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HAND STENCILS AND PRINTS: FURTHER MUSINGS ON METRICS

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Abstract. Hand stencils and prints occur on all continents occupied by humans. The oldest of them date from Neanderthal times, and they continue at intervals at least until the 20th century. Seen as somewhat enigmatic by archaeologists, they, like other nebulous rock art motifs, have only received serious attention from a handful of researchers, particularly in the measuring of hand attributes as an indicator of age and sex. Aspects of distribution, associated art, shelter deposit and other cultural materials have also been, to a varying extent, occasionally addressed. Considering these studies, this paper looks at some of the issues relating to the measurements of hand stencils and prints, and questions the validity of their interpretation.

Introduction

The hand stencil is a universal, readily recognised mark of a person being at that place before you arrived (Fig. 1). They present on all continents except Antarctica, with the oldest dating proposed from at least 66.7ka (e.g. Standish et al 2025). This recently published data from Maltravieso Cave, Spain, suggests hand stencils are the oldest dated parietal art form. The evidence from Australia also shows them to be amongst the most recent rock art produced (e.g. Crawford 1963; Mulvaney 1996: 12, 1999: 43). In some regions, hand stencils or prints form the primary motif in the assemblages (e.g. Arfin and Delange 2004; Strecker 2013; Pettitt et al. 2014; Oktaviana et al. 2016; Taçon et al. 2016; Dubey-Pathak 2022). In Australia, they are particularly numerous in the Queensland Central Highlands (Quinnell 1974; Morwood 1976, 1980; Walsh 1979, 1983; Flood 1987), far-western New South Wales (McCarthy and Macintosh 1962), south-western Western Australia (Davidson 1952; Gunn and Webb 2003), two regions of central Australia (Rosenfeld 1990; Gunn 2002) and in the limestone caves of southern Australia (Lane and Richards 1966; Morse 1984; Cosgrove and Jones 1989) (Fig. 2). Each of these regions contain hundreds, if not thousands, of hand stencils, thus provid-

Figure 1. *The ubiquitous hand stencil: a common bond between the stencillor, the rock and the viewer.*

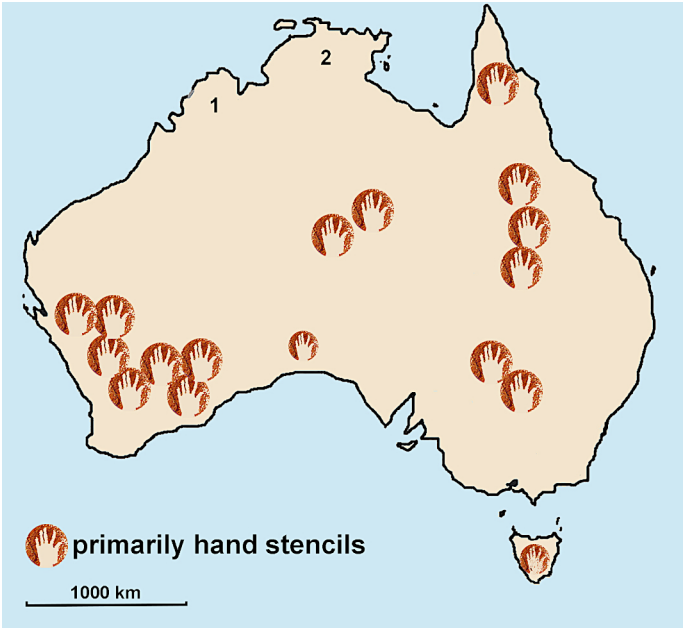


Figure 2. *Distribution of major stencil areas, with reference to the location of the Kimberley region (1) and Arnhem Land (2).*

Figure 3. *Prolific hand stencil site in Australia. Such a repertoire contains a wealth of potential for detailed study.*

ing an immense body of cultural and archaeological information (e.g. Fig. 3). In the Kimberley and Arnhem Land they are also a major component of the earliest rock art but have been well-superposed by a plethora of subsequent art styles in which stencils and prints play only a minor role (Chaloupka 1993; Walsh 2000; Roberts and Parker 2003; Gunn et al. 2022). In many other areas of Australia, hand stencils are present but constitute a smaller part of the repertoire.

Stencils of body parts, hand stencils, handprints and finger fluting reveal the immediate presence of the makers. While free-form art reveals the mind and society of the artist, stencils (a pre-form motif) present a direct, physical and tactile contact with the rock surface and the stencil maker. Analysing stencils can give us an indication of the age and possible sex of the person who left the mark, and to whom we can readily relate through our common trait—hands. Hand measurements may give us an idea of the age and sex of the people using the site, which may then provide some measure of the site's social construct (open or closed to, or preferred by, particular age or sex groups).

While the theoretical and methodological aspects of hand stencils as art have been well-developed (Walsh 1979, 1983; Wright 1985; Forge 1991; Gunn 2006, 2007; Snow 2006; Goodall et al. 2009; Dobrez 2014; Carden and Blanco 2016), and despite the proliferation of hand stencil sites and examples in Australia, little work has been devoted to the study of hand stencils here, either generally or as a unit within any one rock art region.

Hand measurement

Recent methods for assessing the sexes and size of stencilled hands use several landmark points measurements and complex computer programs (Nelson et al. 2017; Fernandez Navarro et al. 2025). Nelson's method, using 19 landmark points around the hand, gave 83.6% reliability for interpreting sex based on size and shape (particularly palm width compared with finger length). They conclude, however, that 'the method still needs to be tested on different reference samples from contemporary populations that are not of northern European descent (Nelson et al. 2017: 212). Fernandez Navarro et al. (2025) tested geometric morphometrics of 32 landmark points of hand size and shape from a contemporary population to assess Palaeolithic hand stencils. From their contemporary samples, they were able to achieve 'precise estimations' of age and sex using a variety of advanced software. As with previous studies, the age categories, while grouped, showed notable overlap. Their results for sex based on shape were inconclusive, but were more positive based on size. For their archaeological sample, they concluded that 'the variables we can establish with the highest efficiency are age from size and sex from size (2025: 24)'. As with previous studies, they also highlight the fact that 'there will always be an inherent uncertainty in interpreting Palaeolithic data' (Fernandez Navarro et al. 2025: 23).

While an improvement on previous studies, these techniques are currently beyond field site recordings, though clearly ones that need to be followed up by further clarifying studies, such as taking into account the variability of the group populations and size of an individual's hand stencils (cf. Gunn 2006). In an

Source	(n)	Mf:H range	Mf:H median	Mf:H mean	Reference
Adult males and females (Tierra Del Fuego)	28	1.7 – 1.9	1.8	1.8	Gusinde 1989 quoted in Carden and Blanco 2016: Appendix 1
Male and female 3–13 yrs (Argentina)	21	2.1 – 2.5	2.3	2.3	Carden and Blanco 2016: Table 3

Table 1. *Mf:H ratio values from full participant lists.*

attempt to derive a more convenient method, I have looked again for other simple associations between finger or hand length and hand size. Following on from Gunn (1983), Carden and Blanco (2016) suggested that hand length (H), rather than middle finger length (Mf), was statistically a surer measure for determining the age of the stencillor (Fig. 4). In Australia, however, the full stencil of the hand is often not apparent. A large proportion of hand stencils from the north of the country are of considerable antiquity and badly affected by weathering. For instance, in rockshelters in the Kimberley region, many hand stencils appear to predate the Irregular Infill Period, which has been suggested to be c. 17 ka (Finch et al. 2021). In other largely friable-sandstone areas, salt-induced erosion is having a deleterious effect on the rock art, even the most recent.

The process of stencilling tends to favour the upper area of the hand (Fig. 4), and often it is only the upper section of the stencil (fingers-knuckles) that is distinct enough for measuring. For this reason, the relationship of middle finger length (Mf) and hand length (H) was explored, while recognising that hand stencils can be up to 0.5 cm larger than the hand being stencilled, and handprints up to 0.5 cm smaller (Gunn 2006).

Although individual finger and hand measurements are rare in biological publications, their measurement is more common in industrial studies, such as the use of mobile phones and other small, handheld tools, to permit appropriate modifications to different regional sizes (e.g. Chowdhury and Kanetkar 2017). These, and some forensic studies, enable a brief sam-

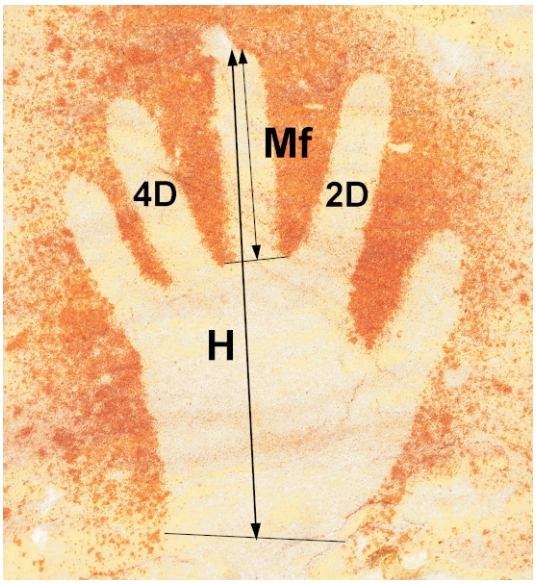


Figure 4. *Location of measures: H=hand length, Mf=middle finger length, 2D=index finger, 4D=ring finger. Note also spray favouring the area above the knuckles.*

Source	(n)	Mf:H mean	Reference
West. Aust. Adult males	91	2.3	Ishak 2010: 71
West. Aust. Adult females	110	2.3	Ishak 2010:71
Kadazan-dusun* Adult males	42	2.3	Khrazi et al. 2023 Table 4
Kadazan-dusun* Adult females	42	2.3	Khazri et al. 2023
Bajau* Adult males	42	2.3	Khazri et al. 2023 Table 4
Bajau* Adult females	42	2.3	Khazri et al. 2023 Table 4
Malay* Adult males	42	2.4	Khazri Table 4
Malay* Adult females	42	2.3	Khazri et al. 2023 Table 4
Chinese* Adult males	42	2.3	Khazri et al. 2023 Table 4
Chinese* Adult females	42	2.3	Khazri et al. 2023 Table 4
Uranian Adult males	529	2.4	Mirmohammadi et al. 2015 Table 4
Indian Adult males	22	2.4	Mirmohammadi et al. 2015 Table 4
Jordanian Adult males	12	2.4	Mirmohammadi et al. 2015 Table 4
Turkish Adult males	23	2.3	Mirmohammadi et al. 2015 Table 4
Vietnamese Adult males	24	2.3	Mirmohammadi et al. 2015 Table 4
Bangladeshi Adult males	20	2.3	Mirmohammadi et al. 2015 Table 4

*Malaysian ethnic groups from Sabah

Table 2. *Mf:H ratio from population where only mean values were provided.*

ple of hand measurements to be compiled for this current study. Also, using measurements from real (rather than stencilled) hands from two sources given in Carden and Blanco (2016), the ratio of middle finger length and hand length (Mf:H0 was calculated (Table 1). The two populations of the Gusinde and Carden-Blanco samples have distinctly different Mf:H ratios (mean 1.8 and 2.3), indicating that the Mf:H ratio is not a universal constant.

Other hand measurement studies (Ishak 2010; Khazri et al. 2023; Mirmohammadi et al. 2015) have used the mean values of their study groups (from the University of Western Australia and Sabah Indonesia), as a basis for their various studies on other aspects of hand measurements. Using their data, the mean Mf:H ratios for the two populations were calculated (Table 2). Unlike the above findings, these ratios show a general consistency.

A comparison of measurements of left and right hands (Table 3) shows no appreciable difference. A similar result was found by Ishak (2010: 71) for the mean measurements of both male and female measurements (M=2.34, F=2.31). It follows, then, that for hand stencils and prints, there would also be no measurable difference.

The study by Khazri et al. (2023: 12–13) also found that:

- There was sufficient evidence to conclude that the right-hand breadth was significantly different from the left-hand breadth. This was the only difference between the two hands (a difference previously noted by both Gunn 2006 and Carden and Blanco 2016).
- There was insufficient evidence to conclude that there is a difference in hand dimensions among the ethnicities of the participants.
- There was sufficient evidence to state that males' hand dimensions were higher than those of females.

Khazri et al. did, however, acknowledge that their results (unrelated to the Mf:H ratio) conflicted with some previous studies, but were unable to isolate any reasons for the differences (Khazri et al. 2023: 13). Some similar variation is also demonstrated in the tables given above and also concluded by Mirmohammadi et al. (2015: 126, Table 1). Hence, there should be little metric difference between a person's Mf:H ratios in stencils of their left or right hands.

The variation in size of hand stencils and prints made by the same person has already been quantified (Gunn 2006). To see how much this affected the Mf:H ratio, the range in variation of the measurements was calculated for the measurements provided by Carden and Blanco (2016: 136) and from personal replication (Gunn 2006: Table 2). The variation in the Mf:H ratio from Carden and Blanco's data ranged from 1.1 to 5.5, with a mean and median of 2.2 (n=33) (Fig. 5). Using personal data, the variation in the Mf:H ratio ranged from 2.4 to 2.7, with a mean of and median of 2.6 (n=34) (Fig. 6). The large ratio size of the personal sample is out of the ordinary given the previous ratios mentioned but indicates that specific individuals may vary notably from the group mean.

While there tends to be a general relationship between the middle finger and hand lengths within a

Hand	Hand length cm (H)	Middle finger length cm (Mf)	Mf/H
Right	19.301	7.900	2.443
Left	19.340	7.923	2.441

Table 3. *Comparison of measurements for male left and right hands from Mirmohammadi et al. 2015 (n=259).*

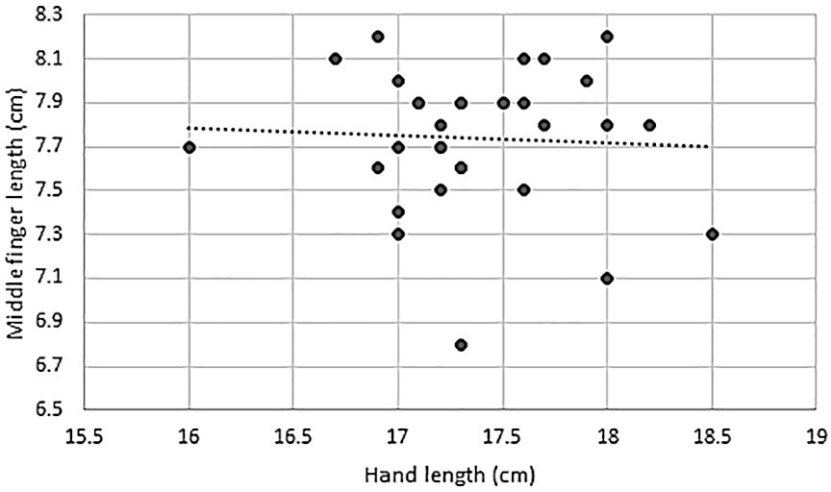


Figure 5. *Mf:H from multiple stencils of a single hand (from Carden and Blanco 2016: 136, Table 4).*

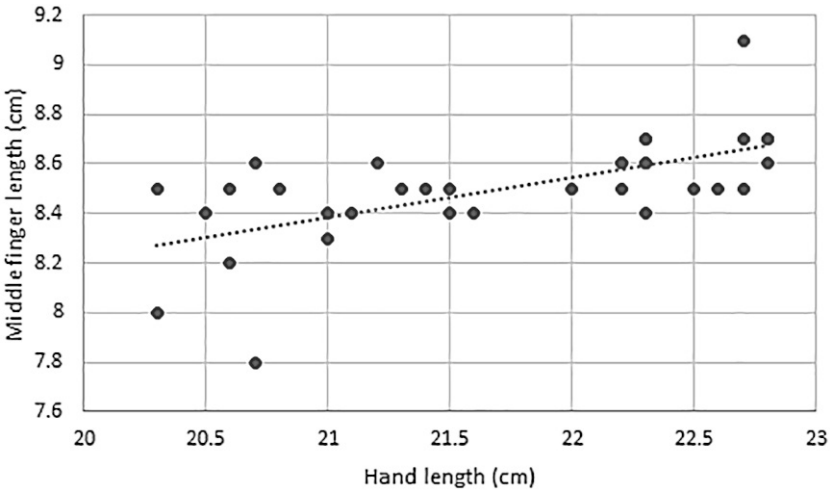


Figure 6. *Mf:H from multiple stencils of a single adult hand (personal measurements).*

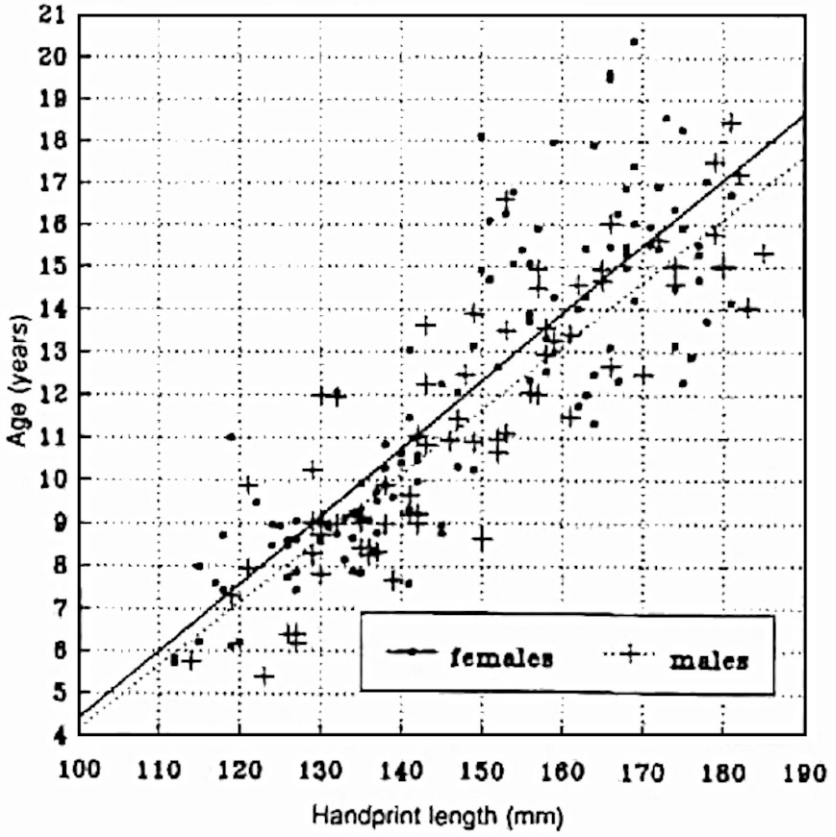


Figure 7. *Scattergram of correlations between handprint length and ages of males and females and least square regression lines (from Henneberg and Mathers 1994: 494, with permission).*

population, the diversity found in different populations suggests there is unlikely to be a universal correlation (see Henneberg and Mathers 1994: 496). This is further supported by variation of population heights around the world (e.g. Baten and Blum 2014), indicating that overall hand size will also vary notably (for both adolescents and adults). Also, given the variation found in the multiple stencils of a single hand (Figs 5 and 6), these differences suggest that any conclusions derived from hand measurements with regard to age or sex of the stencillors must be treated with caution. If a general correlation can be found, or expected, for a particular population, however, the measurements may at least prove useful as a general indication of age, especially if specific size classes are encountered within a local region (cf. Navarro et al. 2025).

The reporting of age class numbers

Hand stencil and print sizes can give an idea of the age/sex of the person whose hand is represented (Henneberg and Mathers 1994; Gunn 2006; Carden and Blanco 2016). Henneberg and Mathers (1994: 494) found that there was a clear but overlapping trend between print length and age, but with greater variability in males than females (Fig. 7). They considered, however, the variability of hand size had more to do with an individual's height rather than their age (1994: 494, and note above conclusion).

As part of an annual program, Schools Canada undertook a study of, among many other things, hand length and the sex of students from 8–19 years of age (Schools Canada 2006). A graph of their mean results (Fig. 8) shows a clear distinction between the two sexes (see also van der Looven 2021). For any particular hand, the hand size could belong to either a female or a younger male, except for hand sizes greater than 19 cm. After 15 years, the two means diverge and suggest that there is a higher likelihood of hand sizes greater than 19 cm belonging to males.

A similar result was obtained by Gunn (2006) from Tindale's unpublished Australian ethnographic field notes (Tindale 1929–34; see Jones 1987). This data, rounded to the nearest 0.5 cm as finer millimetre measurements for stencils and prints on rock surfaces, cannot be considered reliable (Gunn 2006; Bednarik 2008) as, although there was a positive trend between age and sex, there was also considerable overlap of the size classes (Table 5). For stencils (+ 0.5 cm) and prints (- 0.5 cm), this translates to a picture of overlapping classes rounded to the nearest 0.5 cm (Table 6).

For stencils, these results suggest that infants' hands are only represented by <4.5 cm, children's only by 4.5 and 5.0 cm, and adult males by sizes 9.0 cm or greater. All other size ranges could represent more than

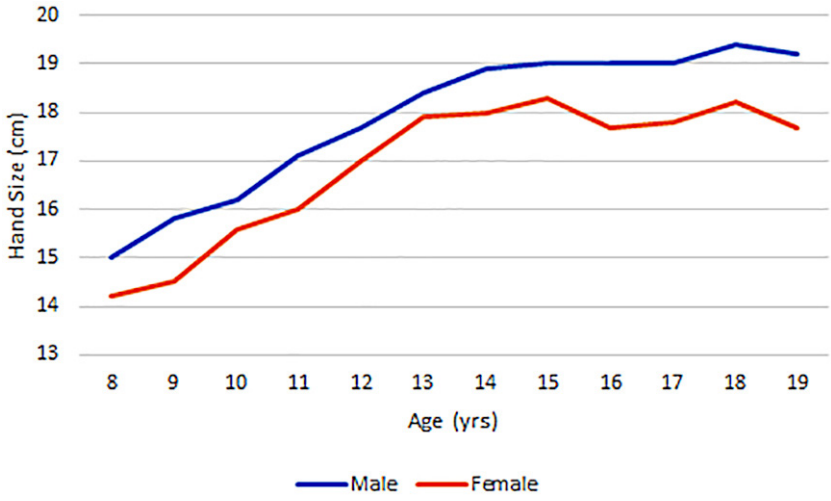


Figure 8. *Hand size by age and sex (from Schools Canada 2006).*

Age range (years)	+2SD	Mean cm	-2SD
4–6	5.7	5.0	4.3
7–12	7.0	5.9	4.8
13–15	7.8	7.0	6.2
Adult female	7.7	7.0	6.2
Adult male	8.2	7.4	6.7

Table 4. *Middle-finger length by age class (mean ±2 standard deviations). Data from Tindale's unpublished fieldnotes, 1927–1932.*

one age class, and a size of 7.5 cm could be either an adolescent, adult female or adult male.

Using Tables 4 and 5 for hand stencils or prints, a numerical count of the size classes can provide a summary of the possible hand sizes represented (e.g. proforma in Table 6).

Henneberg and Mathers (1994: 494) also demonstrated that, for young people (5–20 yrs) standing on a flat floor, there was a clear trend of print length with its placement height above the floor. Using data from two Western Australian sites, Gunn (2006:109) found that the relationship between middle finger length and height above the floor was highly variable, suggesting that, in practice, it was essentially an irrelevant aspect. In another site in central Australia, a horizontal band of similar-sized hand stencils was placed across a wall above a flat floor, giving an impression of being at the height of the stencillor. More generally, though, from personal experience, both hand stencils and prints can be located at any height above the floor, often in extreme locations that would have required artificial 'ladders' or placement within very low clefts. Also, the stencils of infants' and small children's hands are often at a height suggestive of them being held up by adults, who probably blew the stencil (e.g. Mulvaney 1996: 14).

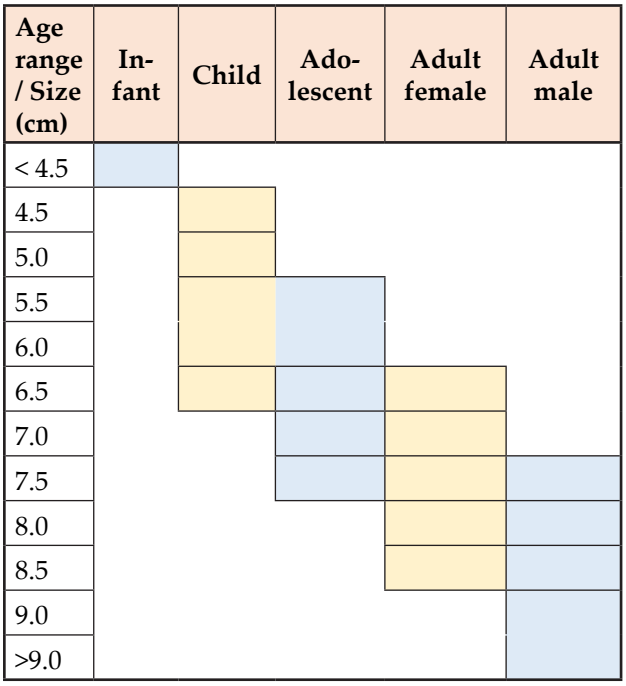
Male and female adult hands

Numerous studies have attempted to determine the sex of stencillors (see summaries of previous studies in Nelson et al. 2017; Table 1). The difference

AGE GROUP	Number
Infants	
Children	
Children or adolescents	
Children, adolescents or adult females	
Adolescents or adult females	
Adult females or adult males	
Adult males	

Table 6. *Blank format for the count of each size class of individuals.*

STENCILS



PRINTS

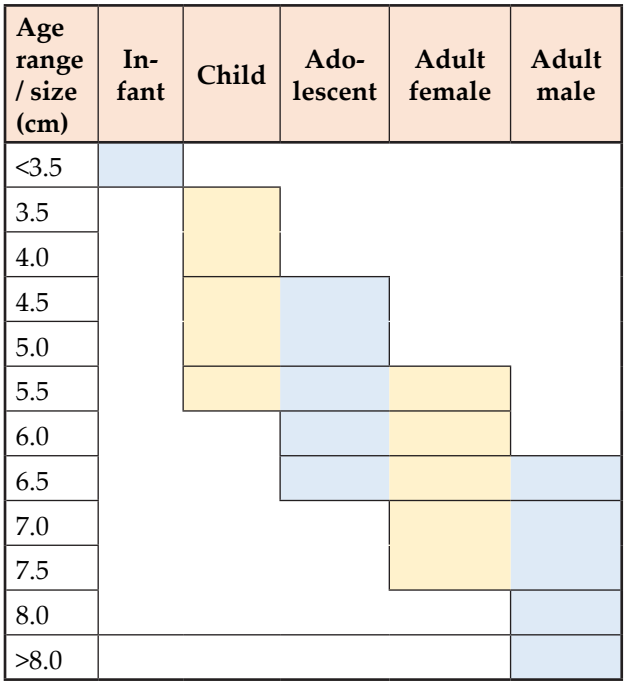


Table 5. *Probable age-sex ranges by size class for hand stencils and prints (from middle-finger lengths). Horizontal rows show age ranges. Coloured columns represent the size range for each age class. Heavily outlined cells indicate examples that cannot be isolated to one particular age class.*

in the length of the index and ring finger of a hand after puberty has been seen as an indicator of the sex of the stencillor for some time (Nicholls et al. 2008; Kanchan and Krishan 2011; Sani et al. 2022). Known as the digital ratio, the measure compares the length of the second to the fourth finger (2D:4D ratio; Fig. 4). 'The average 2D:4D value showed that the index finger

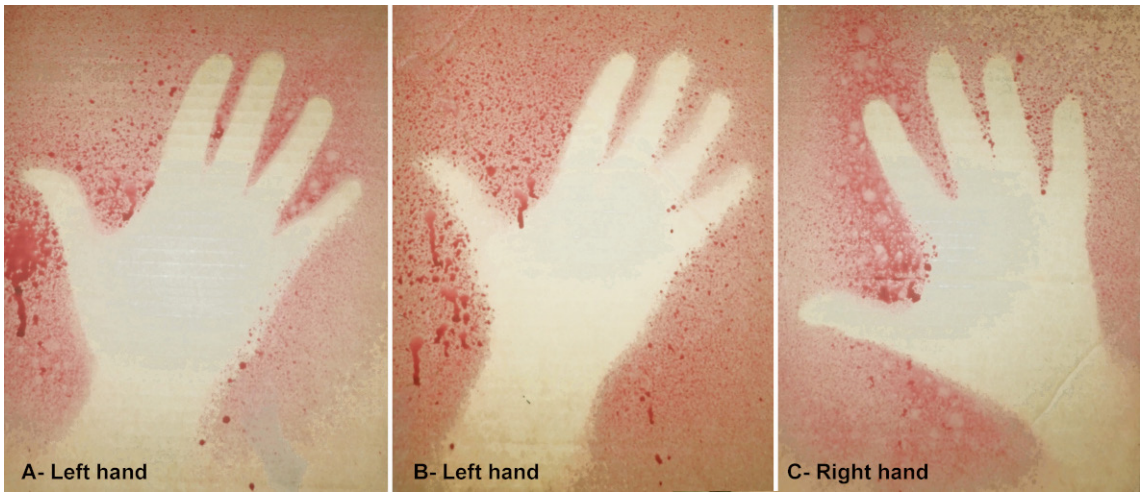


Figure 9. *Hand stencils produced by left-hand palm-up (A and B) and right-hand palm-down (C).*

(2D) is typically shorter in males (0.94 ± 0.01 – 0.96 ± 0.05) compared to females (0.95 ± 0.05 – 0.96 ± 0.06)' (Adenowo and Oladokun 2019: 29). In general, then, a female's ring-finger (4D) is longer than her index finger (2D), whereas in men the two fingers tend to be of similar lengths.

In 2006, Snow proposed the use of digital ratios of hand stencils as 'a rare opportunity to identify the sexes of at least some of the artists with a high level of probability … That means that we can use the equations based on digit and hand lengths only to make a first cut between adult males and all others (Snow 2006: 402). In reference to Snow's paper, Bednarik (2008: 176–117) pointed out that the imprecise measurements of hand stencils and the influence of rock texture make such minor ratio differences negligible in any rock art assessment (see also Brůžek et al. 2010). Nevertheless, it would be reasonable to identify as potential female hands for those examples on clearly defined stencils or prints where the ring finger was notably longer than the index finger.

Stencils: palm up or palm down

A theoretical question occasionally proposed is whether hand stencils were made with the palm down against the wall or with the palm up and the back of the hand flat against the wall. Although the evidence from Australia suggests the hand was normally placed palm down against the rock (e.g. Dunbar 1943–44: 179; Crawford 1968: 22; Bates 1985: 272; Mulvaney 1996), theoretically it is possible that the hand was inverted when stencilled. Using such an inverted hand would distort any count of the proportion of left to right hands used to produce the stencils: left hands by right-handed people and vice-versa (Gunn 2006). The question then is: 'is there any visual evidence that could determine if a hand was used in the inverted position rather than held palm down on the rock face?'

To assess this hypothesis, 14 hand stencils were produced; seven with palm upwards (palm-up) and seven with palm down against the rock (palm-down). The test stencils were made with an atomiser spray over paper sheets so as to provide a finer definition of the edges for measurement than could be achieved with a mouth spray over rock.

From the sample of 14 stencils, three general conclusions were noticed and summarised in the three illustrations above (Fig. 9):

- The lesser edge clarity of the palm-up stencil. The edges of the digits are generally more amorphous. This is particularly apparent with the thumb as it tends to arch away from the rock when held in the palm-up position, in contrast to when it is held palm down, when it lies on the rock. Of the seven palm-up stencils, only one (Fig. 9A) had the finger clarity of a palm-down stencil.
- The left-hand palm-up and the right-hand palm-down stencils orientate in opposite directions. If orientation were not a consideration, then any stencil of a left hand, of either palm up or palm down, would show an inclination to the right, and vice-versa.
- The wrist-forearm area of the palm-up was generally clearer, being held closer to the surface than a palm-down hand.

In the case of hand stencils on a non-flat and textured sandstone surface, the definition of edges is often uneven, especially if one side is given more pigment spray than the other. In such cases, and often in a majority of instances, all these criteria would be difficult to establish, and so it cannot be definitively determined which hand was being stencilled. While most examples of palm-up stencils would be recognisable from the above traits, a small proportion would not, and would, consequently, be erroneously counted as being produced palm-down. Working from available evidence, then, and human nature in observed recent sample groups, it seems reasonable to assume that the majority of hands in rock art have been stencilled with palm-down and that the production of palm-up stencils can be largely discounted.

Figure 10. *A row of contemporaneous hand stencils, four of which, by the use of similar colour and hand pattern, are considered to be made by the same individual as a single event.*

A non-metric view of hand stencils is, as the Australian ethnography suggests, that stencilling is about the association between a person and a place. As the palm and fingertips have most of the hand's touch-receptors (e.g. Johannson and Vallbo 1979), it would make more sense to place the palm down against the surface to 'feel' the association (cf. Dobrez 2013). This tactile association of the place and the person may be the basis for the dominance of hand stencils and prints, for while the cultural interpretations of the marks may vary, the act and resultant image are the same across the world.

Minimum number of individuals

When deriving the number of left and right hands to get a view of the proportion of left to right hands within the population group, the author (Gunn 2007), following Australian ethnographic records and the author's observation of contemporary Jawoyn artists, assumed that each hand stencil was counted as representing a different individual (an assumption this paper now considers incorrect, see below). Thus, 326 hand stencils considered in the 2007 paper were taken to indicate that 326 individuals had made their mark within the shelter. From this, I compared the proportion of left and right hands stencilled and matched it to the ethnographically documented proportions within the local people. This is, in many if not all cases, most likely an incorrect assumption. If, within one shelter, hands are of similar size and condition, they may well represent the work of one individual rather than a group of contemporaneous people. For example, the presence of a patterned arrangement of hands (such as a row or cluster) that are of the same size and condition and utilising the same variant stencil shape, could also be accounted for as being made by the same individual (Roberts and Parker 2003: 31) or by a group of people of similar age and with common associations, such as a group of youths together (e.g. Fig. 10).

Conclusions

The metrics of stencilled or printed hands are tantalising to archaeologists as they have the potential to elucidate aspects of the stencillor that cannot be otherwise obtained. As both Gunn (2006) and Bednarik (2008) have stressed, the measurements of stencils and prints on rock surfaces are fraught with problems that make so-called accurate calculations extremely unreliable. However precise the measuring undertaken, the object we are measuring is inexact with ephemeral or deceptive edge points. This, however, is not to dismiss their value in understanding actions in the past entirely. They remain a physical record of the people and their cultural customs. There are also metric values that are retrievable and, using mean values at a particular site, can at least elucidate some classes to 'probable' categories of sex and age. Hence, assuming a relatively stable gene pool of the local population over time for any site or site cluster, four age-sex groups, with the recognition of overlap in groups, can be isolated:

- Infants
- Children
- Adolescents, adult females and adult males
- Distinctly adult males

Variation in the 2D:4D ratios does not offer a clear distinction between male and female hands, although given notable examples in a site where the differences are readily visually recognisable, the likelihood of the presence of female hands can be accepted.

Finally, the height of a hand mark above the floor of a shelter cannot be taken as a definite reflection of the person's height, although in some instances this assumption may be justified.

The above results have been derived from only

basic comparative data aimed at providing a preliminary assessment of the potential of hand stencils and prints. With the advent of more sophisticated statistical analysis of hands and hand stencils of particular populations, greater accuracy in interpretation is likely for select sites and ideal conditions (e.g. Navarro et al. 2025). However, while the measurement techniques improve, the measured hand stencil or print in relation to the original hand cannot be assumed to be a 1:1 correspondence due to variabilities in the stencilling or printing production techniques.

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REFERENCES

Adenowo, T. K and O. P. Oladokun 2019. Digital ratio and academic performances of college students. *International Journal of Recent Innovations in Medicine and Clinical Research* 1(1): 29–36.

Arifin, K. and P. Delanghe 2004. *Rock art in West Papua*. UNESCO Publishing, Paris.

Baten, J. and M. Blum 2014. Human height. Accessed online at *https://www.researchgate.net/publication/352793628*.

Bates, D. 1985. *The native tribes of Western Australia* (ed. by I. White). National Library of Australia, Canberra.

Bednarik, R. G. 2008. Children as Pleistocene artists. *Rock Art Research* 25(2): 173–182.

Brůžek, J.; M. Lázničková, P. Galeta, J. Maestracci 2010. Les empreintes de mains dans l'art parietal: Possibilités et limites d'interprétations mises en relief par l'anthropologie medico-légale. In J. Clottes (ed.), *L'art pléistocène dans le monde*. Bulletin de la Société Préhistorique Ariège-Pyrénées, LXV-LXVI: 1197–1206.

Carden, N. and R. Blanco 2016. Measurement and replication of hand stencil: a methodological approach for the estimation of age and sex. In R. G. Bednarik, D. Fiore, M. Basile, G. Kumar and H. Tang (eds), *Palaeoart and materiality: the scientific study of rock art*, pp. 129–146. Archaeopress, Oxford.

Chaloupka, G. 1993. *Journey in time: the World's longest continuing art tradition*. Reed, Chatswood.

Chowdhury, A. and M. Kanetkar 2017. Determination of most preferred mobile phone size based on hand anthropometry and mobile handiness. *Smart Innovation* February 2017: 195–204.

Cosgrove, R. and R. Jones 1989. Judd's Cavern: a subterranean Aboriginal painting site, southern Tasmania. *Rock Art Research* 6(2): 96–104.

Crawford, I. M. 1968. *The art of the Wandjina*. Oxford University Press, Melbourne.

Davidson, D. S. 1952. Notes on the pictographs and petroglyphs of Western Australia and a discussion of their affinities with appearances elsewhere on the continent. *Proceedings of the American Philosophical Society* 96: 76–117.

Dobrez, P. 2013. The case for hand stencils and prints as proprio-performative. *Arts* 2013(2): 273–327; doi:10.3390/arts2040273.

Dobrez, P. 2014. Hand traces: technical aspects of positive and negative hand-marking in rock art. *Arts* 2014(3), doi:10.3390/arts30x000x.

Dubey-Pathak, M. 2022. Hand stencils in Chhattisgarh. *Bradshaw Foundation: Rock Art Network* 5/2/2022. *https://www.bradshawfoundation.com/rockartnetwork/meenakshi_dubey_pathak.php.*

Dunbar, K. G. 1943–44. Notes on the Ngemba tribe of the central Darling River, Western New South Wales. *Mankind* 3(6): 172–179.

Fernandez Navarro, D., D. Fidalgo Casares, D. García Martínez and D. Garate Maidagan 2025. Decoding Palaeolithic hand stencils: age and sex identification through geometric morphometrics. *Journal of Archaeological Method and Theory* (2025): 32–24; *https://doi.org/10.1007/s10816-025-09693-w*.

Finch, D., A. Gleadow, J. Hergt, P. Heaney, H. Green, C. Myers, P. Veth, S. Harper, S. Ouzman and V. A. Levchenko 2021. Ages for Australia's oldest rock paintings. *Nature Human Behaviour* 3: 310–318; *https://doi.org/10.1038/s41562-020-01041-0*.

Flood, J. 1987. Rock art of the Koolburra plateau. *Rock Art Research* 4(2): 91–126.

Forge, A. 1991. Hand stencils: rock art or not art? In P. Bahn and A. Rosenfeld (eds), *Rock art and prehistory*, pp. 39–44. Oxbow Monograph 10. Oxbow Books, Oxford.

Goodall, R., B. David, A. P. Kershaw and P. M. Fredericks 2009. Prehistoric hand stencils at Fern Cave, North Queensland (Australia): environmental and chronological implications of Raman spectroscopy and FT-IR imaging results. *Journal of Archaeological Science* 36(12): 2617–2624.

Gunn, R. G. 2002. Our country, their country: preliminary comparisons of the rock-art across the Western Desert / Arrernte borderlands. *Tempus* 7: 109–119.

Gunn, R. G. 2006. Hand sizes in rock art: interpreting the measurements of hand stencils and prints. *Rock Art Research* 32(1): 97–112.

Gunn, R. G. 2007. The interpretation of handedness in Australian Aboriginal rock art. *Rock Art Research* 24(2): 199–208.

Gunn, R. G. B. David, J.-J. Delannoy, B. Smith, A. Unghangho, I. Waina, Balanggarra Aboriginal Corporation, L. Douglas, C. Myers, P. Heaney, S. Ouzman, P. Veth and S. Harper 2022. Superpositions and superimpositions in rock art studies: reading the rock face at Pundawar Manbur, Kimberley, northwest Australia. *Journal of Anthropological Archaeology* 67(2022): 101442.

Gunn, R. G., J. R. Goodes, L. C. Douglas, D. Griffin, B. Briggs and L. Walker 2022. Boorpeck: its significance in Gariwerd rock art. *Rock Art Research* 39(2): 168–181.

Gunn, R. G. and R. E. Webb 2003. Art and archaeology on Coodardy, Austin Downs and Noondie pastoral leases, west of Cue. Unpubl. report to the Thoo Thoo Warninha Aboriginal Cooperative, Cue, and the AIATSIS, Canberra.

Henneberg, M. and K. Mathers 1994. Reconstruction of body height, age and sex from hand prints. *Suid-Afrikaanse Tydskrif vi Wetenskap* 90: 493–496. (now *South African Journal of Science*).

Ishak, N.-I. 2010. Sex and stature estimation using hand and handprint measurements in a Western Australian population. Unpubl. MFSc thesis, Centre for Forensic Science, University of Western Australia.

Johannson, R. S., and A. B. Vallbo 1979. Tactile sensibility in the human hand: relative and absolute densities of four types of mechanoreceptive units in glabrous skin. *Journal of Physiology* 286: 283–300.

Jones, P. G. 1987. South Australian Aboriginal history: the Board for Anthropological Research and its early expeditions. *Records of the South Australian Museum* 20: 71–92.

Kanchan, T. and K. Krishan 2011. Anthropometry of hand in sex determination of dismembered remains – A review of literature. *Journal of Forensic and Legal Med*icine 18(1): 14–7; doi: 10.1016/j.jflm.2010.11.013.

Khazri, H. B., Z. A. Mustapha, S. C. Shimmi, M. T. H. Parash and A. B. M. T. Hossian 2023. Hand anthropometry: baseline data of the major ethnic groups in Sabah. *Borneo Journal of Medical Sciences* 17(1): 5– 9; doi: 10.51200/bjms.v17i1.3780.

Lane, E. A. and A. M. Richards 1966. Hand paintings in caves with special reference to Aboriginal hand stencils from caves on the Nullarbor Plain, southern Australia. *Helictite* January 1966: 3–50.

McCarthy, F. D. and N. W. G. Macintosh 1962. The archaeology of Mootwingee, Western New South Wales. *Records of the Australian Museum* 25(13): 249–298.

Mirmohammadi, S. J., A. H. Mehrparvar, M. Mostaghaci, M. H. Davari, M. B. and S. Mashtizadeh 2015. Anthropometric hand dimensions in a population of Iranian male workers in 2012. *International Journal of Occupational Safety and Ergonomics* 22(1): 125–130; doi: 10.1080/10803548.2015.1112108.

Moore, D. 1979. The handstencil as symbol. In P. J. Ucko (ed.), *Form in indigenous art*, pp: 318–324. Australian Institute for Aboriginal Studies, Canberra.

Morse, K. 1984. First recording of painted Aboriginal rock art in a south-western Australian limestone cave. *Records of the Western Australian Museum* 11(2): 197–199.

Morwood, M. J. 1976. Three rock art sites in central Queensland. *Occasional Papers of the Queensland University Anthropology Museum* 6: 84–96.

Mulvaney, K. 1996. What to do on a rainy day: reminiscences of Mirriuwung and Gadjerong artists. *Rock Art Research* 13(1): 3–20.

Mulvaney, K. 1999. Management strategies and the component of indigenous sacred places: the Dreaming and Aboriginal involvement in site management within Northern Territory National Parks, Australia. *Forum* 16(4): 37–49.

Nelson, E., J. Hall, P. Randolph-Quinney and A. Sinclair 2017. Beyond size: the potential of a geometric morphometric analysis of shape and form for the assessment of sex in hand stencils in rock art. *Journal of Archaeological Science* 78 (2017): 202–213.

Nicholls, M. E. R., A. O. Orr, M. J. Yates and A. M. Loftus 2008. A new means of measuring index/ring finger (2D:4D) ratio and its association with gender and hand preference. *Laterality: Asymmetries of Body, Brain and Cognition*, 13(1): 71–91.

Oktaviana, A. A., D. Bulbeck, S. O'Connor, B. Hakim, Suryatman, U. P. Wibowo, E. St Pierre and Fakhri 2016. Hand stencils with and without narrowed fingers at two new rock art sites in Sulawesi, Indonesia. *Rock Art Research* 33(1): 32–48.

Pettitt, P., A. M. Castillejo, P. Arias, R. Ontañón Peredo and R. Harrison 2014. New views on old hands: the context of stencils in El Castillo and La Garma caves (Cantabria, Spain). *Antiquity* 88: 47–63.

Quinnell, M. C. 1974. Aboriginal rock art in Carnarvon Gorge, south central Queensland. *Minutes of the Anthropological Society of Queensland* 29/11/74: 2–10.

Roberts, D. A. and A. Parker 2003. *Ancient ochres: the Aboriginal paintings of Mount Borradaile*. JB Books, Marlston.

Rosenfeld, A. 1990. Rock art in Watarrka National Park. Unpubl. fieldwork report to the Faculties, Australian National University.

Sani, S. H. Z., D. Sadeghi-Bahmani, Z. Fathirezaie, M. T. Aghdasi, K. Abbaspour, G. Badicu and S. Brand 2022. Gender differences and relationship of 2D:4D-ratio, mental toughness and dark triad traits among active young adults. *Biology* 2022, 11: 864; https://doi.org/10.3390/biology11060864.

Schools Canada 2006. Canadian summary results for 2005/2006 – length of hands. Accessed online at *https://censusatschool.ca/data-results/2005-06/average-length-of-hand/*.

Snow, D. R. 2006. Sexual dimorphism in Upper Palaeolithic hand stencils. *Antiquity* 80: 390–404.

Standish, C. D., P. Pettitt, H. Collado, J. C. Aguilar, J. A. Milton, M. García-Diez, D. L. Hoffmann, J. Zilhao and A. W. G. Pike 2025. The age of hand stencils in Maltravieso Cave (Extremadura, Spain) established by U-Th dating, and its implications for the early development of art. *Journal of Archaeological Science: Reports* 61(2025): 104891. *https://doi.org/10.1016/j.jasrep.2024.104891*.

Strecker, M. 2013. Preceramic rock art in Bolivia: a preliminary approach. *American Indian Rock Art* 40: 189–208.

Taçon, P. S. C., H. Tang and M. Aubert 2016. Naturalistic animals and hand stencils in the rock art of Xinjiang Uyghur Autonomous Region, northwest China. *Rock Art Research* 33(1): 19–31.

Tindale, N. B. 1929–1935. Unpublished notes. South Australian Museum archives, Adelaide.

van der Looven, R., M. Deschrijver, L. Hermans, M. De Muynck, G. Vingerhoets 2021. Hand size representation in healthy children and young adults. *Journal of Experimental Child Psychology* 203: 105016; doi: 10.1016/j.jecp.2020.105016.

Walsh, G. L. 1979. Mutilated hands or signal stencils? A consideration of irregular hand stencils from central Queensland. *Australian Archaeology* 9: 33–41.

Walsh, G. L. 1983. Composite stencil art: elemental or specialised. *Australian Aboriginal Studies* 2: 34–44.

Walsh, G. L. 2000. *Bradshaw art of the Kimberley*. Takarakka Nowan Kas Publications, Toowong.

Wright, B. 1985. The significance of hand motif variations in the stencilled art of the Australian Aborigines. *Rock Art Research* 2(1): 3–19.

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