Phillips, & Taylor, 2010; Taylor, 2017) exploring learning theory in informal spaces. The dyadic relationship between course instructor and student shifts within the different contexts, allowing students and course facilitators to move more fluidly between the roles of teacher and student based on who has the more expert knowledge at any one time (e.g., Rogoff, 1994). This unique course structure promotes emergent learning and allows students to make important and meaningful connections between theory and practice.

A case study approach using ethnographic research methods was used for this particular study. Video data of Connor interacting with his graduate student mentor and the art installation during the site visit was recorded. A post-site visit interview of Connor explaining what he was thinking as he narrated the story of the art installation has also been recorded. Both of these videos have been analyzed using interaction analysis (Jordan & Henderson, 1995) and discourse analysis (Gee, 2005) techniques to surface points of disequilibrium between what was being said and what was being signaled through gesture and body position. Student and GSM memos were also used as sources of data.

Preliminary analysis indicate the following:

- Upon analysis by this researcher, the story narrated by Connor to his GSM related to the museum exhibit only partially explained what was represented in the storyboards, and, in fact, some of what was relayed to the GSM was wrong. I offer that data-wisdom must account for learners' sociohistoric development of self, as this impacts what knowledge they bring to different learning contexts.
- Misconceptions also provide important data points for data-wisdom.
- Whenever we analyze data, what we are analyzing has already happened. Any interventions based on this data is always for future situations, which have already changed by the time our interventions are deployed.

Paper 3: Building collective data-wisdom: STEM learning and mentoring in higher education

STUDIO: Build our World is an after-school mentoring program, and collaborative research endeavor between University of Washington (UW) and a local community-based organization (CBO). One of our main goals is to shift the focus of STEM higher education from its epistemological dimension to relationships through positioning undergraduate students as wise actors who become answerable to their knowledge within relationships they create between themselves, and with youth. We design the STUDIO experience so that the mentoring activities center around project-based activities that recognize, and support youth's and undergraduate mentors' diverse STEM

interest and motivations. With this goal and design in mind, researchers, CBO staff, and undergraduate mentors have been collecting ethnographic data documenting, surveying, videotaping, analyzing, and reflecting on mentoring interactions with youth. Our previous work analyzed this data to understand how undergraduate mentors built relationships, and acted wisely from a relational standpoint (Herrenkohl et al., 2019). However, we have not explored the process of how we collaborate to build a shared understanding of the data, what we call common knowledge. What is missing is an understanding of this collaborative process, often imbued with tensions that arise from multiple motives that each participant brings to working on the issue of improving mentoring practice (Hopwood & Edwards, 2017). Understanding this collaboration plays a critical role in exploring how to build wisdom, especially a collective wisdom. Here, we investigate one of our collaborative reflective practices—weekly Friday Seminar—where researchers, undergraduate mentors, and CBO staff articulate and share information about youth, mentoring experiences, and ask questions about how to act wisely in the moment to respond to youth’s socioemotional, STEM needs, and interests. This talk focuses on the complex process of building common knowledge within a reflective seminar structure when we share potentially problematic data about study participants that concerns their safety and privacy. We write this proposal to educators who work with communities of people from diverse racial, cultural, and historical backgrounds. Our analysis comes from a motivation to approach data sharing to improve mentoring practice from more horizontal and dialogical mentor-mentee and/or teacher-student relationships.

We understand learning as fundamentally a social, cultural, and historical process involving taking up valued cultural practices and tools (e.g., Cole & Wertsch, 1996). From this starting point, learning is defined as a “transformation of participation” (Rogoff, 1994, p.209), a process of becoming a fully participating member of a particular community (Lave & Wenger, 1991). Rooted in sociocultural theory, common knowledge can become a “resource that mediates how people respond, and work together on complex problems” (Vygotsky in Hopwood & Edwards, 2017, p. 109). We recognize that building common knowledge is intertwined with collecting, and interpreting data (e.g. undergraduate mentor written reflections, interviews, field notes, videos, and photos) that potentially contain sensitive and personal information about participants. In STUDIO, we collect and interpret data under a collective goal of creating the best possible program for youth, however, the interpretations of data are not always aligned because participants have different insights associated with different motives informed by diverse historical, political, and cultural elements of their lives. Here, we define motive “in terms of what matters to others in practice they inhabit” (Hopwood & Edwards, 2017, p.109). We see these different insights as strengths and support undergraduate students in building common knowledge through “listening to, recognizing, revealing, and engaging with others’ motives” (Hopwood & Edwards, 2017).

We used video data of the Friday Seminar discussions, written reflections, and an interview with undergraduate mentors to explore the following questions: How do undergraduate mentors make sense of the data, and information about youth in relation to their own positionality? How do these different interpretations affect what they identify as problems to be acted on in the context of mentoring? How can researchers and CBO staff redesign our reflective seminar to better facilitate dialogue that encourages more listening, recognizing, and revealing their own interests and motives? We viewed video data and identified moments in the Friday Seminars when mentors expressed multiple perspectives on a mentor-youth interaction of interest. We performed narrative analysis on the dialogues by tracing story lines of four mentors, two researchers, and two CBO staff. We conducted short follow-up interviews with two mentors who had strong emotional reactions (e.g. tears, absence from class after conversation) to understand how the dialogue supported or did not support their learning while participating.

Preliminary interaction and narrative analyses of the video data, written reflections, and interviews suggest that mentors, researchers, and CBO staff collaborate to contextualize and reflect on shared information about their personal experience and knowledge about youth to make sense of what happened in mentoring activities within larger cultural and social issues. One instance illustrates how they listen to others’ interpretations of presented data and identify different problems that needed to be acted on. One undergraduate White mentor, Ella, shared her concerns and confusions about how to respond to one Black youth, Casey. Ella suspected that Casey could have been involved in a school fight when Casey told her about nose pain she was experiencing. Researchers asked Ella to share her story in one Friday Seminar to make sense of her experience and invite others to pitch in on how to respond wisely to Casey in the future. Friday Seminar participants shared several interpretations of Casey’s disclosure that reflected their personal, historical, and racialized experiences and knowledge. Abdul, a Black male CBO staff, and Makena, a Black female undergraduate mentor described the danger of talking about a fight, risking oneself to be labeled as a snitch in their community. Nicky, a Latina undergraduate mentor, described the importance of being a non-judgemental support to youth, and encouraged Ella to talk to Casey again. Toward the end of the discussion, Makena described how common it is to get into a fight in schools and insisted that we should not problematize Casey’s possible fight by talking about it as a group. She later revealed that she felt as if the group dialogue stigmatized youth of color in the interview. Two motives

at tension emerged in the analysis: 1. Improving mentoring practice through open, and collective dialogue, and 2. Preventing further damaged-centered research that could be perpetuated by the same dialogue. This instance provided researchers an opportunity to think about the unintended consequence of open, collective dialogue. We argue that this study provides a nuanced understanding of how common knowledge is constructed and invite researchers and educators to wrestle with collectively approaching data sharing with openness and yet with historicized understandings of the study participants.

Paper 4: “Hey! That’s my house!”: Data as visibility, for better and for worse

The now ubiquitous tools of navigation that Google provides open up new possibilities for learning in embodied, out-of-classroom settings where learning is mobile and on-the-move (Taylor, 2018; Leander, Phillips, & Taylor, 2010). Mobile devices reframe notions of traditional asymmetric classroom learning through flattened access to data (Taylor, 2017; Sakr et al., 2015, Bell et al., 2018). Constant information access through mobile data makes it possible to transform traditional education contexts. Locations of learning stretched beyond the classroom reposition learners as connected members of sociotechnical assemblages engaged in navigating and placemaking connected through Google-provided representations of the lived world. These technologies are embedded into everyday interactions with place, and through an afterschool STEM program, we sought to uncover some of the possibilities, affordances, and drawbacks of everyday tools and their emergent modalities as a way to learn and connect to personal histories of local place.

In this paper, I explore a curriculum of local place originally designed to explore new ways to connect youth to community using mundane and emergent technologies of place. Spatiotemporal technologies like Google Maps, Google Earth, and Google Street View were used as part of a Mobile City Science curriculum (Taylor et al., 2019) to deepen and enrich connections to local community. However, youth privacy and safety implications emerged across modalities when these common data-dependent tools were used in the design process. Such implications raise the question of whether it is possible to responsibly design an emergent spatiotemporal curriculum across emergent modalities reliant upon existing tools.

As youth experimented with data among spatial modalities, opportunities for new learning pathways emerged alongside privacy and safety concerns. Youth were first asked to reflect on their neighborhood by drawing a paper map, and then by locating those places on a collaborative version of Google Maps, so youth could see relationships between places. Kay drew a paper map that included her house, her friend’s house, and the local grocery store. In the next task, youth were asked to use mentors’ phones to capture 360° photospheres of locations across the neighborhood which could be used in the VR builder, CoSpaces, as a way to build upon the real world with 3D elements. Kay chose to capture a photosphere of the park across from her and Zee’s house which was inadvertently published to Google Maps.

Neighborhood activities flowed into VR-building activities. In one task, Kay worked with Zee to “reimagine” a place in the neighborhood that were meaningful to them in the VR building space. The two included a location featured earlier in the curriculum – the local pond. During that experience Kay and Zee found themselves reminiscing about sunshine. “We call them sun showers,” exclaimed one mentor looking up at the rain. “Isn’t that a rainbow?” asked Kay, which prompted the two to theorize about how rainbows are made. Kay’s mentor captured a photosphere of the two girls in front of the pond, which Kay then brought into the VR builder, and included a rainbow and pieces of their earlier conversation. This flow between neighborhood walks and virtual re-imaginings open doors into new learning possibilities and emergent spatial modalities.

For the purposes of this paper, I followed Kay, who participated with a group of 10-15 middle schoolers in a STEM-based afterschool program that meets once a week for two hours over a 10-week period. Undergraduates from the local university accompanied youth in one-to-one configurations. The curriculum was roughly based into 3 parts: 1) reflecting on place 2) re-walking place and 3) re-imagining place. Activities comprised hand-drawn maps, 360° immersive photosphere images, and an HTC Vive and headset running an immersive virtual reality (VR) version of Google Earth. GoPro cameras collected video data through the neighborhood as well as embodied movement in the computer lab. As youth re-walked through the virtual landscape, a screen projected first-person views allowing youth to co-view the immersive experience. Virtual re-walks were screen captured, recorded, coded and analyzed for emergent themes (Jordan & Henderson, 1995).

In re-walking the virtual neighborhood, Kay was initially excited by the opportunity to fly far away but decided to check out her home first. Youth in the study all wanted to see the representation of their home within the virtual neighborhood. One youth, Jay, spent an hour “walking” in the rendered photorealistic version of Google Earth which makes use of photospheres like the ones captured by youth. As he navigated the virtual version of his neighborhood, Jay walked us through his own personal history and pointed out his old and new school, the places where he catches the bus, and then stopped at the front door of his house, which was open. “Why is my door open?” he asked. “No, seriously, why is my door open?” Jay reacted as if his door was at that very moment

left open as the implication of time is not explicit in Google Earth VR and only the recent past is compressed into an eternal present. In another example, youth ran into themselves in Google Earth VR not realizing that photospheres of themselves had been published across platforms – or even at all.

To date, little if any research on educational uses of Google Earth VR exists. Related research into desktop uses of Google Earth focus on its use as a visualization tool (Whitmeyer, 2012), or way to accommodate virtual field trips and curate “tours” (Treves & Bailey, 2012). One of virtual reality’s main draws is its sense of “being there.” When first stepping into a high-end VR machine, it feels as if you are transported into another world. But what happens when that world is a representation of your own world, your own lived experience? And what abilities to write that experience do we collectively give over to an entity like Google who has the ability to collect and distribute snapshots of time and place intertwined with the technologies that are shaping our perception and the lives that depend upon them to get around? In the end, mentors removed the photosphere images tied to their accounts upon request of the researchers. The affordances of the technologies demonstrated here are numerous, but privacy concerns remain. How can we as learning scientists explore the possibilities of emerging modalities of the everyday and also keep youth safe?

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