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A cross-cultural comparison of spatial language and encoding in Bali and Geneva

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Abstract

The paper presents some comparative aspects of the ongoing study, in particular some results from a replication study in Bali, in which a strong impact of socio-economic and cultural variables (that can be subsumed under the concept of acculturation) was found. Results from a study in Geneva, with monolingual and bilingual children, demonstrate the consistent use of egocentric language and encoding in French and other European languages.

Our first study in Bali carried out in 1994 (Wassmann & Dasen, 1998) and subsequent research in India and Nepal (Mishra, Dasen & Niraula, 2003), have been reviewed briefly in the introduction to this symposium (Mishra & Dasen, this volume). Overall, we found a strong tendency towards the use of a geocentric frame of spatial reference (FoR) in all of our samples, taken from societies in which the language allows a choice between all three frames, but in which a geocentric orientation system is generally used (NSEW in India and Nepal, and also Up-down in the latter). Large differences between encoding tasks showed that the choice of a FoR is strongly task dependent, and differences between rural and urban groups showed the influence of ecological settings (Mishra & Dasen, in press). While differences between schooled and unschooled children were also explored (Dasen, Mishra & Niraula, 2004), we did not take socio-economic indicators or other family background variables into account. We also did not find the same results in India and Nepal as in Bali in terms of age trends: while absolute encoding seemed to decrease with age in Bali, it increased in all three samples in India and Nepal. One of the first endeavors in the current project was therefore to replicate the study in Bali itself.

Bali 2002, a replication study

One of the limitations of our earlier study in Bali was the small sample size. This was due to the fact that we carried out the research in a fairly remote area of Bali, in the small village of Bunutan, and we did not have access to the local school which would have provided us with a larger sample of children.

In 2002, we were able to work with much larger samples, in schools of two different locations, as well as testing again a small sample of young children in the Bunutan area. The number of children tested is given in Table 1. The city sample was obtained in a private, experimental school attached to the only teachers training college of Bali, in the city of Singaraja, on the North coast of Bali. The pupils attending this school were mainly from middle-class families.

Table 1 : Sample characteristics of studies in Bali, 2002, and 1994.

Age groups	4-5	6-8	9-11	12	Total
Singaraja (city)	15	24	28	5	72
Sambangan (village)	16	35	37	10	98
Bunutan (remote village)	15	18			33
Total	46	77	65	15	203
Bunutan 1994	9	8	7	14	38

The village of Sambangan was situated in a rural area about 15 km from Singaraja, on a north facing slope of the mountain, with a clear view of the sea in the distance. The parents of the children were mainly farmers, except for the 4 and 5 year olds who attended a pre-school in the same locality but closer to town. Information on the family background of each child was obtained through interviews with teachers, or a questionnaire sent home to the parents. For the background variables of mother and

father's level of education, occupation, access to media such as newspapers, radio and TV, all t-tests comparing the two locations were statistically significant at the .01 level. The language of instruction is Indonesian in both schools, so all children were bi-lingual, however Balinese is the common language used in the community in Sambangan, while Indonesian is spoken more in the city.

Methods

The tasks used in this study were divided into two main categories, language elicitation and spatial encoding. They have been described by Mishra and Dasen (this symposium). All instructions were given in Balinese by two local research assistants. The testing was carried out in various rooms in the school or, for the youngest age group, outside in front of the pre-schools. Towards the end of our field-work period in Bali, we also returned to the Bunutan area where we had carried out our initial study in 1994, and tested a few children aged 4 to 6 years with the animals task only ; this was done at the children's home, with the help of local interpreters and often with a large group of onlookers.

We had requested the teachers to select only children whom they knew to speak Balinese in their homes, but a later analysis of home background data and the language they spontaneously used on some of our tasks proved that this was partly unsuccessful. In the village, 70% of the children use Balinese only, while this is the case of only 30% of the children in the city. Teachers were also asked to provide some background information, for which they sometimes consulted the parents. Information was collected on mother's and father's education and occupation, media in the home (newspapers, radio, TV), language spoken in the home, and contact with the city in rural areas and contact with village in the city.

Results

Knowledge of orientation system

Do the children actually know the Balinese orientation system? And can they point to the directions correctly? For those who systematically speak Balinese, this is indeed the case even for the youngest children, while those who mix the two languages know it perfectly only by age 9 or 10 and those who speak Indonesian don't perform above chance level.

More detailed analyses show that for the Balinese speakers, all the children but three, if they know the Kaja-kelod axis, they also know the kangin-kauh axis, and if they know it outside, they also know it inside a room. The correlation between knowledge outside and inside is .86, which is significant at the .01 level. This capacity to carry the orientation system with them inside a room is indeed one of the most striking features of a geocentric orientation system, and warrants a further study of how exactly it is done (such a study is in progress in Varanasi). Levinson (2003) mentions a constant dead-reckoning process that becomes an unconscious routine, and functions even in unfamiliar surroundings. In the present case, the rooms we used were familiar to the children and there were open windows ; it would have to be established whether they could also carry the orientation system into an unfamiliar room without any possible visual cues.

How do the children learn the Indonesian cardinal directions (i.e. NSEW as opposed to *kaja-kelod*) ? Contrary to what might have been expected, it is not the Indonesian speaking children who learn these first, but the Balinese speaking children. This is no doubt because they are socialised early to use the Balinese orientation system, and therefore find it easy to transfer this knowledge to the Indonesian cardinal directions. Their performance, however, is far from perfect and the NSEW system is completely mastered by all children only by the age of 12.

Again, further analyses show that if the children know the NSEW system outside, they can also use it inside ; the correlation between performance outside and inside is .83, which is significant at the .01 level, and this is the case even if age and language groups are controlled.

Balinese children are also taught very early on to distinguish their right and left hands, because the appropriate use of each has to be acquired. Right, left, front and back, in Balinese and in Indonesian, are known by all the children by age 9 in both languages, but before that age, the Indonesian speaking children still have some problems in Balinese, and the Balinese speaking 4-5 year olds the same in Indonesian.

Spontaneous use of language

While describing motion along a road, the younger children of our study, up to age 11, use mainly geocentric terms if they are Balinese speaking (or mix the two languages), and they never use relative terms ; they do to some extent (on the average on half of the segments of the road) if they speak Indonesian. The 12 year olds of all groups use geocentric terms almost exclusively. In other words, there is a trend for the Indonesian speaking children to change from relative to geocentric terms, while the Balinese speaking children do not show any age trend. The same is true for language use on Perspectives, except that the use of relative terms is less frequent even for the Indonesian speaking children. The Indonesian speaking children up to age 8 also use some intrinsic locatives, which is not the case for the Balinese speaking children. Landmarks (whether situation specific or conventional) are never used.

As to language used on items 4 and 5 of each of the three encoding tasks, it is generally geocentric ; in the Balinese speaking group, this is almost exclusive, while in the Indonesian speaking and mixed language groups, some relative language occurs up to age-group 9-11, as well as some intrinsic and deictic terms.

In sum, the various language tasks complement each other to show a systematic difference between the Indonesian and the Balinese speaking groups. In the

former, while geocentric language is present even in the youngest age group, some of the children start using some intrinsic, deictic and relative language and do this up to about age 10. In contrast, in the Balinese speaking group, geocentric language is an almost exclusive usage from 4 to 12 years.

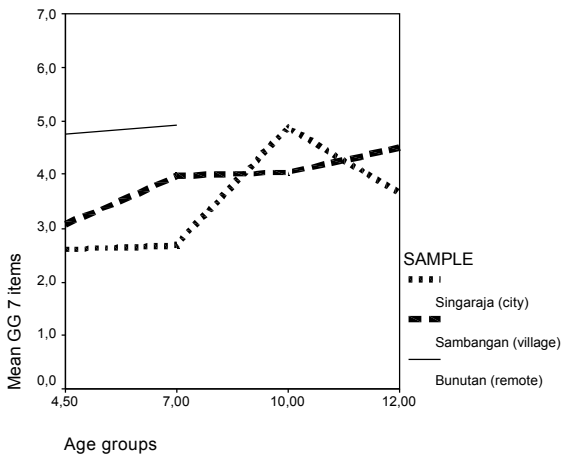
To obtain summary measures for egocentric and geocentric language over the four language task, we computed two variables adding up the correct knowledge of the respective terms with their correct use on the Road and Perspectives and their use on the Nijmegen tasks. An age effect is seen in these summary measures in the Indonesian speaking group, and in the city, with a sharp increase of geocentric language with age, while in the Balinese speaking group and the village, geocentric language is already established early and has less room for change.

Spatial encoding

Let us start with the simplest task, Animals, the only one that was used systematically in all of our previous research and in all three samples in the present one, and look at the results with 3 animals only (since that was the format used in previous studies). The results are presented in Figure 1.

As we can see, the results in the three samples are all marked by a very high RA gradient, all between 50 and 100%. Similarly to our previous results in India and Nepal, the rural samples have on the average a higher RA gradient over the whole age span than the city sample. Bunutan, the remote village location where we used only this single task, has the highest proportion of absolute encoding in the comparison ; however, compared to the 1994 research, the age trend is different : instead of a 100% absolute encoding in the 4-5 year old group followed by a slight increase of relative encoding, we now have the same age trends we found in India and Nepal, namely a steady increase of absolute encoding with age.

Figure 1: Mean items with absolute encoding for 4 Animals (7 items) in three samples of 2002 study



Compared to our previous study in 1994, the proportion of absolute encoding (RA-gradient) is lower, but we are now using a more stringent test of absolute encoding, namely taking four animals into account (the fourth one at right angle with the three others) and seven items, including two with a rotation of 90° (as described in Mishra & Dasen, this symposium). The correlation between the simple RA-gradient (3 animals, 5 items) and the more stringent measure is .85 (which, with an N of 203, is highly significant). This confirmation with more stringent conditions comforts us in the affirmation that even our previous measures with three animals were reflecting mainly absolute and not intrinsic encoding (see Li & Gleitman (2002) and Levinson, Kita, Haun & Rasch (2002) for the controversy over this issue).

On Chips and on Steve's Maze, we find the same difference between the village and the city samples, with a higher RA-gradient in the village. Steve's Maze produces, as it did in all our previous research, a much lower RA-gradient ; in fact, there is on this task more relative than absolute encoding. As we have hypothesized before (Wassmann & Dasen, 1998 ; Mishra et al., 2003) this is no doubt due to the fact that it is easy to verbalize the Animals and Chips task in a geocentric form ("They all look *kangin*", "The red square is *kaja*"), while it would take several sentences to do this for the segment of path in Steve's Maze, and it is therefore easier to remember it as a shape (that is inherently egocentric).

Another of our previous findings that is therefore strongly confirmed with these results is the task specificity of frames of reference used for encoding : Individuals do not necessarily use the same frame under all conditions, but "choose" one frame over another, this choice being of course quite unconscious. The mean RA-gradients in each age group may of course hide the fact that some children indeed use an absolute frame systematically (for all or at least most items), while others do not, in other words, that there may be two different pathways or cognitive styles.

This question is related to the fact that we found, in Bunutan in 1994, 100% absolute encoding by the younger children. Despite lower mean values, do we also find such a sub-group within our present sample ? In Bunutan, if we look at the youngest children (4-5 years), we find that half of them are indeed in the systematically absolute group, the other giving some mixture of encodings (but never systematically relative). The same conclusion would be reached if we looked at the Animals task in the way it was presented in 1994, i.e. with 3 animals only. If we also include slightly older children, up to age 8, the percentage of children in the systematic A group is somewhat lower (41%) but still quite important. We can therefore conclude that very young children who start with a completely absolute frame of reference indeed do exist.

The difference with the 1994 results is that they do not represent the complete cohort, but only about half of it.

How could this be explained? Possibly, it could be due to sampling, since we are dealing with very small numbers ; out of 9, it is not impossible that we sampled by chance 9 from that group, instead of 5 or 4. We cannot rule this out, but it is also possible that social change in the 8 years separating the two studies could have introduced more of the urban characteristics that seem to go with more relative encoding. Indeed, the Bunutan region has become an attractive site for tourists, with many lodges, dive-shops and even an internet café, while it was very isolated in 1994.

If we look at the other two locations, in the village of Sambangan we also find a systematic absolute group in the younger ages, representing approximately 1/4 of the children, but there is also another group of the same size that is using a systematically relative encoding. In the city, there is no systematically absolute group, only a relative one. Of 27 children in the absolute group (ages 4 to 8), none speaks Indonesian and only one lives in the city ; on the other hand, the systematically relative encoding group of 16 children is rather mixed, coming from both the city and Sambangan, and from the three language groups. This pattern of results seems to show that we indeed have a socio-historical process going on, where the more traditional Balinese cognitive style (or developmental path?) is being replaced slowly through the processes of acculturation and globalisation. If that is so, and since we have collected other background information on the children's families in the main two samples, there may be other social indicators that we could link to the two styles of encoding.

One difference with the results we obtained previously in India and Nepal is that in our present results, the average RA-gradient for Chips is the same as that for Animals, or even higher, particularly if we take the more stringent measure for Animals, while in our previous research in India and Nepal, Chips was always intermediate between Animals and Steve's Maze. Why this should be so is not immediately obvious, but may be due to the fact that we increased the complexity (and hence possibly the memory load) of the Animals task (even if coding only for the 3 animals in a row, the task did comprise a 4th animal) and decreased that of Chips (using only squares instead of squares and circles). As acknowledged by Levinson (2003), memory load does influence the encoding on these tasks.

Language and encoding

In our first study in Bali, we had collected spatial language data, but were not able to relate each individual's language use to the FoR on the encoding tasks. When we did this in India and Nepal, we found, surprisingly, that there was hardly any relationship between the two (while geocentric language was found to be related to performance on spatial cognitive tasks). So we concluded that the hypothesis of linguistic relativism received support at the group level [when geocentric language is used as the adult group norm, encoding also tends to be absolute] but not at the individual level. We can now explore this issue with the new Bali data.

Correlation coefficients between the two domains of interest, language and encoding, and some of the background measures are presented in Table 2.

Table 2 : Pearson correlation coefficients between language, encoding and background variables

		GENDER	**AGE**	**SCHOOL**	**LOCATION**	**BALINESE vs INDONESIAN**	**G language**	**E language**
Animals	r	-,053	**,143**	**,119**	**,284**	**,186**	**,403**	**-,177**
	p <	,228	,022	,046	,000	,004	,000	,015
	N	200	200	200	200	200	149	150
Chips	r	-,062	**,236**	**,206**	**,406**	**,350**	**,436**	**-,412**
	p <	,216	,001	,005	,000	,000	,000	,000
	N	160	160	160	160	160	144	145
Steve's Maze	r	-,035	-,069	-,107	**,272**	,113	,105	**-,159**
	p <	,348	,216	,114	,001	,100	,129	,042
	N	130	130	130	130	130	119	119
G language	r	-,028	**,424**	**,386**	**,484**	**,677**	1,000	**-,594**
	p <	,365	,000	,000	,000	,000	,	,000
	N	149	149	149	149	149	149	142
E language	r	,038	,047	,101	**-,551**	**-,581**	**-,594**	1,000
	p <	,320	,284	,109	,000	,000	,000	,
	N	150	150	150	150	150	142	150

Absolute encoding is positively linked to geocentric language on Animals and Chips (but not Steve's Maze), and negatively with egocentric language. However it is also related to background measures such as age and schooling (but not gender), as well as location (more absolute in rural samples) and preferred language during testing (more absolute with Balinese rather than Indonesian). Partial correlations controlling for age, schooling and location are .35 and .23, and remain statistically significant ($p < .001$ and .01 respectively). These relationships between language and encoding are not very strong, but nevertheless present at the structural level (i.e. cannot be explained by common background variables such as increase with age). This is indeed an interesting finding, since it contradicts the absence of relationships we found in previous research in India and Nepal, and will comfort adherents to the linguistic relativity theory.

Family background and other social indicators

When language and encoding are correlated with the various family background variables, a coherent picture emerges: The children who use more geocentric (and less egocentric) language have parents who are less educated and have more modest occupations, less contact with the media (in particular newspapers), speak Balinese in the home, and have less contact with the city. The Pearson correlations are to the order of .4 to .5 with geocentric language and -.3 with egocentric language, all significant beyond the .01 level. Absolute encoding is similarly related to these variables, in particular for Chips. Using principal component factor analysis as a data reduction technique, the family background variables were combined into a single factor score, indicating what we might call social change or "acculturation". The principal component explained 66% of the variance. Similarly, the three encoding tasks were combined into a factor score explaining 54% of the variance. The correlations between these summary variables is show in Table 3.

Table 3. Pearson correlations between acculturation, language and encoding

		G language	E language	Encoding
Acculturation	r	-,486	,438	-,331
	p <	,000	,000	,000
	N	125	125	100
G language	r		-,649	,474
	p <		,000	,000
	N		156	124
E language	r			-,388
	p <			,000
	N			123

The correlations remain the same when age and schooling are controlled. These results point to a strong link between the choice of FoR in both language and encoding and social family background variables that combine to show that in Bali, the geocentric system is linked to a more rural, traditional life style, and that contact with the city, media and Indonesian brings about the use of more egocentric language and encoding.

Bali 2002 : Discussion and conclusion

Already in the first field-work, Wassmann and Dasen (1998) had noted that there was somewhat more use of egocentric language in the (more urban) South of Bali than in our remote location on the North coast. We also considered the possibility that the developmental trend from more absolute to more relative encoding could have been produced by acculturative factors such as schooling, and the Indonesian language that is linked to it. The present results strongly point to the importance of social change or acculturation.

The Balinese orientation system, and the Balinese language (in particular in its complex form with several levels of address depending on social position), together with their religious and symbolic connotations, are all part of the traditional Balinese culture, and so is the geocentric FoR and the process of absolute spatial encoding that go with it. We therefore find more of it (geocentric language, systematically absolute encoding) in rural locations than in the city (and more in a more remote rural location such as Bunutan), more in Balinese speakers than in those who prefer to use Indonesian, more in traditional, farmer families with little contact with the city and limited access to the media than in families where parents have a higher level of education, paid employment and access to media, in particular to newspapers.

In all three samples, the age trends on the language elicitation tasks are an increase of geocentric language with age, and an increase of absolute encoding (except for Steve's Maze). It seems that the influence of acculturation does not increase with age, as one might have expected (with the number of years of schooling, greater proficiency in Indonesian, possibly more wider geographical mobility with age), but the children seem, on the contrary, to be socialised progressively into the Balinese cultural norm irrespective of their various social and linguistic backgrounds. In other words, Balinese traditional culture shows its strength!

Geneva, Switerland

We will report only briefly on the study carried out in Geneva, that was done mainly to ascertain that children speaking European languages do indeed use exclusively egocentric language and relative encoding.

In Geneva, Switzerland, we tested 70 children aged 4 to 12, with an equal number of boys and girls; 27 of these

were monolignual French speakers, the others were bilingual (mainly with Portugese and Spanish, Albanian, Arabic, English and a few other languages).

Of the 70 children, only two (aged 9 and 10) knew about cardinal directions, both being boy scouts. This is despite of the fact that a huge compass was drawn in the middle of the play ground. On the language elicitation tasks, no geocentric language was used whatsoever. Until age 6, deictic ("this way") and intrinsic words are used, almost entirely replaced from age 7 onward by egocentric language.

The encoding on the Animals and Chips tasks is presented in figure 3, comparing Geneva and Bali (2002) results, the latter being calculated on the combined city and village samples.

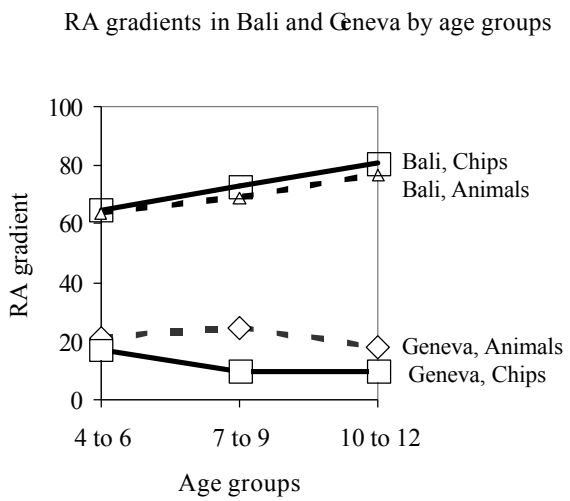


Figure 3: Absolute encoding on Animals and Chips, in Bali (2002 study) and in Geneva.

It is not really surprising that there is a very low rate of absolute encoding in Geneva (the 10 to 20% rate is no doubt spurious, due to guessing or distraction mainly for the younger children). The results on Steve's Maze, on the other hand, show no difference between Bali and Geneva, which again confirms task specificity. No differences in encoding were found between monolingual and bilingual children.

Conclusion

In cross-cultural developmental psychology (see Segall, Dasen, Berry & Poortinga, 1999; Berry, Dasen & Saraswathi, 1997), it is not often that we find attempts at a replication of field studies. In this case, pursuing research first in India and Nepal was, in a way, a first attempt at replication, since in the locations used, the people also use geocentric orientations systems. Similarly, they also have at their disposal, as do the Balinese, two systems of reference to describe and encode space, the geocentric and the egocentric one (discounting the intrinsic, that is universal), so that we can study when and how they give preference to one or to the other. We are therefore in a case somewhat different from the two populations on which Levinson (2003) concentrates most of his discussion, the Tzeltal speakers of Tenejapa in Mexico, and the Guugu Yimithirr Australian Aborigines, who use only the geocentric system. That some relative encoding occurs at all in these two populations is therefore more surprising than if it occurs in all of the samples we have been studying, including Bali.

The research in India and Nepal allowed us to show that the proportion of absolute and relative encoding, and the development of geocentric and egocentric language, is to a large part linked to the eco-cultural context, combining the appropriateness of the orientation system to the local topography and symbolic and religious aspects, as well as language, the latter being, as we see it, a part of the overall culture and not a single determinant of cognition in itself. The fact that the choice of a frame of reference for encoding is also task specific had been born out by our first research in Bali, and was confirmed throughout further research. On the other hand, the developmental trend of an early absolute encoding on the Animals task, that then changes to some extent to relative with age, was not confirmed in any of the locations in India and Nepal, and it therefore seemed imperious to replicate the study also in Bali itself.

While this particular age trend was not found again in this renewed study, not even in the same area of Bali (although Bunutan itself, as we have mentioned, has also changed), we now have what appears to be a very coherent body of results, all of which make good sense. Working in several locations, and with relatively large samples, gives us a chance to study several variables beyond age, such as urban and rural contexts, the use of Balinese or Indonesian, and other social indicators.

Levinson (2003) reviews carefully the evidence collected by the CARG/MPI group on various socio-cultural factors, such as urban/rural location, literacy, and age, schooling and "conservatism" as indices of social change. He ends up discarding all these variables, except for language, and he concludes that "these variables show no substantial effect" (p.196) and "all further tests provide no evidence for the effect of cultural change" (p.197). However Levinson also realises that some of the measures of social variables (and even age) in these studies were rather crude and the sample sizes quite small, so that "there remains a good chance that a positive effect might be found with better data" (Levinson, 2003, p.196).

We believe that we now have better data, and contrary to Levinson's affirmation, we think that acculturation is one of the main variables to explain our results in Bali, of both 1994 and 2002.

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