

Balinese Spatial System: Language or Culture Affecting It?

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Abstract: The present paper was designed to point out if the practice of Balinese spatial system by its speakers is linguistic or cultural in nature. Several scholars indicated, though not dominantly, that the use of a relative system in Balinese spatial system was observed to be used by their research participants. Other scholars in their studies, employing linguistic and nonlinguistic tasks in the production tasks, nevertheless, found out that an absolute system was largely practiced by their research participants. Additionally, there are also quite recent studies investigating the use of Balinese spatial system by local signers in Bengkala village. The findings pointed out that children and adult deaf subjects consistently used pointing in linguistic tasks. However, the child and adult deaf subjects used absolute responses in nonlinguistic tasks. Cultural and Balinese Hindu religious practices seem to guide the use of spatial systems in Balinese.

Keywords: sign language; spatial system; absolute system; relative system; spatial cognition

1. Introduction

There has been a claim if the use of various spatial systems affects human cognitive functioning. Levinson (2003) and Boroditsky (2011), for example, based on the findings of their experimental studies, pointed out that spatial systems of languages influence their native speakers' way of thinking, at least in solving nonlinguistic spatial tasks. To put the current paper in a proper context, it is necessary to show how spatial systems practiced across languages and societies vary. There are many practices of spatial systems. Hausa language, as reported by Herskovits (1982), uses a relative spatial system in which an observer's bodily axes (i.e. his/her front, back, left, right) are directly translated

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to another object being encountered. English also applies the relative system. The principle, nevertheless, is distinct from that used in Hausa. In the English relative system, the front of the object being faced by the observer is facing the observer, while the back is in the opposite direction of the front (Herskovits, 1982).

In addition to the relative system, there are also languages applying an intrinsic system in their spatial orientations. In the system, the intrinsic parts of reference objects are used as anchors to describe spatial relations between objects. Tzeltal language (a Mayan language spoken in the Mexican state of Chiapas), for example, decides its intrinsic system by referring to the shapes of an object (Levinson, 2003). Specifically, a teapot for example, its lid is identified as its 'mouth', the teapot handle as the 'ear', the bottom part as the 'bottom', etc. Thus, in the language, an object is spatially described to be 'on the mouth of the teapot'.

In contrast to the two spatial orientations, there is a spatial system that uses a fixed bearing, hence called an absolute spatial orientation. Balinese, as reported by Aryawibawa (2010; 2012; 2016) and Aryawibawa et al. (2018; 2023), practices the system in which the fixed north, south, east, west orientations are applied when explaining spatial relations between objects (e.g. the book is north of the TV).

The current paper is mainly dedicated to highlight aspects (i.e. linguistic or cultural) affecting the use of Balinese absolute spatial system. The findings reported in this paper refer to Aryawibawa (2010) and Aryawibawa et al. (2018; 2023) studies on Balinese spatial system. The report is expected to contribute to on-going discussions on the universality of spatial systems. It has been claimed that the relative spatial system is universal (Herskovits, 1982; Landau and Jackendoff, 1993). The claim seems to be incorrect given the fact that within the relative system the spatial orientation varies (i.e. while Hausa language applies the translation system, English practices the reflection system). More interestingly, as a matter of fact, there are languages that do not use the relative system in their spatial relations such Balinese (as exemplified at the outset of the introduction). In addition to Balinese, Guugu Yimithirr, as reported by Levinson (2003), also does not practice the relative system. Rather, it employs the absolute system. Thus, the current paper is expected to provide further evidence of the spatial system, particularly in pointing out if the spatial system is linguistic or cultural in nature.

The definition of culture that might also shape the use of spatial frameworks adopted here follows a discussion provided by Spradley (in Spradley & McCurdy, 2012, p. 2). There are two possible definitions of culture. The first definition, certain characteristic behaviors shared by a group of people

is inherited. Thus, for example, the way Balinese people live which is different from that of Javanese people, following Spradley's discussion, is a product of inheritance.

The second definition argues that such differences are due to learning. In other words, the particular behaviors practiced by a certain group of people are learned. Spradley further explains that the definition of culture he adopts is *'the learned and shared knowledge that people use to generate behavior and interpret experience'*. In the context of cultural aspects that seem to influence the use of spatial systems by Balinese speakers follows the definition just outlined.

2. Literature Review

The use of spatial systems (i.e., relative, intrinsic, and absolute systems) across languages and societies have become a very interesting topic since it can be used to showcase a relation between language and mind (i.e., cognitive function). There is a claim that the relative system (e.g., to the left/right) is universally practiced (Herskovits, 1982). The claim seems to be not justified since within the relative system the principles to decide left/right is distinct from one language to another as reported by Levinson (2003). Hausa, for example, applies the translation principle. In contrast to Hausa, English uses a reflection principle, while Na tar employs 180° rotation principle. Aryawibawa (2010) provides a comprehensive discussion on the three principles.

In the intrinsic system, differences of applying principles in deciding intrinsic parts of an object (e.g., front/back sides) can also be observed. While English applies a functional concept, Tzeltal practices a shape-based system. For example, in English the front part of a TV is the one that we are facing when watching it, a house's front is the part with an entrance gate and an entrance door. Nevertheless, as reported by Aryawibawa (2010), in Tzeltal deciding intrinsic parts of an object is based on the shape of the parts. Thus, the teapot's lid is named its 'mouth', the spout is its 'nose', and the handle is the 'ear'.

Distinctions in determining bases used in spatial systems can also be pointed out in absolute systems. Balinese, for instance, uses fixed terms such as north, south, east, west in its spatial orientations. Wassmann and Dasen (1998) did a study to test Balinese spatial systems. They pointed out that the majority of subjects applied the absolute system. The use of the relative system was observed, though not dominant. Nevertheless, they did not explain what contributed to the use of the relative system. To respond to Wassmann and Dasen's findings, Aryawibawa (2010) administered an experimental investigation on what spatial systems practiced by Balinese speakers. The results indicated that the subjects used the absolute system in the nonlinguistic tasks. Additionally, they consistently and systematically practiced the absolute

system in the linguistic tasks as well. In other words, the use of the relative system in Balinese, as pointed out by Wassmann and Dasen (1998), was not confirmed in Aryawibawa's study (2010).

In contrast to Balinese, Khwe uses place-names in its absolute frame of reference (Brenzinger, 2008, p. 4-5) as described below.

In conveying spatial information on locations in the bush, for example, on hunting/collecting sites, Khwe refer to landmarks – mainly the water pans, which all have individual names. The mental map of an experienced Khwe hunter or collector includes names and positions of between one hundred and two hundred pans; he will memorize the location of many fossil drainage lines and is familiar with the major elephant tracks. Most of all, he will remember thousands of prominent trees. Khwe place-names, as a rule, are primarily names for water pans *óró-ca* and dug wells //gáàna – the main water sources in West Caprivi. One could expect a total of far more than 600 Khwe place-names for the core area of Khwe-land, which stretches from West Caprivi north into Angola and south into Ngamiland of Botswana. A Khwe elder once stated emphatically that in Khwe-land 'There is no place named, where there is no water'. It is the water sources that are named, and this is done mainly by referring to environmental features, such as plants, animals and physical features.

The use of other spatial systems can be informed from other quite recent studies. Wu et al. (2024), for example, based on their study employing naturalistic data obtained from the Beijing *Early Childhood Mandarin Corpus*, pointed out that there are six spatial systems used by the children: direct reference, geomorphic reference, landmark-based reference, object-centered reference, relative reference, and people-centered reference. Interestingly, the absolute spatial system that is commonly practiced by the adult Beijing is not used by the children. In the study, they conclude that language, culture, and cognition shape the implementation of spatial systems by children.

Another study incorporating a multilingual aspect of speakers is conducted by Ogelo (2024). The study involved 80 multilingual Dholuo speakers in the contexts of Dholuo spoken in Kenya and northern parts of Tanzania and English languages. The results showcased that the multilingual Dholuo speakers (i.e., they speak both English and Dholuo) use the relative spatial system, which is dominant in English, more frequently than the monolingual Dholuo speakers. In other terms, the study indicates that the use of spatial systems in a language is affected by multilingualism.

The different use of spatial systems has an implication to the cognitive functioning of speakers. Levinson (2003) administered experiments by giving

non-linguistic tasks (i.e., animal rearrangement task) to Dutch subjects (N= 37) and Tenejapan participants (N= 27). The results indicated that 95% of the Dutch subjects used a relative order, while 75% of Tenejapan participants applied an absolute order. Several factors affected the less consistent use of the absolute system such as educational background of the participants, interference of the relative system available in the language. Please recall that the study by Ogelo (2024) demonstrates that the English relative system influences the use of the relative system by multilingual Dholuo speakers.

3. Method and Theoretical Framework

3.1 Method

The most current study reported in the present paper, methodologically, is a replication of Aryawibawa's previous investigations on Balinese spatial system (2010; 2018; Aryawibawa et al., 2023). The method applied is production tasks consisting of both linguistic and non-linguistic tasks. The linguistic tasks consist of object rotation and asking direction tasks. In the object rotation task, an object (e.g. a pen) is placed next to another object (e.g. a book). An experiment participant is then asked about the spatial relation between the pen and the book (e.g. where is the pen?). The participant then provides the spatial relation information (e.g. the pen is to the left/north of the book). For the asking direction task, the participant is asked how to get to a place (e.g. can you tell me how to go to a market/temple, etc.). The task is expected to tap the spatial knowledge of the research participants.

As for the nonlinguistic task (i.e. object rearrangement), the experimenter and subject participant sit face to face separated by a table between them. Three different objects (e.g. a pen, a car's key, a TV remote control) are placed on the table. The participant is asked to look at the objects carefully. The objects are then collected by the experimenter. The experimenter and participant then switch the seat (i.e. the experimenter now sits on the participant's seat, and vice versa). The participant is then asked to rearrange the objects exactly as he observed before. Please note, following Baddeley (1990), there is a time interval before the participant rearranges the objects. The task is expected to tap participants' knowledge (i.e. if the spatial orientation used in the nonlinguistic task is consistent with that applied in the linguistic tasks). The same tasks are employed in three different studies (Aryawibawa 2010; Aryawibawa et al. 2018; Aryawibawa et al. 2023). Please note that in Aryawibawa et al. (2023) the experiments are administered in both inside and outside rooms to test if the presence of a landmark (i.e. a mountain in the area) impacts the participants' use of spatial systems.

Thus, in this study we used three data classification, they are data obtained from the object rotation tasks, asking direction techniques, and object rearrangement tasks. Please note that the data are from the local sign language (*Kata Kolok*) used by the local signers in Bengkala village, North Bali.

3.2 Theoretical Framework

As it is previously stated (partly repeated here) that Wassmann and Dasen (1998) did a study to test Balinese spatial systems. They pointed out that the majority of subjects applied the absolute system. The use of the relative system was observed, though not dominant. To respond to Wassmann and Dasen's findings, Aryawibawa (2010) administered an experimental investigation on what spatial systems practiced by Balinese speakers. The results indicated that the subjects used the absolute system in both the linguistic and nonlinguistic tasks. The findings further suggest that the application of the absolute system indicates that language (i.e., the spatial system) seems to affect the way Balinese speakers think in particular in solving nonlinguistic spatial tasks. In other words, as Levinson (2003) pointed out, language influences human cognitive functions.

Provided with such evidence, Li and Gleitman (2002), nevertheless, explains that "cultural differences in modes of thought render certain linguistic usages handier than others, and thus influence their prominence and frequency of use" (Li and Gleitman, 2002; p.268). In short, the present study reports the spatial system used in Balinese (in the context of definitions outlined previously in this paper) and to indicate if the factor that drives the practice of spatial systems in Balinese is linguistic or cultural in nature.

4. Results and Discussion

At the outset of the current paper, it is stated that the paper mainly discusses three studies on Balinese spatial system to highlight if the application of the Balinese spatial system is linguistic or cultural in nature. This section presents the results and discussions of the three studies administered by Aryawibawa et al. (2010; 2018; 2023).

Aryawibawa (2010) in his study employed three adult Balinese who were monolinguals. The study used both linguistic and nonlinguistic tasks. The results show that the fixed orientation terms (e.g. north, south, east, west as in *Kunci e dauh bal e* 'The key is to the west of the ball') are consistently practiced in both object rotation and asking direction techniques. Interestingly, the fixed terms (i.e. the absolute system) is again consistently employed by the research participants in the nonlinguistic tasks. The findings do not confirm Wassmann and Dasen's findings (1998), in which the use of the relative system by their research participants was observed. How to explain the finding gap? The use of

the relative system in Wassmann and Dasen (1998) study might be affected by the interference of the Indonesian relative system. Please note, however, Wassmann and Dasen (1998) did not report if their subjects are Balinese monolinguals or not.

Please recall that the number of research participants participating in Aryawibawa's first study is only three adult monolingual Balinese. Thus, the claim that Balinese speakers use the absolute system exclusively seems to be not persuasive in the sense that the number of participants is only three Balinese monolinguals. We need more subjects to further confirm the results. A follow up study is then administered. Aryawibawa et al. (2018) conducted a similar study in the northern part of Bali Island precisely in the Bengkala village. The reason for administering the study in the northern part of Bali Island is that the use of fixed terms in Bali is local depending upon where people locate when using the terms. When they are in the southern part of Bali Island, the north is towards the North (of compass orientation) as in *Umahne Wayan dajan bale banjar e* 'Wayan's house is to the north of the community building'. In this context, the location of Wayan's house is towards the location of the north (the mountain location) which is in alignment with the direction of the compass north. However, when you are in the northern part of Bali Island, the north is the opposite of the north of Balinese people living in the southern part of the island. The difference is due to the fact that north in Balinese is associated with the position of mountains which pepper in the middle part of Bali Island, south is associated with the location of sea, east is related to the location where the sun rises, and the west is to the location where the sun sets.

Aryawibawa et al. (2018) included 51 child participants aged 6-12 years old and 6 adult monolingual Balinese. Like Aryawibawa (2010), Aryawibawa et al. (2018) employed linguistic and nonlinguistic tasks. For the linguistic tasks, the object rotation and asking direction techniques were again used. The results of the object rotation task showed that 50% of the children used the absolute system, 19% of them used the relative system, 26% applied the intrinsic system (i.e. in front/back of), and 5% employed demonstratives such *here* and *there*. Interestingly, of the children subjects, there is an increase of using the absolute system (i.e. from 23% by younger children aged 6-8 years old to 68% by older children aged 9-12 years old). The data provide evidence that the children are still in the process of learning to use the absolute spatial system. Unlike the child responses, all the responses by the adult subjects apply the absolute system.

Regarding the asking direction technique, like the results of object rotation technique, the adults also employ the absolute system consistently (e.g., *Ulli dini mejalan ngajanan, yen sube ked di bale banjar ada jalan ngauhan* 'From here you walk to the north. When you arrive at the community building you see a street to the west'). The example demonstrates how the absolute terms (i.e., *ngajanan*,

ngauhan) were consistently employed. The child participants, however, provide distinct evidence. Specifically, the younger children aged 6-8 years old do not produce codable responses. The coded responses can be observed from the older children’s responses in which 63% of them use the relative system (e.g., *Pak Ngurah mejujuk sebelah kanan kursi e* ‘Pak Ngurah is standing to the right of the chair), 35% practice the absolute system, and 2% use the demonstrative *here* or *there*. The results are not as expected. How to explain it? The use of the relative system is triggered by the fact that the children used to stay in Denpasar where Indonesian is used at schools and in many other domains (e.g. home, market, offices).

As for the object rearrangement task, of the 25 codable responses by adult subjects all of them use the absolute system. And for the child responses, 72% of them used the absolute system, while 28% applied the relative system. The results are similar to that of the object rotation task. There is also a developmental pattern of using the absolute system by the child participants in the object rearrangement task. In specific terms, the increase of using the absolute system is from 60% by the younger participants to 75% by older participants. And the use of the relative system decreases from 40% by the younger participants to 25% by the older participants.

To confirm the results of the previous two studies, a follow up study is conducted. This time the use of Balinese spatial system in a local sign language (i.e. Bengkala village sign language) is investigated. Please note that De Vous (2012) initiated a similar study in the village. Marsaja (2015) and Putri (2018) also investigates the same sign language from the sociolinguistic and grammatical aspects respectively. The findings (Table 1-6), taken from Aryawibawa et al. (2023), are presented in the following parts.

4.1 The Object Rotation Task

Please note that the data elicited during the experiments are based on the local sign language used in the village, so we do not provide textual data. Instead, responses by subjects for each task in the form of local sign language (*Kata Kolok*) are presented in the figures 1, 2, 3a and 3 b. Each response represents each task tested in the study.

Table 1. Spatial System Used by Signers on the Object Rotation Task (Inside Room)

No.	Response type	Children (10-14)	Adults (18-75)
1.	Absolute	-	-
2.	Relative	-	-
3.	Intrinsic	-	-
4.	Deictic (pointing)	40	48



Figure 1. Pointing in the object rotation (Linguistic task)



Figure 2. Pointing in the asking direction (Linguistic task)



Figure 3a. Original arrangement of objects



Figure 3b. Subject's absolute response of object rearrangement

(Nonlinguistic task)

(All Photos taken by I Nyoman Aryawibawa)

Table 2. Spatial System Used by Signers on the Object Rotation Task (Outside Room)

No.	Response type	Children (10-14)	Adults (18-75)
1.	Absolute	-	-
2.	Relative	-	-
3.	Intrinsic	-	-
4.	Deictic (pointing)	40	48

Table 1 indicates that, in the inside room experiment, all the child participants use pointing in the object rotation task (illustrated in Figure 1). Like the child participants, all the adult participants use pointing as well. The same results can be observed in the outside room experiment where all the child and adult participants practice pointing in the task as shown in Table 2 (illustrated in Figure 1).

4.2 The Asking Direction Task

In the asking direction tasks, as Table 3 shows, all the child and adult participants use pointing in the inside room experiment (illustrated in Figure 2). The same results repeat in the outside room experiment as Table 4 shows (illustrated in figure 2).

Table 3. Spatial System Used by Signers on the Asking Direction Task (Inside Room)

No.	Response type	Children (10-14)	Adults (18-75)
1.	Absolute	-	-
2.	Relative	-	-
3.	Intrinsic	-	-
4.	Deictic (pointing)	40	48

Table 4. Spatial System Used by Signers on the Asking Direction Task (Outside Room)

No.	Response type	Children (10-14)	Adults (18-75)
1.	Absolute	-	-
2.	Relative	-	-
3.	Intrinsic	-	-
4.	Deictic (pointing)	40	48

4.3 The Object Rearrangement Task

Interesting findings can be observed from the final task employed in the study as indicated in Table 5 and 6. Specifically, the results in Table 5 (inside room experiment) inform that 80% of the child participants use the absolute system (illustrated in Figures 3a and 3b), while the other 20% use neither relative nor absolute system. In other words, they just mixed the rearrangement of the objects. For the adults, 75% of them use the absolute system (illustrated in Figures 3a and 3b), the other 17% practice the relative system, and the other 8% employ neither relative nor absolute system (i.e. he just mixed the rearrangement of the objects).

Table 5. Spatial System Used by Signers on the Object Rearrangement Task (Inside Room)

No.	Response type	Children (10-14)	Adults (18-75)
1.	Absolute	8	9
2.	Relative	-	2
3.	Deictic (pointing)	-	-
4.	Other (unidentified)	2	1

Table 6. Spatial System Used by Signers on the Object Rearrangement Task (Outside Room)

No.	Response type	Children (10-14)	Adults (18-75)
1.	Absolute	8	11
2.	Relative	-	-
3.	Deictic (pointing)	-	-
4.	Other (unidentified)	2	1

In the outside room experiment, however, there is a change of results as shown in Table 6. While the child participants' results remain the same, the number of the adult participants employing the absolute system is increasing in which 92% of them now use the absolute system, while the rest (8%) still mixed the object rearrangement.

All the findings (of the three studies) suggest that the spatial system in Balinese is clearly the absolute one. The use of the Balinese spatial system is not a matter of using a spatial linguistic system which is superficial in nature, hence it is different from that in other languages and societies. Rather, it brings impact on the way Balinese people think particularly in solving the nonlinguistic tasks as evidenced in the three studies outlined previously. The question now is if the use of the spatial system in Balinese is linguistic or cultural in nature (Arka, 2004; 2005).

Given the findings, it seems that the dominant use of the absolute spatial system in Balinese is affected by cultural and religious values of Balinese Hindu in which a landmark like a mountain is considered sacred and is used to anchor the absolute system (i.e., the fixed reference system). Specifically, it is associated with the north, which is believed by Balinese Hindu as a place where Gods dwell, while south is associated with the location of sea, which in Balinese Hindu it is believed to function as a purification place. For the other two fixed spatial references (i.e., east and west) are connected to a place where the sun rises and sets respectively.

The findings seem not to support Boroditsky (2011) and Levinson (1992; 1996; 2001; 2003) studies claiming that language does influence people's cognitive functions (i.e., in solving nonlinguistic tasks). Boroditsky reported that in Kuuk Thaayorre the speakers entirely use fixed cardinal terms like north, south, east, west, etc. In the language, for example, a speaker says, "the cup is southeast of the plate" (Boroditsky, 2011, p. 64). Quite interestingly, as further reported by Boroditsky (2011) the use of a particular spatial system also relates to the practice of temporal structure. Specifically, when Kuuk Thaayorre speakers are given shuffled pictures of a crocodile growing, the speakers arrange them from east to west. The response is different from English speakers where they put

all the shuffled pictures from left to right, while Hebrew speakers arrange the pictures from right to left (Boroditsky, 2011, p. 64).

Like Kuuk Thaayorre, Guugu Yimithirr, as reported by Levinson (2003), only applies a fixed coordinate system (i.e., north, south, east, west). Thus, a speaker in the language describes an object north of the other object, someone goes north, etc. Interestingly, Levinson points out that the use of the absolute system in the language affects Guugu Yimithirr speakers' cognitive function. To make it more specific, when the subjects participating in nonlinguistic tasks (i.e., the tasks are similar to those tested by Aryawibawa et al., 2023), they apply the absolute fixed terms as well. In Balinese, however, the dominant use of the absolute spatial system appears to be not wholly linguistically motivated. Rather, it is also likely affected by cultural practices. More specifically, the use of Balinese spatial system is always associated with the location of a landmark (i.e., mountains) to decide the north which is considered to be sacred in Balinese Hindu (i.e., it is believed that the gods dwell there).

5. Conclusion

The findings of the three studies inform that the spatial system employed in Balinese is the absolute system. In the case where the relative system is observed, that is affected by a sociolinguistic factor. In specific terms, when the participants use the relative system that is related to the interference of Bahasa Indonesia relative system.

The use of the absolute system in Balinese is not superficial. In fact, it affects the way Balinese speakers think particularly in solving the nonlinguistic tasks. The evidence is interesting in terms of what affects it. The findings suggest that it seems the cultural and Hindu religious practices (i.e. where the position of a mountain is considered to be sacred) also factor in. To confirm the claim, nevertheless, it is highly suggested that the topic needs further testing in other languages especially in languages that do not belong to the same language family as Balinese.

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