Strings Attached: A Balinese Dance from Attentional Anchors to Auxiliary Constructions

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Abstract

Indicating auxiliary constructions on a geometry problem is often key to solving it, and yet teaching and learning to do so is challenging, given that these lines are by nature "invisible" prior to being marked. We are developing a culturally situated educational response called Geometry Resources in Dance (GRiD) that bridges Balinese tradition and embodiment philosophy. We first solicit from students imaginary lines that they conjure spontaneously to perform intricate postures or movements; then they mark these lines on a geometrical mat, which the first author, a Balinese dancer and educational researcher, intuitively covered with a patterned mesh of concentric eight-rayed matrices. We report on a retrospective multi-faceted cognitive domain analysis of Balinese historical practices that implicated the very same diagrammatic matrix, thus validating its cultural authenticity.

Introduction

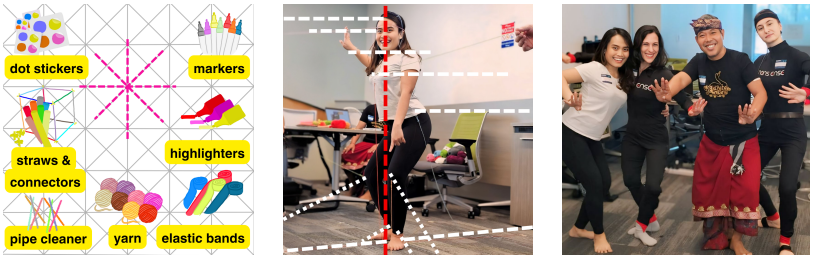
Auxiliary lines are vital cognitive tools for solving geometry problems, because they promote alternative perceptual constructions of the shapes in question [10]. However, teaching and learning how to construct auxiliary lines remains challenging, because students are expected to "see" and then build something that, by definition, is not yet in their visual field; moreover, pointing out to students where to draw these lines could defeat the purpose of training them to do so independently [8]. Addressing this problem of practice, our design-based project elaborates on action-based embodied design [1] in an attempt to create a culturally situated context wherein students would intuitively construct auxiliary lines.

Our initial inquiry focused on dance, because dancers are known to create imaginary figurative elements to navigate space and enhance the execution of movements [5]. From a resonant enactivist perspective, Hutto and Sánchez-García [9] introduced the construct of *attentional anchors*—perceptual resources, such as imaginary linear constructions, that individuals project into their sensory field to coordinate the performance of challenging movements. We conjectured that, *given suitable diagrammatic resources, dancers could access their tacit attentional anchors and materialize them as external linear forms [11] conducive to geometric discourse.*

We designed GRiD—*Geometry Resource in Dance* (Figure 1(a)), a system of spatial orientation cues and inscription tools for students to utilize as they engage in the designed activities. The GRiD mat is covered with an orderly mesh comprising four sets of equidistant parallel lines angled respectively along the vertical, horizontal, and two main diagonal axes. A concentric eight-rayed matrix is discernible unit structure in GRiD's crisscross lines. To evaluate these experimental activities and analyze the engagement process, we collected data from 77 Balinese fifth-graders aged 9–12. For examples of our activities and its empirical findings, readers are referred to our previous publication [2].

We chose to both ideate and evaluate GRiD in the Indonesian context, because Author Apsari—the lead researcher of this ongoing PhD project—is a Balinese. During the advanced project stage of data analysis, she stepped back to ponder her early intuitive decision to design the 8-rayed matrix, a reflection that led to a scoping *cognitive–anthropological domain analysis* [15] into the spatiality of Balinese dance. The analysis revealed a system of archeo-ethnographic spatial practices rooted in topographical, architectural, spiritual, and linguistic facets of Balinese cultural identity, all cohering on the 8-rayed matrix. The objective of this paper is to argue that in intuitively creating GRiD's 8-rayed design, Apsari

inadvertently implicated, surfaced, and materialized her own Balinese cultural form cohering underlying variegated local heritage practices, thus rendering GRiD culturally authentic.



(a) (b) (c)

Figure 1: *The tacit lines of Balinese dance: (a) Components of the GRiD. (b) Tacit linear perceptual orientations in dancing. (c) Demonstrate a basic Balinese dance stance.*

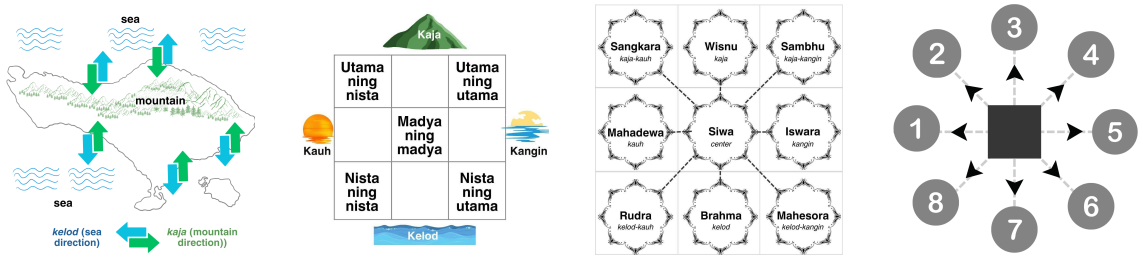
A Topographic–Cosmological Matrix Orientating Balinese Dance Spatiality

Traditional Balinese dance style is a most rigorous and demanding practice requiring whole-body coordination. For example, it is extraordinarily challenging to balance the static asymmetrical body organization of *agem*, the foundational posture of Balinese dance that represents imbalance [7]. In "right *agem*," the left foot is one fist distance in front of the right foot, the body weight is on the right foot, the shoulder blades are squeezed together, and the arms are bent with the wrist lower than the elbow. Also, the right hand is placed at eye level while the left hand is placed at chest level, and the head is tilted slightly to the right. One strategy dancers may employ to achieve this position is to imagine lines that would allow them to correctly orient their body parts (e.g., Figure 1(b) depicts Apsari's attempting to make her imaginary personal lines visible for workshop onlookers by attaching multiple auxiliary strings to her body, each string materializing one postural orientation, as approximately schematized with red and white dashed lines).

When beginner dancers struggle to achieve balance within their *agem* (see example in Figure 1(c), a renowned Balinese dancer, I Made Suteja, introducing Balinese dance during the GRiD workshop, posing with Apsari and two workshop participants, Ami Shulman and Dr. Bilge Göksülük, to demonstrate a basic dance stance [14]), the teacher usually instructs them to establish an imaginary vertical line, running from the sky/heaven above, through their body, and down to the underworld (red dashed line in Figure 1(b)). This tripartite corporeal axial extension—heaven, body, underworld—implements the Balinese concept of *Tri Angga*, by which everything can be divided into three parts: *utama* (high), *madya* (middle), and *nista* (low). The *utama* of the universe is the zenith, such as the heaven, sky, or mountain, the sacred dwelling place of the Gods as well as the spirits of ancestors. Humans live on the earth, the *madya* section. The *nista* comprises lower geo-cosmological echelons, such as the sea or underworld, where malevolent spirits lie and the essence of impurity [4][6]. Reflexively, the human body itself constitutes the tripartite moralistic–cosmological diagram, whereby the head is *utama*, the torso is *madya*, and the feet are *nista*.

Mythological in its cultural roots, *Tri Angga* runs deep in contemporary Balinese discourse and practice, implicitly suffusing variform aspects of praxis, ethos, and mores, including the topographic layout of villages and, fractally, within the village, the architectural design of each traditional home. The plurality, if not majority of Balinese villages are configured on the topographical cardinalities of *kaja* (towards the mountain) and *kelod* (towards the sea), which vary in their absolute cardinal alignment in the north and south of the island (Figure 2(a)). Each village has three types of main temples (*Kahyangan Tiga*), two of which—the temple of origin and the temple of the creation—are located at the *kaja* side, inclined near the lofty mountain grounds, while the temple of death is erected downstream in the *kelod* extremity, often placed near the cemetery, which is considered impure. The middle section of the village, in between *kaja* and *kelod*, is left for household and community building. Balinese also use the orthogonal *kangin–kauh* axis corresponding to the sun's orientations. *Kangin* is where the sun rises, roughly east for near-equatorial Bali,

and *kauh* is where it sets, correspondingly, the west. As in the case of *kaja–kelod*, the wide-ranging *kangin–kauh* axis, along with its middle section, also serves in partitioning a local territory into three regions. Together, the tripartite *kaja–kelod* division and tripartite *kangin–kauh* division factor a nine-celled cross-product spatial matrix known as the *Sanga Mandala* (Figure 2(b)), a sacred compass consisting of a center from which emanates eight orientations, per the *Dewata Nawa Sanga* (Figure 2(c)) principle. Balinese people associate each compass direction with a particular deity along with all it portends. Traditional Balinese architecture, whether a sacred temple structure or a humble dwelling compound, is organized based on this *Sanga Mandala* spatial–deific concept. The holiest direction (*utama ning utama*) will be both in the direction of the mountain (*kaja*) and towards the sun rise (*kangin*), hence *kaja–kangin*.



(a) (b) (c) (d)

Figure 2: *Balinese geospatial matrix correlated with divine cosmology: (a) Map of Bali [4]. (b) The Sanga Mandala. (c) The Dewata Nawa Sanga. (d) Illustration of a 8 mandatory egocentric orientations.*

When Balinese dance is performed in a temple, *the kaja–kelod* axis is applied to determine the precise location of the performance in accordance with the dance's sacredness [3]. In general, Balinese dance can be divided into three categories. The most sacred dance category (*wali*) is reserved for religious purposes and is therefore performed in the inner courtyard of the temple (the sacrosanctum). The second-down dance category is the ceremonial performance of *bebali*, which, while also ritualistic, is not quite as sacred as *wali* and should, therefore be performed in the second courtyard or the middle of the temple. Similarly, the third category, *balih-balihan*, is performed in the temple's outer arenas.

Further, Balinese dancers learn to imaginatively partition the stage according to the nine-celled gridded spatial organization and center their performance on its central cell. Moreover, just as a village layout reinstates the land's geo-topography, the dancer's body recapitulates the *Dewata Nawa Sanga* at a micro level. Finally, the dancer-centric invisible matrix is portable—dancers can translate and rotate the matrix across the stage to serve their evolving coordination needs. To illustrate the incorporation of the deific matrix onto the dancer's position and orientation, we reproduce, below, a translated excerpt from recordings of the Apsari's private lessons with one of Bali's most prominent Gambuh dancers and teachers, I Made Suteja. For him, when someone is dancing, they position themselves as Siwa (lord Shiva), who is located at the center of the *Dewata Nawa Sanga* diagram (Figure 2(c)). By "being the Siwa," Suteja referred to his attempt to center himself vis-à-vis the system of imaginary horizon points he perceives and abides with as he dances (compared Figure 2(d) and respective deities' positions on Figure 2(c)). As Suteja explained:

> "(When) we are dancing, there are eight mandatory points. If we go there [*orients himself toward a location marked with a square, center of Figure 2(d)*] . . . the points are . . . the sides, right and left [*points in the directions of 1 and 5*], straight forward, corners right and left [*ditto, 3, 2, and 4, respectively*]. That is one, two, three, four, five [*ditto, 1–5*]. On the back . . . six, seven [*ditto, 6 and 7*] . . . eight [*ditto, 8*]."

While the *Sanga Mandala* and *Dewata Nawa Sanga* forms play explicit roles in Balinese life, their practical function in traditional dance is mostly implicit. Dancing instructors do not explicitly state that students should consider the nine-grid. Notwithstanding, dance teachers are evidently aware of the student's orientation, correcting it when a student moves off course.

Conclusions

Learning to dance may be more than physical entrainment in some ad hoc choreographic routines—learning to dance may covertly constitute broader cognitive and epistemic entrainment in a culture's spatial, moral, and spiritual practice. Balinese eight-pronged patterned system of cardinal orientations, embedded in and learned through dance, tacitly mediates the enactment of mundane cultural practice, such as physical navigation and narrative reference. In dance, the Balinese orientational compass serves as a stylized diagrammatization of cultural dynamics. Partaking in dance, the student implicitly appropriates, *incorporates*, the land's divine cosmology and mythology (see also [12][13]). As such, dance instruction mediates subtle intergenerational knowledge. Specifically, the GRiD method for cultivating auxiliary construction diagrammatically instantiates the Balinese divine matrix *Dewata Nawa Sanga*, inviting students to attune to its lines of thought. Hence, the GRiD materializes tacit Balinese spatial practice into language, nurturing the heritage practice for students to sustain, thus grounding geometry in local identity.

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