

Assessment of Skeletal Maturity and Prediction of Adult Height (TW2 Method)

Second Edition

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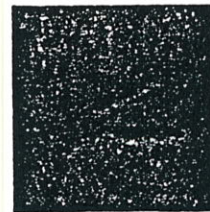
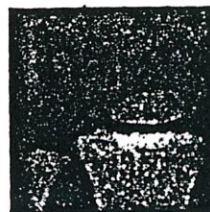
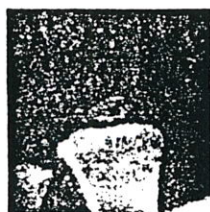
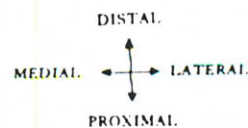


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Radius



B



C



D



E



Boys'
Scores

TW2 RUS
15 16

Stage B

- (i) The centre is just visible as a single deposit of calcium, or more rarely as multiple deposits. The border is ill-defined.

Stage C

TW2 RUS
17 21

- (i) The centre is distinct in appearance and oval in shape with a smooth continuous border.

Stage D

TW2 RUS
21 30

- (i) The maximum diameter is half or more the width of the metaphysis.
(ii) The epiphysis has broadened chiefly at its lateral side, so that this portion is thicker and more rounded, the medial portion more tapering.
(iii) The centre third of the proximal surface is flat and slightly thickened and the gap between it and the radial metaphysis has narrowed to about a millimeter.

Stage E

TW2 RUS
27 39

- (i) A thickened white line has appeared just inside the distal border of the epiphysis; this represents the edge of the palmar surface and the newly appeared bone distal to it is the edge of the dorsal surface.

Girls'
Scores

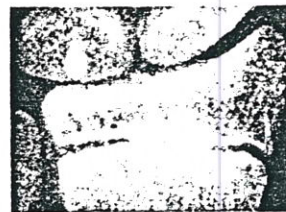
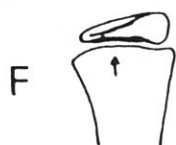
TW2 RUS
17 23

TW2 RUS
19 30

TW2 RUS
25 44

TW2 RUS
33 56

Radius



Boys' Scores

Stage F

- (i) The proximal border of the epiphysis is now differentiated into palmar and dorsal surfaces; the palmar surface is visible as a broad irregularly thickened white line at the proximal edge of the epiphysis.
- (ii) Both ends of the epiphysis, but particularly the medial one, have grown outward and proximally since the last stage so that the proximal border now conforms to the shape of the metaphysis along most of its extent.

TW2 RUS
48 59

Stage G

- (i) The dorsal surface now has distinct lunate and scaphoid articular edges joined at a small hump.
- (ii) The medial border of the epiphysis has developed palmar and dorsal surfaces for articulation with the ulnar epiphysis; either palmar or dorsal surface may be the one which projects medially, depending on the position of the wrist.
- (iii) The proximal border of the epiphysis is now slightly concave.

TW2 RUS
77 87

Stage H

- (i) The epiphysis now caps the metaphysis on one (usually the medial) or both sides.

TW2 RUS
96 138

Stage I

- (i) Fusion of epiphysis and metaphysis has begun. A line may still be visible composed partly of black areas where the epiphyseal cartilage remains and partly of dense white areas where fusion is proceeding; or the line may have disappeared.

TW2 RUS
106 213

Girls' Scores

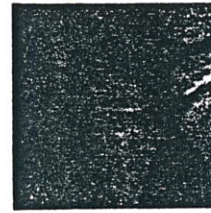
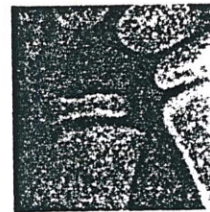
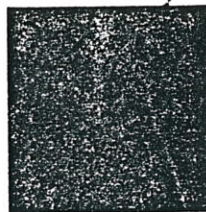
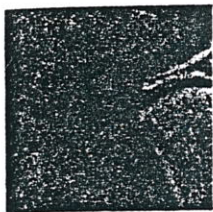
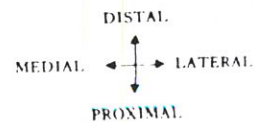
TW2 RUS
54 78

TW2 RUS
85 114

TW2 RUS
99 160

TW2 RUS
106 218

Ulna



Boys' Scores

TW2 RUS
22 27

Stage B

- (i) The centre is just visible as a single deposit of calcium, or more rarely as multiple deposits. The border is ill-defined.

Stage C

TW2 RUS
26 30

- (i) The centre is distinct in appearance, with a smooth continuous border.

Stage D

TW2 RUS
30 32

- (i) The maximum diameter is half or more the width of the metaphysis.
(ii) The epiphysis is now elongated so that the transverse, medio-lateral diameter is considerably greater than the longitudinal, disto-proximal diameter.
(iii) Proximal and distal borders are both flattened, though not necessarily parallel, so that the epiphysis is usually wedge-shaped with the point facing laterally.

Stage E

TW2 RUS
39 40

- (i) The styloid process is now visible as a distinct though small projection.

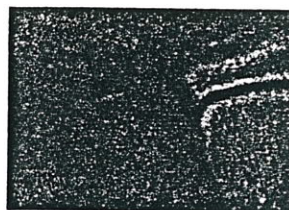
Girls' Scores

TW2 RUS
22 30

TW2 RUS
26 33

TW2 RUS
30 37

TW2 RUS
39 45


Boys'
Scores

Stage F

- (i) The head of the ulna is now distinctly defined and denser than the styloid process. (Its medial surface usually appears as a thickened white line differentiating it from the styloid process, and there is often a concavity of the proximal and/or distal border of the epiphysis where the head and styloid meet.)
- (ii) The border adjacent to the radial epiphysis is flattened.

TW2 RUS
56 58

Stage G

- (i) The epiphysis is now as wide as the metaphysis.
- (ii) The proximal border of the epiphysis and the distal border of the metaphysis overlap in their central one-third.

TW2 RUS
73 107

Stage H

- (i) Fusion of epiphysis and metaphysis has begun. The line between epiphysis and metaphysis may be still visible composed partly of black areas, usually on the styloid side, where the epiphyseal cartilage remains, and partly of dense white areas where fusion is proceeding; or the line may have disappeared.

TW2 RUS
84 181

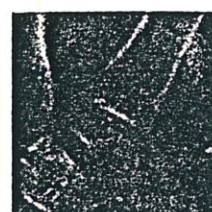
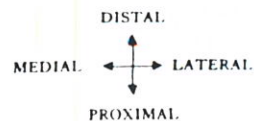
Girls'
Scores

TW2 RUS
60 74

TW2 RUS
73 118

TW2 RUS
80 173

First Metacarpal



Boys'
Scores
TW2 RUS
4 6

Stage B

- (i) The centre is just visible as a single deposit of calcium, or more rarely as multiple deposits. The border is ill-defined.

Stage C
TW2 RUS
5 9

Stage C

- (i) The epiphysis is distinct in appearance and oval in shape, with a smooth continuous border.

Stage D
TW2 RUS
11 14

Stage D

- (i) The maximum diameter is half or more the width of the metaphysis.

Stage E
TW2 RUS
19 21

Stage E

- (i) The epiphysis is as wide as the metaphysis.
- (ii) A concavity is present in the proximal border. (This is due to the first appearance of palmar and dorsal surfaces of the epiphysis, though as yet these surfaces themselves are not distinct.)

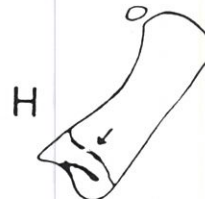
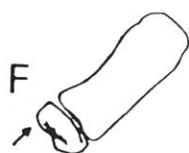
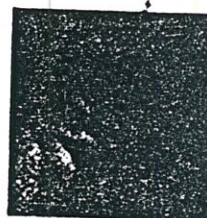
Girls'
Scores
TW2 RUS
5 8

Stage C
TW2 RUS
6 12

Stage D
TW2 RUS
11 18

Stage E
TW2 RUS
18 24

First Metacarp



Boys' Scores

TW2 RUS
24 26

TW2 RUS
28 36

TW2 RUS
30 49

TW2 RUS
32 67

Stage F

- (i) The differentiation of the proximal surface into palmar and dorsal portions is now distinct and the full extent of the dorsal surface can be made out; due to the rotation of the thumb in its position on the film, these surfaces appear as latero-dorsal and medio-palmar. The saddle formed by these surfaces conforms to the adjacent border of the trapezium bone.

(Towards the end of this stage the medial border of the epiphysis changes from a rounded shape to a flat distinct border.)

Stage G

- (i) The epiphysis caps the metaphysis on one or both sides; the capping is usually seen better on the medial than on the lateral side, due to the rotation of the thumb in positioning the hand.

Stage H

- (i) Fusion of epiphysis and metaphysis has begun. A line is still visible, composed partly of black areas where the epiphyseal cartilage remains and partly of dense white areas where fusion has occurred.

Stage I

- (i) Fusion of epiphysis and metaphysis is completed. (Over the majority of its length the line of fusion has entirely disappeared, but some thickened remnant of it may still be visible.)

Girls' Scores

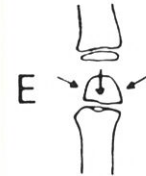
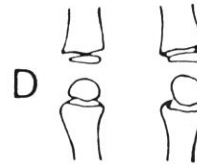
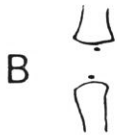
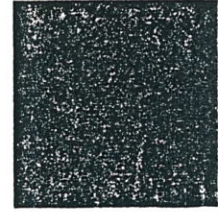
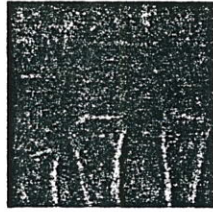
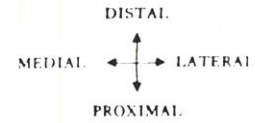
TW2 RUS
24 31

TW2 RUS
29 43

TW2 RUS
31 53

TW2 RUS
33 67

Third (III) and Fifth (V) Metacarpals



Boys' Scores

	TW2	RUS
III	3	4
V	3	4

Stage B

- (i) The centre is just visible as a single deposit of calcium, or more rarely as multiple deposits. The border is ill-defined.

Stage C

	TW2	RUS
III	4	5
V	3	6

- (i) The epiphysis is distinct in appearance and rounded in shape with a smooth continuous border.

Stage D

	TW2	RUS
III	6	9
V	6	9

- (i) The transverse diameter is half or more the width of the metaphysis.

Stage E

	TW2	RUS
III	10	12
V	12	14

- (i) Since the last stage the shape of the epiphysis has changed from being an oval or semicircle to that of a spade or finger-nail. This occurs by virtue of the lateral, medial and proximal borders of the epiphysis becoming distinct one from another, and identifiable by the angles seen at their junctions.

Girls' Scores

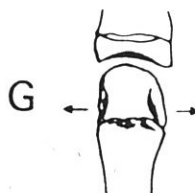
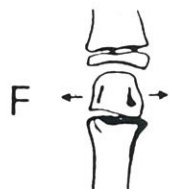
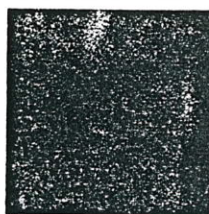
	TW2	RUS	
III	3	5	III
V	3	6	V

	TW2	RUS	
III	5	8	III
V	4	9	V

	TW2	RUS	
III	7	12	III
V	7	12	V

	TW2	RUS	
III	11	16	III
V	12	17	V

Third (III) and Fifth (V) Metacarpals



Boys' Scores

Stage F

- (i) It is now possible, in a good film, to distinguish the palmar from the dorsal surface of the epiphysis. Since the last stage the medial and/or lateral edges of the dorsal surface have grown outwards to overlap the palmar surface of the epiphysis. The outlines of the palmar edges now appear as longitudinal thickened white lines.

	TW2	RUS
III	16	19
V	17	18

Stage G

- (i) The epiphysis is as wide as, or wider than, the metaphysis. (This stage would seem to be the equivalent of the stage of capping in the epiphysis of the phalanges.)

	TW2	RUS
III	22	31
V	21	29

Stage H

- (i) Fusion of epiphysis and metaphysis has begun. The dark line of cartilage extends over less than three-quarters of the bone's breadth, but is not entirely obliterated.

	TW2	RUS
III	23	43
V	23	43

Stage I

- (i) Fusion of epiphysis and metaphysis is completed. (Over the majority of its length the line of fusion has entirely disappeared, but some thickened remnant of it may still be visible.)

	TW2	RUS
III	25	52
V	25	52

Girls' Scores

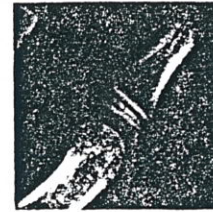
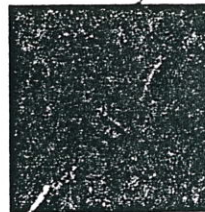
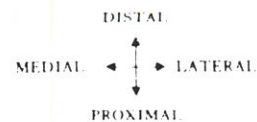
	TW2	RUS	
III	17	23	III
V	18	23	V

	TW2	RUS	
III	23	37	III
V	22	35	V

	TW2	RUS	
III	24	47	III
V	24	48	V

	TW2	RUS	
III	26	53	III
V	25	52	V

Proximal Phalanx of the Thumb



B



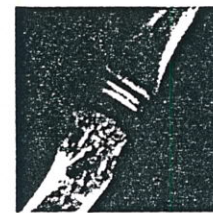
C



D



E



Boys'
Scores

TW2 RUS
4 7

Stage B

- (i) The centre is just visible as a single deposit of calcium or more rarely as multiple deposits. The border is ill-defined.

Stage C

TW2 RUS
5 8

- (i) The centre is distinct in appearance and disc-shaped, with a smooth continuous border.

(Multiple centres may occur whose summed maximum diameters exceed half the width of the metaphysis; they should however be rated stage C.)

Stage D

TW2 RUS
8 11

- (i) The maximum diameter is half or more the width of the metaphysis.

Stage E

TW2 RUS
15 17

- (i) The proximal border is concave and usually thickened.
(ii) The medial side is longer than the lateral, giving a wedge-shaped appearance.

Girls'
Scores

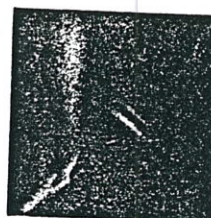
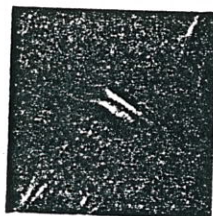
TW2 RUS
5 9

TW2 RUS
5 11

TW2 RUS
8 14

TW2 RUS
14 20

Proximal Phalanx of the Thumb



Boys' Scores

TW2 RUS
23 26

Stage F

- (i) The epiphysis is wider than the metaphysis, particularly at the medial side, and follows closely its shape.

Stage G

TW2 RUS
28 38

- (i) The epiphysis caps the metaphysis. (The capping is seen better on the medial than on the lateral side.)

Stage H

TW2 RUS
30 52

- (i) Fusion of epiphysis and metaphysis has begun.

Stage I

TW2 RUS
32 67

- (i) Fusion of epiphysis and metaphysis is completed. (Over the majority of its length the line of fusion has entirely disappeared, but some thickened remnant of it may still be visible.)

Girls' Scores

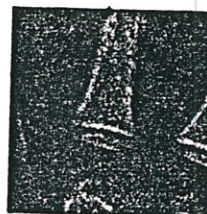
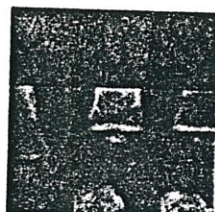
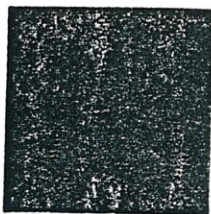
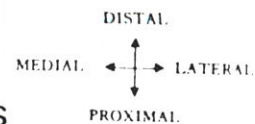
TW2 RUS
24 31

TW2 RUS
29 44


TW2 RUS
30 56

TW2 RUS
32 67

Proximal Phalanges of Third (III) and Fifth (V) Fingers

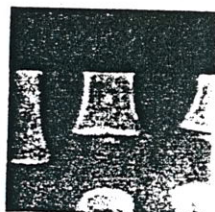


B 

C 

D 

E 



Boys'
Scores

	TW2	RUS
III	3	4
V	3	4

Stage B

- (i) The centre is just visible as a single deposit of calcium, or more rarely as multiple deposits. The border is ill-defined.

Stage C

	TW2	RUS
III	4	4
V	3	5

- (i) The centre is distinct in appearance and disc-shaped, with a smooth continuous border.

Stage D

	TW2	RUS
III	6	9
V	6	9

- (i) The epiphysis is half or more the width of the metaphysis.

Stage E

	TW2	RUS
III	13	15
V	13	15

- (i) The proximal border of the epiphysis is concave and distinctly thickened.

Girls'
Scores

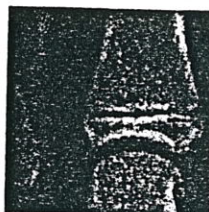
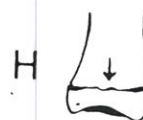
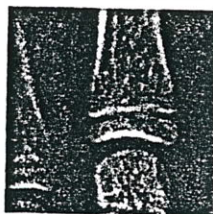
	TW2	RUS	
III	4	5	III
V	4	6	V

	TW2	RUS	
III	4	7	III
V	4	7	V

	TW2	RUS	
III	7	12	III
V	7	12	V

	TW2	RUS	
III	13	19	III
V	13	18	V

Proximal Phalanges of Third (III) and Fifth (V) Finger



Boys' Scores	
TW2	RUS
III 20	23
V 19	21

Stage F

- (i) The epiphysis is as wide as the metaphysis and follows closely its shape, although it does not yet cap it at the edges.

Boys' Scores	
TW2	RUS
III 23	31
V 22	30

Stage G

- (i) The epiphysis caps the metaphysis.

Boys' Scores	
TW2	RUS
III 24	40
V 23	39

Stage H

- (i) Fusion of epiphysis and metaphysis has now begun. A line is still visible composed partly of black areas where the epiphyseal cartilage remains and partly of dense white areas where fusion is proceeding.

Boys' Scores	
TW2	RUS
III 26	53
V 25	51

Stage I

- (i) Fusion of epiphysis and metaphysis is completed. (Over the majority of its length the line of fusion has entirely disappeared, but some thickened remnant of it may still be visible.)

Girls' Scores

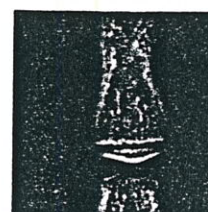
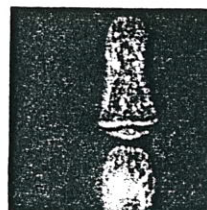
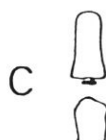
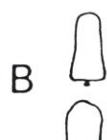
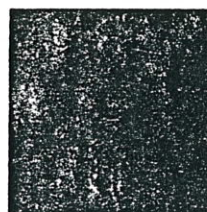
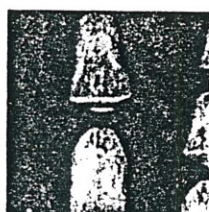
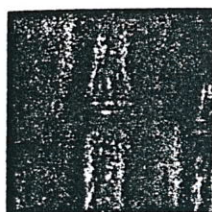
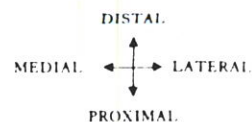
TW2	RUS
20	27
19	26

TW2	RUS
24	37
23	35

TW2	RUS
25	44
24	42

TW2	RUS
26	54
25	51

Middle Phalanges of Third (III) and Fifth (V) Fingers



Boys'
Scores

Stage B

TW2	RUS
3	4
4	6

- (i) The centre is just visible as a single deposit of calcium, or more rarely as multiple deposits. The border is ill-defined.

Stage C

TW2	RUS
4	6
4	7

- (i) The centre is distinct in appearance and disc-shaped, with a smooth continuous border.

Stage D

TW2	RUS
7	9
8	9

- (i) The maximum diameter is half or more the width of the metaphysis.

Stage E

TW2	RUS
13	15
14	15

- (i) The central portion of the proximal border has thickened and grown towards the end of the adjacent phalanx, shaping to its trochlear surface.

(This thickened white line represents the dorsal surface of the epiphysis; proximal to it the palmar surface is usually visible on one or both sides as a convex projection. In some positions of the hand, however, these proximal edges of palmar and dorsal surfaces appear superimposed.)

Girls'
Scores

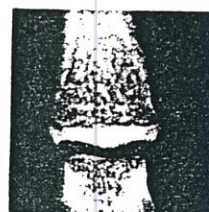
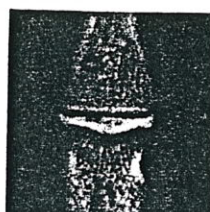
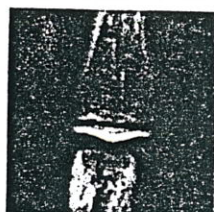
TW2	RUS	
4	6	III
4	7	V

TW2	RUS	
4	8	III
5	8	V

TW2	RUS	
7	12	III
8	12	V

TW2	RUS	
13	18	III
14	18	V

Middle Phalanges of Third (III) and Fifth (V) Fingers



Boys' Scores	
TW2	RUS
III 19	22
V 19	23

Stage F

(i) The epiphysis is as wide as the metaphysis.

Girls' Scores	
TW2	RUS
20	27
20	28

TW2	RUS
III 22	32
V 21	32

Stage G

(i) The epiphysis caps the metaphysis.

TW2	RUS
23	36
22	35

TW2	RUS
III 23	43
V 22	42

Stage H

(i) Fusion of epiphysis and metaphysis has begun. A line is still visible, composed partly of black areas where the epiphyseal cartilage remains and partly of dense white areas where fusion is proceeding.

TW2	RUS
24	45
22	43

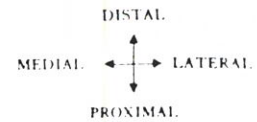
TW2	RUS
III 25	52
V 23	49

Stage I

(i) Fusion of epiphysis and metaphysis is completed. (Over the majority of its length the line of fusion has entirely disappeared, but some thickened remnant of it may still be visible.)

TW2	RUS
25	52
23	49

Distal Phalanx of the Thumb



Boys' Scores

TW2 RUS
4 5

Stage B

- (i) The centre is just visible as a single deposit of calcium, or more rarely as multiple deposits. The border is ill-defined.

Stage C

TW2 RUS
4 6

- (i) The centre is distinct in appearance and disc-shaped, with a smooth continuous border.

Stage D

TW2 RUS
7 11

- (i) The maximum diameter is half or more the width of the metaphysis.

Stage E

TW2 RUS
14 17

- (i) The epiphysis is as wide as the metaphysis.
(ii) The shape has changed, so that there is now a somewhat flattened distal border and an angulated proximal border. (The change in shape of the proximal border comes about through a down-growth similar to that seen at this stage in the epiphysis of the middle and distal phalanges of the fingers in their central axis. Due to the rotation of the thumb in its position on the film, however, this down-growth appears usually at the proximo-medial edge, although sometimes it may be nearly central.)

Girls' Scores

TW2 RUS
5 7

TW2 RUS
5 9

TW2 RUS
8 15

TW2 RUS
15 22

Distal Phalanx of the Thumb



Boys' Scores

Stage F

- (i) The proximo-lateral border of the epiphysis is now concave and shapes to the head of the proximal phalanx. (In some positions of the thumb this border is not visible as such. Instead the articular surface may be seen as a white concave line inside the proximo-lateral border.)
- (ii) On the distal border the medial and lateral surfaces can both be seen, with the base of the terminal phalanx conforming to the saddle shape between them.
- (iii) The epiphysis is now wider than the metaphysis.

TW2 RUS
23 26

Stage G

- (i) The epiphysis caps the metaphysis. (Because of the position of the thumb this is better seen on the medial side.)

TW2 RUS
30 38

Stage H

- (i) Fusion of the epiphysis and metaphysis has begun. A line is still visible, composed partly of black areas where the epiphyseal cartilage remains, and partly of dense white areas where fusion is proceeding.

TW2 RUS
31 46

Stage I

- (i) Fusion of epiphysis and metaphysis is completed. (Over the majority of its length the line of fusion has entirely disappeared, but some thickened remnant of it may still be visible.)

TW2 RUS
33 66

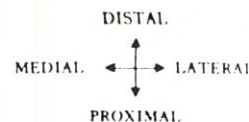
Girls' Scores

TW2 RUS
24 33

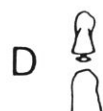
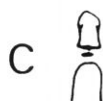
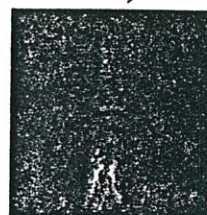
TW2 RUS
31 48

TW2 RUS
32 51

TW2 RUS
34 68



Distal Phalanges of Third (III) and Fifth (V) Fingers



Boys'
Scores

	TW2	RUS
III	3	4
V	3	5

Stage B

- (i) The centre is just visible as a single deposit of calcium, or more rarely as multiple deposits. The border is ill-defined.

Stage C

	TW2	RUS
III	4	6
V	4	6

- (i) The centre is distinct in appearance and disc-shaped, with a smooth continuous border.

Stage D

	TW2	RUS
III	6	8
V	7	9

- (i) The maximum diameter is half or more the width of the metaphysis.

Stage E

	TW2	RUS
III	10	13
V	11	13

- (i) The epiphysis is as wide as the metaphysis.
(ii) The central portion of the proximal border has grown towards the end of the middle phalanx, so that the proximal border no longer consists of a single convex surface; no differentiation into palmar and dorsal surfaces, however, can yet be seen.

Girls'
Scores

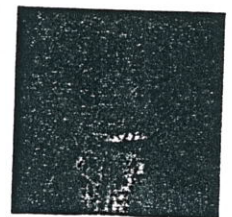
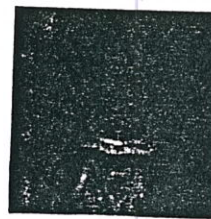
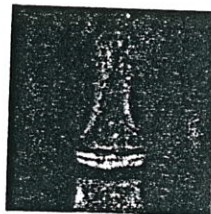
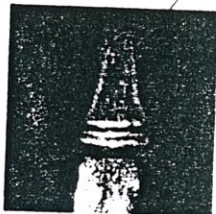
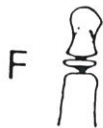
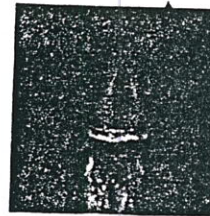
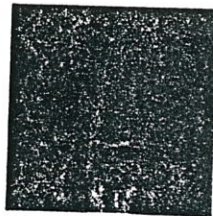
	TW2	RUS	
III	3	7	III
V	3	7	V

	TW2	RUS	
III	4	8	III
V	4	8	V

	TW2	RUS	
III	6	11	III
V	7	11	V

	TW2	RUS	
III	10	15	III
V	11	15	V

Distal Phalanges of Third (III) and Fifth (V) Fingers



Boys' Scores

	TW2	RUS
III	16	18
V	16	18

Stage F

- (i) Palmar and dorsal proximal surfaces are distinct, and each has shaped to the trochlear articulation of the middle phalanx. The palmar surface appears as a projection proximal to the thickened white line representing the dorsal surface.

Stage G

- (i) The epiphysis caps the metaphysis.

Stage H

- (i) Fusion of epiphysis and metaphysis has begun. (A line is still visible, composed partly of black areas where the epiphyseal cartilage remains and partly of dense white areas where fusion is proceeding.)

Stage I

- (i) Fusion of epiphysis and metaphysis is completed. (Over the majority of its length the line of fusion has entirely disappeared, but some thickened remnant of it may still be visible.)

Girls' Scores

	TW2	RUS	
	17	22	III
	17	22	V

	TW2	RUS	
	22	33	III
	21	32	V

	TW2	RUS	
	23	37	III
	22	36	V

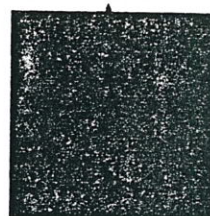
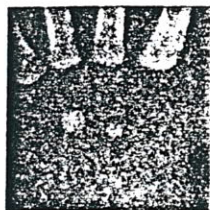
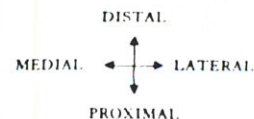
	TW2	RUS	
	24	49	III
	23	47	V

	TW2	RUS
III	21	28
V	20	27

	TW2	RUS
III	22	34
V	21	34

	TW2	RUS
III	24	49
V	23	48

Capitate

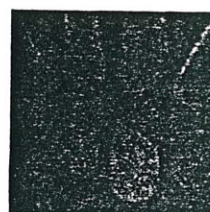
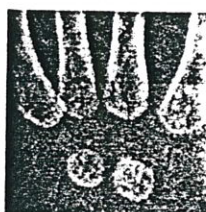
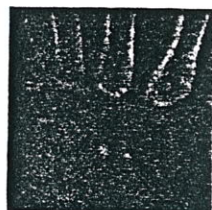


B •

C ○

D → ○ ↖

E → ○



Boys'
Scores
TW2 Carp
60 100

Stage B

- (i) The centre is just visible as a single deposit of calcium, or more rarely as multiple deposits. The border is ill-defined.

TW2 Carp
62 104

Stage C

- (i) The centre is distinct in appearance and oval in shape, with a smooth continuous border.

TW2 Carp
65 106

Stage D

- (i) The maximum diameter is half or more the width of the radial metaphysis.
(ii) The border adjacent to the hamate is now flat or only slightly convex.
(iii) The border adjacent to the second metacarpal is also beginning to become distinct from the hamate border so that the centre now appears somewhat D-shaped.

TW2 Carp
71 113

Stage E

- (i) The hamate border is now concave and slightly thickened.
(ii) The bone has lengthened, so that the longitudinal diameter is distinctly greater than the transverse, but less than the distance from its proximal border to the radial metaphysis.

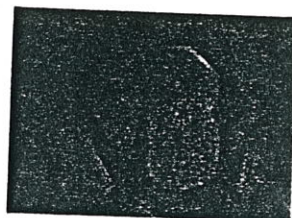
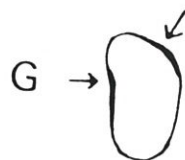
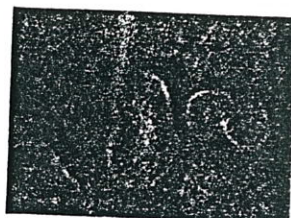
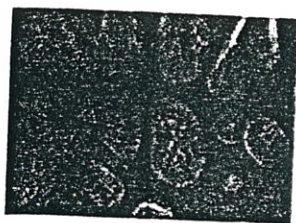
Girls'
Scores
TW2 Carp
53 84

TW2 Carp
56 88

TW2 Carp
61 91

TW2 Carp
67 99

Capitate



Boys' Scores

TW2 Carp
79 133

Stage F

- (i) The longitudinal diameter is now equal to or greater than the distance from its proximal border to the radial metaphysis.
(If the hand is improperly posed, with ulnar deviation at the wrist, then this distance is artificially increased. Such a pose should be identified and allowed for).

Stage G

- (i) A thickened white line has appeared along the latero-distal border, due to the formation of the articular facets with the second and third metacarpals.
- (ii) A thickened white line has appeared at the middle of the concavity of the hamate border, due to the formation of the articular facet of the hamate.

Stage H

- (i) The articular facets for both the second and third metacarpals have now developed so that both palmar and dorsal surfaces are visible. The thickened white line seen along the border of the bone in the last stage is now placed inside the bone's outer margin, because of the growth of the dorsal surface out beyond it.

TW2 Carp
116 214

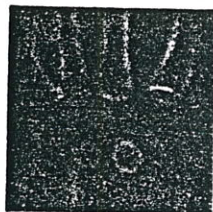
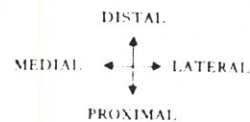
Girls' Scores

TW2 Carp
76 121

TW2 Carp
85 149

TW2 Carp
113 203

Hamate

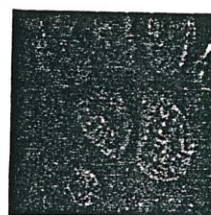
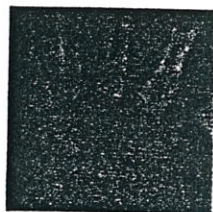


B ◦

C ○

D

E



Boys'
Scores
TW2 Carp
42 73

Stage B

- (i) The centre is just visible as a single deposit of calcium, or more rarely as multiple deposits. The border is ill-defined.

TW2 Carp
44 75

Stage C

- (i) The centre is distinct in appearance and round in shape, with a smooth continuous border.

TW2 Carp
49 79

Stage D

- (i) The maximum diameter is half or more the width of the radial metaphysis.
- (ii) The surface that later articulates with the triquetral has flattened so that the appearance of the hamate (like that of the capitate at the same stage) is D-shaped, with the straight side running diagonally to the long axis of the hand.

TW2 Carp
59 100

Stage E

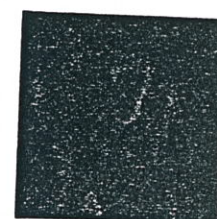
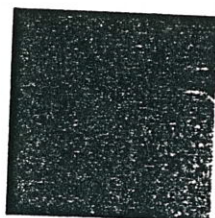
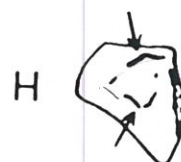
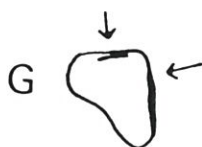
- (i) The capitate border has now begun to shape to the hamate articular facet of the capitate. This shaping usually takes the form of a slight bulge appearing about half to two-thirds of the way down the border, with somewhat flattened edges proximal and distal to it.
- (ii) The metacarpal and capitate borders have become differentiated so that the shape has changed from a D to a three-sided figure.

Girls'
Scores
TW2 Carp
44 72

TW2 Carp
47 74

TW2 Carp
53 78

TW2 Carp
64 102

Boys'
ScoresTW2 Carp
70 128

Stage F

- (i) A concavity is now present in the triquetral border (because of considerable growth upwards towards the base of the fifth metacarpal since the last stage).

Stage G

TW2 Carp
81 159

- (i) The articular facet for the fourth metacarpal has now begun to form and differentiation into palmar and dorsal surfaces can be seen as a thickening running along or inside the distal border of the bone.

Stage H

TW2 Carp
92 181

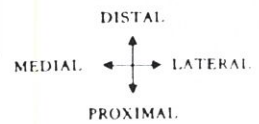
- (i) The hook of the hamate has begun to appear as a white line, to be distinguished from the articular surfaces adjacent to metacarpals four and five, described below.
(ii) The articulations with the fourth and fifth metacarpals have now progressed so that there are two distinct surfaces at the distal edge of the bone, one running transversely and the other, on the medial side, running diagonally to the axis of the hand.

Stage I

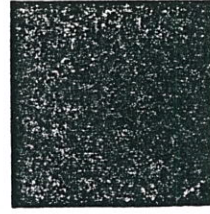
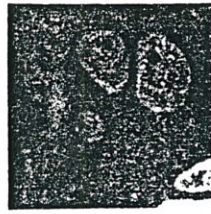
TW2 Carp
106 194

- (i) The hook of the hamate is now completely visible.

Girls'
ScoresTW2 Carp
74 131TW2 Carp
85 161TW2 Carp
97 183TW2 Carp
109 194



Triquetral

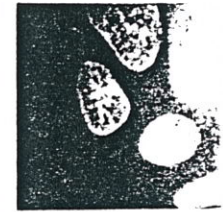
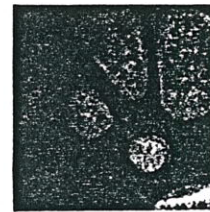
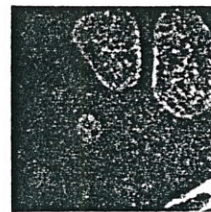


B •

C ○

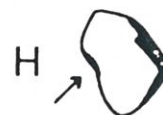
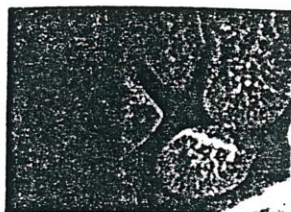
D ○

E ○



Boys' Scores		Stage B	Girls' Scores	
TW2	Carp		TW2	Carp
7	10	(i) The centre is just visible as a single deposit of calcium, or more rarely as multiple deposits. The border is ill-defined.	8	11
		Stage C		
TW2	Carp		TW2	Carp
10	13	(i) The centre is distinct in appearance and round in shape with a smooth continuous border.	12	16
		Stage D		
TW2	Carp		TW2	Carp
17	28	(i) The maximum diameter is half or more the width of the ulnar metaphysis. (ii) The border adjacent to the hamate has flattened.	19	31
		Stage E		
TW2	Carp		TW2	Carp
28	57	(i) The bone is elongated in shape with the longitudinal diameter distinctly greater than the transverse. (This is due to growth since the last stage having been relatively greatest at the medio-distal border.)	28	56

Triquetral



Boys' Scores

TW2 Carp
38 84

Stage F

- (i) The lunate border has now become flat and distinct and forms an angle of a little over 90 degrees with the hamate border. One or both borders show slight thickening as the articular facets begin to form.

Stage G

TW2 Carp
45 102

- (i) Palmar and dorsal surfaces are now visible on the hamate and/or lunate borders so that the white lines seen in the last stage at the borders of the bone are now slightly inside the borders.

Stage H

TW2 Carp
62 124

- (i) The broadening, chiefly of the distal half of the bone, since the last stage has caused a concavity to appear in the medial border.

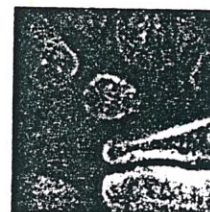
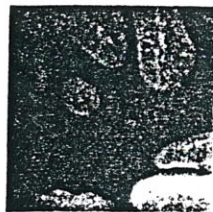
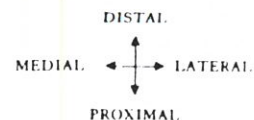
Girls' Scores

TW2 Carp
36 80

TW2 Carp
46 104

TW2 Carp
63 126

Lunate



B •

C ○

D ↓ ○

E ↓ ↑ ○



Boys'
Scores
TW2 Carp
10 14

Stage B

- (i) The centre is just visible as a single deposit of calcium, or more rarely as multiple deposits. The border is ill-defined.

TW2 Carp
13 22

Stage C

- (i) The centre is distinct in appearance and oval in shape, with a smooth continuous border.

TW2 Carp
20 39

Stage D

- (i) The maximum diameter is half or more the width of the ulnar metaphysis.
(ii) The distal border of the bone is now thickened.

TW2 Carp
27 58

Stage E

- (i) The palmar and dorsal surfaces of the distal part of the bone are now clearly defined with one or the other, or both, projecting distal to the thickened white line which marks their area of confluence. The dorsal surface may project towards the scaphoid but no proper saddle, as in the next stage, is yet formed.
(ii) There is flattening of the border adjacent to the radius.

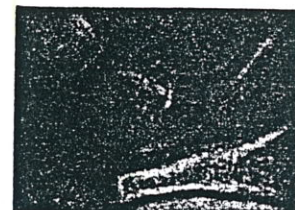
Girls'
Scores
TW2 Carp
10 16

TW2 Carp
14 24

TW2 Carp
20 40

TW2 Carp
27 59

Lunate



Boys'
Scores

Stage F

- (i) The distal surface now forms a definite saddle for articulation with the capitate, due chiefly to an out-growth of its dorsal part towards the scaphoid. This dorsal part extends out beyond the lateral edge of the palmar (thickened) part of the saddle, but less than half way from the palmar edge to the edge of the scaphoid.
- (ii) The scaphoid and triquetral borders are now flat and slightly thickened.

Stage G

- (i) The dorsal surface of the capitate saddle has further enlarged since the last stage and now covers more than half the distance from the palmar edge of the saddle to the scaphoid.
- (ii) There is a definite angle between the scaphoid border (which is still straight) and the radial border.

Stage H

- (i) The dorsal surface of the capitate saddle now extends laterally to touch or overlap the edge of the scaphoid.
(Either palmar or dorsal surface, or both, depending on individual shape and positioning, touch or overlap the capitate.)
- (ii) The scaphoid border is now concave.

Girls'
Scores

TW2 Carp
36 84

TW2 Carp
35 84

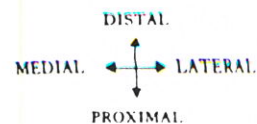
TW2 Carp
44 101

TW2 Carp
46 106

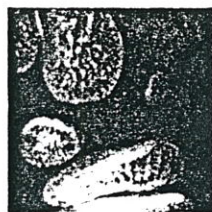
TW2 Carp
60 120

TW2 Carp
60 122

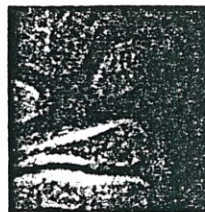
Scaphoid



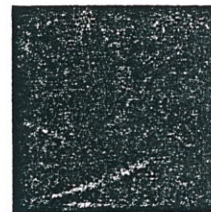
B ◦



C ◦



D ◯



E ◯



Boys'
Scores
TW2 Carp
14 26

Stage B

- (i) The centre is just visible as a single deposit of calcium, or more rarely as multiple deposits. The border is ill-defined.

TW2 Carp
18 36

Stage C

- (i) The centre is distinct in appearance and round in shape with a smooth continuous border.

TW2 Carp
23 52

Stage D

- (i) The maximum diameter is half or more the width of the ulnar metaphysis.

TW2 Carp
30 71

Stage E

- (i) The dorsal surface of the capitate articulation is visible outside the thickened white line, which represents the palmar articular surface.

Girls'
Scores

TW2 Carp
13 24

TW2 Carp
17 35

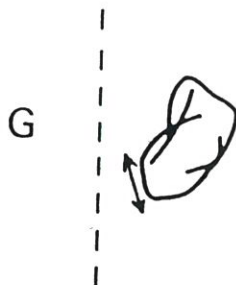
TW2 Carp
23 51

TW2 Carp
29 71

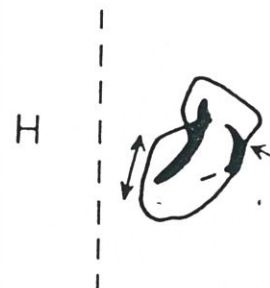
Scaphoid



MIDLINE



MIDLINE



Boys'
Scores

Stage F

TW2 Carp
35 85

- (i) The capitate surface is concave in both its palmar and dorsal aspects.
- (ii) The border adjacent to the trapezium and trapezoid is flat.

Stage G

TW2 Carp
42 100

- (i) The bone has grown chiefly in a proximal and medial direction, so that its dorsal surface now extends beyond the thickened white line over towards the lunate and the proximal part of the capitate.
- (ii) There is now a distinct border running adjacent to the lunate, its direction such that its capitate end is nearer the midline than its radial-epiphyseal end. The border is as yet in contact with the lunate only at the capitate end.

Stage H

TW2 Carp
58 116

- (i) The capitate surface conforms closely to the capitate bone throughout the whole of its extent.
- (ii) The lunate border has changed its direction so that now its radial-epiphyseal end is as near or nearer the midline of the hand than the capitate end. The border is now in contact with the lunate bone over most of its distal portion.
- (iii) Lateral enlargement of the distal portion of the bone and differentiation of the radial styloid articular surface has resulted either in a concavity appearing in the distal part of its lateral border, or in the appearance of a distinct distal head.

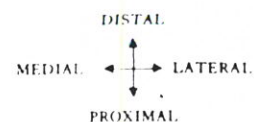
Girls'
Scores

TW2 Carp
36 88

TW2 Carp
44 104

TW2 Carp
57 118

Trapezoid

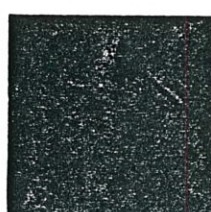


B ◦

C ◯

D ○

E ↗ ↘



Boys'
Scores

Stage B

TW2 Carp
14 27

- (i) The centre is just visible as a single deposit of calcium, or more rarely as multiple deposits. The border is ill-defined.

Stage C

TW2 Carp
16 32

- (i) The centre is distinct in appearance and round in shape with a smooth continuous border.

Stage D

TW2 Carp
20 42

- (i) The maximum diameter is half or more the width of the first metacarpal metaphysis.

Stage E

TW2 Carp
23 51

- (i) There is now flattening of the capitate border and/or of the border which lies at right-angles to it and which will eventually articulate with the medial side of the base of the second metacarpal.

Girls'
Scores

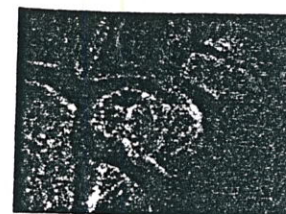
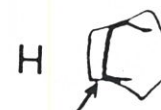
TW2 Carp
13 21

TW2 Carp
16 30

TW2 Carp
20 43

TW2 Carp
24 53

Trapezoid



Boys'
Scores

Stage F

- (i) Thickened white lines have appeared along the capitate and/or medial second metacarpal borders. Differentiation of one but not both of these borders into palmar and dorsal surfaces may have taken place.
- (ii) The distal edge of the bone has grown since the last stage and now forms a rounded peak which will later articulate with the central indentation of the second metacarpal base. Though this peak is part of the future dorsal surface and may appear as such, there is at this stage no very clear differentiation into palmar and dorsal surfaces.

TW2 Carp
32 77

Stage G

- (i) The dorsal surface of the articulation with the second metacarpal is now visible distal to the thickened white line which marks the edge of the palmar surface. The dorsal surface of the capitate articulation is also now visible. These dorsal outgrowths have developed so that they overlap, or nearly overlap, the edges of the second metacarpal and capitate.

TW2 Carp
39 93

Stage H

- (i) The dorsal proximal border of the bone is concave, although the palmar aspect of this border, which shows as a thickened line, remains straight.

TW2 Carp
56 115

Girls'
Scores

TW2 Carp
31 77

TW2 Carp
40 97

TW2 Carp
57 118