NOTES ON SOUTH AUSTRALIAN DECAPOD CRUSTACEA. PART III.

By W. H. BAKER.

[*From "Transactions of the Royal Society of South Australia," vol. xxix., 1905.*]

[Read October 3, 1905.]

PLATES XXXII. TO XXXVI.

The following notes deal with some species of *Anomura*. The first three are true hermit crabs of the family *Paguridæ*, which are closely allied to each other, belonging to that division of the family whose chief characteristics are the possession of a pair of modified appendages on the first, and another on the second, abdominal somite in the male, and a pair on the first in the female. The female also is provided with a brood pouch, which arises from the fourth somite on the left side, and covers the unpaired biramous appendages which serve for the attachment of the eggs. These three species are referred to the genus *Paguristes*. Of the four remaining species, three belong to the *Porcellanidæ*. *Petrocheles australiensis*, Miers, is a fine species, showing well the transition to the *Galatheidæ*, and as far as I know has never been figured. Of *Polyonyx transversus*, Haswell, the same may be said; so it is here figured, and the description extended. Lastly, a *Galathea*, belonging to the group which contains *G. australiensis*, Stimpson; *G. aculeata*, Haswell; and *G. magnifica*, Haswell, is described—though provisionally—as *G. setosa*, for the first time.

Family PAGURIDÆ, Dana.

Section I., *Paguringæ*, Ortmann.

Genus *Paguristes*, Dana.

For latest description of genus see Alcock Cat. Ind. Decap. Crust., part 2, p. 30, 1905.

Paguristes frontalis, M.-Edw. Pl. xxxii., figs. 1-7.

Pagurus frontalis, M.-Edw., An. des Sci. Nat., 2e série, t. vi., p. 283, pl. xiii., fig. 3. Hist. Nat. Crust., t. ii., p. 234.

Paguristes frontalis, Alcock Cat. Ind. Decap. Crust., part 2, p. 155, 1905.

Eupagurus frontalis, Cat. Aust. Crust., Haswell, p. 154.

The carapace anterior to the cervical groove is only slightly convex from side to side, anteriorly depressed, rather oblong viewed from above, the sides behind the curve of anterior angles being nearly straight; its surface is smooth and polished except for some small scattered punctations, but towards the sides it becomes somewhat rough or rugose. The

triangular rostriform tooth is acute, quickly accuminating to its apex, depressed and projecting between the bases of the scales of the ocular peduncles. The margin of the front is raised, and the antennal projections, which do not reach as far as the rostrum, are each tipped with a small tooth. A depression behind the rostral tooth sends off an oblique branch towards each side marking off the hepatic regions, and also a median longitudinal groove, which, however, is short. In the region of this groove the carapace is slightly rugose transversely. The hepatic regions are prominent and rounded. The antero-lateral portions of the carapace scarcely project forward as far as the tubercles of the first joints of the antennæ; their descending margins carry two or three spinules. The cervical groove is deeply marked, and the carapace behind it is membranaceous, and is marked with some faint, irregular, longitudinal lines; there is a narrow median region expanding anteriorly, and running to a depression behind. The branchial regions are moderately tumid. The carapace is sparingly hairy at the sides.

The narrow tergum of the first abdominal segment is triangular, firm, and bears a few setæ. The remainder of the abdomen is soft, except in some specimens a little leathery underneath; it is glabrous, except the margin of the ovigerous sac in the female. The sixth segment is strongly calcified dorsally, and is divided into two main unequal portions by a deep, transverse, irregular furrow, the anterior portion thus divided is irregularly pitted, the posterior has a median, shallow furrow, which broadens out behind.

The ocular peduncles are long, as long as the greatest breadth of the anterior portion of the carapace, moderately robust, not expanding distally, and with a tendency to become slightly unequal in length. The basal scales are rather small, spiniform, close together, and anteriorly depressed. The eyes are rather small.

The basal joint of the antennular peduncle is flattened and hollowed above, its external margin is compressed, and each edge bears distally a minute spine (stylocerite). There is a small distal spine below also. The second and third joints and the thick portion of the upper flagellum are subequal in length; the lower flagellum is about half the length of the upper, and is naked, as is also the short distal portion of the upper flagellum.

The first joint of the antennal peduncle has a prominent tubercle below, which bears the aperture of the green gland. The second joint is produced distally on the outer side, ending in three converging spines, with a group of setæ immediately below, the inner distal angle is less produced, and ends in a

downward curved spinule. The upper surface of the joint is hollowed. The third joint is produced below to a strong spine, which projects one-third the length of the fifth joint; the fourth joint is short and bears a small distal spinule above. The fifth joint is cylindrical, slightly curved, and expands slightly towards the distal end, reaching to about half the length of the ocular peduncle. The acicle is short and stout, reaching about as far as the spine on the third joint; it bears, besides the acute apex, two short, strong spines externally, and one near the base above; it also carries several fasciculi of coarse setæ. The flagellum is short, not much more than twice the length of the peduncle, and is non-ciliate.

The mandibles have the edge of the cutting plate entire; a narrow and not deep cleft separates it from the molar process; into this the terminal joint of the palp dips. The molar process is narrow. The palp is three-jointed, the second joint markedly compressed, its plane being transverse to the edge of the cutting plate; the third joint, which is about as long as the two preceding ones together, is compressed and much expanded, its plane being parallel to the same edge.

In the first maxillæ the external branch has the second joint articulated below the apex of the preceding, presenting a bifid arrangement; the distal portion is strongly reflexed. This branch bears a strong setum on the inner side near the base.

In the second maxillæ the third joint is compressed, tapering irregularly, the apex being without setæ.

In the first maxillipeds the third joint is twisted and turned aside so as to be partially hidden behind the exopod. The exopod is flagellate.

The exopods of the two succeeding maxillipeds are very robust, compressed, and flagellate. The third maxillipeds have their coxal joints contiguous, the ischium bears a row of corneous teeth on the inner side, and the merus a few spinules on the same side.

The chelipeds are large and very unequal, the left one is the larger; in it the merus is trigonous, reaching a little beyond the eyes; it bears a few small, low tubercles, which become more numerous and larger towards the distal end; some are minutely punctate at their summits. The upper surface of the carpus is strongly tuberculate, the tubercles becoming almost spiniform on the inner margin. The hand is large and swollen, whitish (in contrast to the rest of the appendages, which are red), and finely granulate, the granules becoming larger towards the inner side. The fingers open transversely, and are excavate, especially the immobile one, the

contiguous surfaces having some punctations, from which a few hairs spring. The mobile finger is corneous at the tip. There is a broad, rather obscure, ridge on the outer side of the immobile finger reaching some distance on the hand; at the inner end of this ridge is a small area of well-defined, reddish granules. The hand, including the fingers, is more than twice as long as the carpus. On the outer side the fingers show no hiatus, but a prominence on the immobile one fits into a corresponding slight hollow in the mobile one. The right cheliped has the carpus and hand bearing larger tubercles and granules, and a few fasciculi of hairs on the inner margin.

The second and third pairs of legs are long, almost glabrous and robust, exceeding the chelipeds in length. The third is more robust than the second. In these the meris and propodi are very slightly serrate above and below, the carpi have a distal spine above, and two or three on the outer side, on the distal margin. The dactyli, which are longer than the penultimate joints, are moderately curved and compressed, that of the third pair is more flattened on the outer side, and bears a well-marked, spinulate ridge above; the inner side is rounded and has scattered spinules, the lower margin is acute and serrate, especially towards the end. The spinules usually arise from dark red spots. The dactyli terminate in small black claws.

The fourth pair are much shortened, the joints are setose on their anterior and posterior margins, non-chelate, the propodi becoming narrower distally. The dactyli are short, and bear some stout teeth. The fifth pair are shorter, smaller, and minutely chelate, the pad of scale-like setæ covers the whole breadth of the distal end of the propodus.

The first and second abdominal segments bear sexual appendages in the male, the rami of the first being coalesced to form a semi-cylinder, the inner ramus is provided with a tuft of brown stiff setæ, which originate about the middle of the inner side, and extend beyond its end, intermingling with those of the opposite limb, the outer ramus is thickened, compressed, rounded at the end, which is slightly recurved outwards, bearing a row of minute teeth. The second pair of abdominal appendages are long, slender, and uniramous, and are terminally slightly spatulate and setose. The three succeeding segments are each provided with a weak uniramous appendage on the left side.

The uropods, as usual, are very unequal, the external ramus of the pair of the left side is much larger than the inner, falcate, and expanded with the usual pavement of scale-like setæ.

The telson bears a few setæ in groups, and is divided dorsally into four lobes, with a small lozenge-shaped area in the middle; the two terminal lobes are unequal, with a median cleft between them. The two anterior lobes have each an ear-shaped pit.

The female has a large brood pouch.

This littoral species is one of the largest and commonest hermit crabs of our coast, and varies much in size.

Specimens in the Adelaide Museum.

Length of a medium-sized specimen, 6 cm.

Length of carapace, 26 mm.

Breadth of the anterior portion of the carapace, 10 mm.

Length of large cheliped, 4 cm.

Length of ocular peduncle, 10 mm.

Length of second ambulatory leg, 47 mm.

Paguristes brevirostris, *n. sp.* Pl. xxxiii., figs. 1, 1*a*.

The animal is somewhat hairy, especially on the chelipeds, the hairs there, however, not thick enough to hide the armature.

The anterior portion of the carapace is rather flat above, sparingly pitted, rough or rugose towards the front and sides, with a depression behind the front, marked on each side by a short, slightly oblique ruga, then another small, depressed area lies beween this and the hepatic region. The rostral tooth is very short, obtuse, and scarcely projecting farther than the prominences external to it; these are rounded, and each is tipped with a very small denticle. The hepatic regions are rounded and slightly tuberculate; they are separated from the other regions by a faintly marked, very irregular, longitudinal groove, which joins the cervical groove behind. The frontal margin is thickened. The portion of the carapace behind the cervical groove is thin, and shows some small disconnected areas of calcification. The branchial regions are moderately tumid and sparingly setose; there is a tuft of setæ on each side of the cardiac region.

The ocular peduncles are moderately robust, not as long as the breadth of the anterior portion of the carapace, and somewhat constricted towards the middle. The basal scales are rather small, and bear five or six small red denticles on each. They are well separated from each other.

The antennular peduncles reach nearly to the level of the eyes.

The outer side of the first peduncular joint of the antennæ bears one or two denticles. The second joint is hollowed above, its outer distal angle is produced, bearing four or five spinules, and there are one or two denticles at the inner angle. The acicle is moderately robust, quickly tapering

to a terminal spine, with three or four others on its external border, and two on its inner border near the base; it reaches more than half the length of the fifth joint. The third joint is produced below to a prominent spine, and a small spinule terminates the fourth joint above. The fifth joint is short, reaching about two-thirds the length of the ocular peduncle. The flagellum is short, much shorter than the carapace, the internodes of the joints bearing rather long setæ.

The chelipeds are moderately robust, nearly equal. The merus reaches a little beyond the level of the eyes, its lower external border is spinulate, and it is slightly rugose on the external surface; it bears some spinules on the distal margin, and one or two also above a little removed from the distal end. The carpus is short, its anterior surface is covered with white, more or less spiniform tubercles, which become larger on the inner margin. The palm is not much longer than the carpus, and is covered anteriorly with similar spiniform tubercles, which extend on to the fingers; on a side view the joint is strongly wedge-shaped, being swollen proximally and tapering quickly to the end of the immobile finger. The fingers are slightly longer than the palm, transverse, corneous at the tips, and denticulate on their opposable margins, with a small hiatus.

The second and third pairs of legs are nearly equal in length—the carpi and propodi of the more posterior pair being slightly longer—and exceed the chelipeds by about the length of the dactyli. The more anterior pair is more spinulate, spinules being situated on the posterior edges of the meri, and on the anterior edges of the carpi and propodi. The carpi and propodi also show squamose markings, from which hairs arise: these, again, are more evident on the more anterior pair; the dactyli of both pairs are longer than the propodi; they are scarcely compressed, slightly sulcate, and end in dark, corneous claws, and are distally more or less spinulate.

In the male the pairs of appendages to the first and second abdominal segments are well developed, as also are the uniramous appendages on the left side of the third, fourth, and fifth segments; these bear very long setæ.

In the female the brood pouch is a widely open sac, springing from the fourth segment. This covers the biramous unpaired appendages of the second, third, and fourth segments, and carries the ova.

The ultimate segment is four-lobed, with minute teeth and some hairs on the margin of the terminal lobes.

Length of body, 28 mm.

Length of carapace, 11 mm.

Breadth of carapace, anterior portion, 5 mm.
Length of cheliped, 17 mm.
Length of third leg, 19 mm.
Dredged by Dr. Verco, S.A. coast, 20-30 fms.
Types in Adelaide Museum.

Paguristes sulcatus, *n. sp.* Pl. xxxiv., figs. 1, 1*a*

The animal is very hairy, especially on the chelipeds; the hairs are plumose or pinnate.

The carapace anterior to the cervical groove is medianly smooth, except for a few scattered pits; towards the sides, however, it becomes rough and irregularly furrowed. There is a rather deep depression behind the rostral tooth, and the portion of the carapace immediately behind this dips into it rather abruptly. In this region there are a few slight, irregular furrows, which appear as branching from a median, shallow groove, which extends from the frontal depression for a short distance behind. The lateral portions of the frontal depression are marked on each side by a short, oblique ruga (more pronounced than in the preceding species), and the hepatic regions, which are full and sparingly pitted, are marked off from the rest of the carapace by irregular longitudinal grooves, which join the cervical groove behind. The rostral tooth is triangular, acute, slightly depressed, reaching nearly as far as the ophthalmic scales. The front between the two antennal projections is strongly thickened; these do not project as far as the rostral tooth, and each is tipped with a small denticle.

The abdomen is of the usual soft nature, the dorsal surface of its sixth segment is strongly calcified, and divided by a transverse groove into two unequal parts: the anterior portion is marked with three irregular pits, the posterior by a median sulcus, which is not so deep as the transverse one, and a few small pits.

The ocular peduncles are long and slender, scarcely expanding distally from about the middle; they are a little shorter than the widest part of the carapace anterior to the cervical groove. The ophthalmic scales are small, well separated, and each is tipped with three spinules, one of which is small.

The antennular peduncle reaches nearly as far as the eyes. The upper flagellum slightly exceeds the ultimate peduncular joint in length.

The first joint of the antennal peduncle bears externally two spinules. The upper surface of the second joint is slightly excavated: it is much produced exter-

nally, bearing four or five spines, the two apical ones being rather divergent; there is also a prominent spine on the inner angle, with a small spinule just below it. The acicle is robust, regularly tapering to end in two spines, with one just below them on the outer or upper side, and one on the inner side, near the base; the acicle reaches rather more than half the length of the fifth joint. The third joint is produced below to a strong spine, which reaches nearly as far as the fourth joint. The fourth joint has a small spinule above at the distal end. The fifth joint reaches about as far as the middle of the ultimate joint of the antennular peduncle. The flagellum is shorter than the carapace, and hairy.

The chelipeds are equal, and weak. The merus reaches to about the level of the acicle of the antennæ; it bears a few spines on the upper margin, near the distal end, and a few on the other two margins; the external surface is slightly rugose. The anterior surfaces of the carpus and palm are densely hairy—the hairs hiding the spines—flattened and covered with spiniform tubercles, mostly curved forwards, and many with acute, dark tips; these are larger on the inner margins. The palm is shorter than the carpus; it is not swollen behind, as in the preceding species. The fingers are longer than the palm, spinulose, corneous at their tips, and externally marked at their opposable edges with small, rather regular teeth. There is no hiatus.

The second and third pairs of legs are nearly similar, the third pair being slightly longer; they exceed the chelipeds in length by about half the length of the dactyli in the second pair. The meri are slightly rugose externally. The carpi are externally sulcate, as also are the propodi, and with them bear on their anterior margins spines similar to those on the chelipeds, which, however, are smaller and less numerous on the third pair. The propodi also are slightly squamose. The dactyli are about as long as the propodi; they are faintly sulcate and spinulate on their anterior and posterior edges, are slightly curved, and end in dark claws.

The fourth pair is short, non-chelate, the carpus and propodus nearly equal in length, the propodus distally narrowing. The dactylus is short, robust, and spinulate.

The first two pairs of abdominal appendages in the male are well developed; the single pair of the first segment in the female is weak. The other appendages are of the usual character.

The telson is four-lobed, the two anterior lobes larger than the posterior; the posterior lobes are unequal, rounded behind, and spinulate and setose on the margins.

Length of body, 37 mm.
Length of carapace, 16 mm.
Breadth of carapace anterior to the cervical groove, 7 mm.
Length of cheliped, 20 mm.
Length of third leg, 26 mm.
Length of ocular peduncle, 6 mm.
A littoral species. Port Willunga, S.A. coast.
Types in Adelaide Museum.

This species differs from *P. subpilosus*, Henderson, in the following particulars:—The ocular peduncles are longer and slenderer. The ophthalmic scales are smaller and trispinose. The rostral tooth is more acute, and there is a strong depression behind it on the carapace, and a short, median, longitudinal groove. The antennal flagellum is well ciliated. In the chelipeds the hand is not swollen behind. In the second and third pairs of legs the dactyli are not longer than the propodi, and the anterior borders of the last three joints are very spinose. Finally, the telson is quadrilobate.

Family PORCELLANIDÆ.

Genus *Porcellana*, Lamarck.

Porcellana rostrata, *n. sp.* Pl. xxxv., figs. 1, 1*a*, 1*b*.

The carapace is subpentagonal, slightly longer than broad, slightly convex behind the protogastric ridges. The surface is uneven, being marked by numerous minute transverse striæ; some of the striæ are more distinct, bearing groups of soft plumose setæ, especially in the female; two protogastric ridges are particularly thus indicated. The regions are well marked; the cervical groove distinct. The postero-lateral regions are rounded and rugose, the rugæ extending around the sides of the carapace to the pterygostomial region, but not uniting dorsally, as a nearly smooth space intervenes. The epibranchial regions are slightly tumid. A narrow, depressed area borders the antero-lateral regions. The front viewed from above shows two prominent lobes, divided by a median sulcation, which extends gradually, becoming shallower backward between the protogastric ridges: from a front view the margins of these lobes show as two arches, the outer limb of each being much shorter than the inner, the two inner limbs uniting to form an almost vertically depressed, acute, median lobe or rostrum; the outer lobes, which form part of the inner margin of the orbits, are also depressed; the edge of the front itself bears a series of small denticles, which extend to the antero-lateral margins. The antero-lateral margin is longer than the postero-lateral; it is cristate, and shows an acute prominence at the external angle of the orbit, a distinct

antennal spine, and two others further back; the crest is interrupted by a notch at the anterior end of the cervical groove, and on a slight lobe behind the notch are sometimes found two other small spines. The posterior border is raised and insinuate.

The pleon is smooth, polished, and glabrous, except on the margins.

The *linea anomurica* reaches from beneath the antennal peduncle to the edge of the lateral wall of the carapace, just above the coxa of the third pair of legs, a short, oblique ridge immediately behind the marginal notch before mentioned reaches from the antero-lateral crest across to this suture.

The eyes are small, and scarcely projecting.

The first joint of the antennular peduncle has two oblique ridges, which converge and unite inwardly.

The basal joint of the peduncle of the antenna is somewhat triangular; it forms the external margin of the orbit; its upper portion reaches the margin of the carapace, its lower border bears three or four teeth towards the inner end, the innermost one of which is below the eye, is spiniform, and directed forwards, and is visible from above; the other three teeth are small, and point inward. The third joint is a little longer than the second, expanding towards the distal end, where there is an anterior projection; the fourth joint is small, and also has a slight projection. The flagellum is long.

In the external maxillipeds the ischium is moderately broad, sub-triangular, produced a little, and broadly rounded at the inner distal angle, its outer distal angle having a strong, obtuse tooth, which usually lies in a shallow groove of the exopod. The outer surface is slightly excavate, and the external margin thickened and defined by two ridges. The merus has the inner lobe marked with six or seven denticles. The carpus also has an internal lobe, with a strong tooth below, and a longitudinal lateral ridge, and its upper distal end terminates in an acute tooth. The joints are fringed with the long hairs, as is usual. The exopod is slightly curved, and tapers to an obtuse point. It reaches to more than half the length of the merus; its outer face is slightly excavate.

The chelipeds are usually equal in the female; they are rough, like the carapace. The merus is short, and bears a large anterior lobe, which is acute, with very small denticles on its edge; there is a small spine on the distal margin underneath. The carpus, which is about as long as the palm, is slightly excavate longitudinally on the inner surface; the upper surface has two longitudinal sulcations, with a prominent ridge between them marked by oblique striæ; the outer

margin bears a series of small forward directed teeth; the inner margin is divided into two acute lobes and a distal prominence, the two lobes bear marginal minute denticles; there are also a few spinules near the distal end above; the lower surface is nearly smooth. The palm is much compressed, it widens considerably from the proximal end; there is a broad ridge on the upper surface which extends to the base of the mobile finger; the inner margin is rather acute, with a small tooth near the distal end, besides a terminal one; the outer margin, which is nearly straight for most of its length, bears a series of spinules which extend to the end of the immobile finger; there are also a few spinules along with a dense mass of hair on the upper surface towards the outer margin; the under surface is nearly smooth. The fingers are very much compressed and rather unsymmetrical, meeting their whole length with some obscure longitudinal sulcations; the mobile one has a sharp ridge above, which near its distal end shows some small denticles, its apex is constricted to a hook, its inner surface is excavate. The immobile finger is excavate; its apical tooth is unsymmetrically placed. In the adult male the chelipeds are very unequal, one is often greater developed, the hairs are absent, and the asperities much reduced, the fingers do not meet except at their apices, and there is a tooth on each near the proximal end of their opposable edges. This cheliped takes a strong red colour.

The carapace of the male is much less hairy.

The three pairs of ambulatory legs are stout, rather rough, with groups of soft hairs, the propodi have a series of spines behind, the dactyli are strong, more than half as long as the propodi; they end in one strong claw, at the base of which there is a little tubercle, tipped with a small spine, and inwardly from this there are four spines.

The last pair of legs are very slender and chelate: they reach about half the length of the carapace.

Dredged by Dr. Verco, Investigator Straits, 20-30 fms.

Length of carapace, 6 mm.

Breadth of carapace, 5 mm.

Length of cheliped, female, 10 mm.

Length of cheliped, enlarged, male, 16 mm.

Types in Adelaide Museum.

Sub-genus *Polyonyx*, Stimpson.

Polyonyx transversus, Haswell. Pl. xxxvi, figs. 2, 2*a*.

Porcellana transversa, Haswell, Cat. Aust. Crust, p. 150.

The carapace is nearly smooth, much broader than long, showing from above a transversely ovate shape, very convex in the antero-posterior direction, much less so in the trans-

verse, rather more depressed behind than in front. The regions are faintly defined; the postero-lateral strongly rugose. The protogastric lobes are slightly prominent. The front, when viewed from above, appears slightly arcuate, rather more than one-third the width of the carapace, marked by a distinct ridge or crest, the median lobe of which projects, and there are two lateral lobes very obscure. Slight insinuations mark the orbits above. Viewed from before, the front appears nearly straight, the median portion slightly depressed. The antero-lateral regions are two-lobed, the lobes separated by a wide notch of the cervical groove; they are faintly cristate, and the anterior one is depressed.

The basal antennular joint is ovate and slightly ridged above.

The eyes are small, scarcely projecting beyond the margin of the carapace.

The basal joint of the antenna is large, sub-triangular in shape; its lower margin very arcuate and prominent; a ridge runs nearly parallel to the inner margin, and there is a small tooth projecting inwards at its interior angle beneath the eye; its upper portion reaches the edge of the carapace, and both its inner and outer sides are strongly incurved. The third joint of the peduncle is narrower and longer than the second, the fourth is very short; these three joints are not crested or lobed.

The appendages are more or less iridescent.

The external maxillipeds are smooth. The internal margin of the ischium is almost semi-circular. The merus is subequal in length to the propodus, and there is on the inner side near the proximal end a prominent lobe. The carpus is a little shorter than the propodus; it is sub-triangular in shape from a side view. The joints are fringed with very long hairs. The exopod does not reach to the middle of the merus.

The chelipeds are slightly unequal—in this specimen the right is larger—they are long and well developed, and very hairy. In the right one the merus is short, its upper surface irregularly rugose; there is a small incision on the upper distal end. The carpus is nearly smooth, rounded behind, somewhat spindle-shaped viewed from above, nearly as long as the carapace; the inner and upper margin, which is a thin, very prominent ridge, bordering a deep longitudinal concavity, is entire and convex, and is clothed with very long plumose hairs, which extend to parts of the upper surface; the lower inner margin is scarcely prominent; there is a small incision at the distal end above. The palm is a little shorter than the carpus, it is compressed, rounded on its upper margin, which is marked by a longitudinal line, and bears a few spinules

towards the mobile finger. The lower margin is an acute ridge, bearing a row of small teeth, which reach to the end of the immobile finger. The oblique outer surface is covered with a dense mass of plumose or ciliate hairs, which end abruptly at the ridge, the under surface being quite glabrous. The mobile finger bears a longitudinal row of well-developed teeth on the outer side, on a ridge which sharply marks the hairy portion from the glabrous. The fingers are crossed at their apices, and each has an internal large tooth.

The three pairs of ambulatory legs are short, robust, and mostly smooth, very hairy. The propodi have a series of spines behind. The dactyli are short, curved, and end in two claws; behind these there are two or three strong spines. The last pair is very slender and chelate.

The pterygostomial regions are somewhat excavate, and are crossed by a rather sigmoid ridge.

The pleon of the female is very long and partially overlaps the external maxillipeds: it is smooth or slightly punctate. The first joint is narrow at first, but soon becomes as wide as the second, these become successively broader till the fifth inclusive, the sixth is slightly concave at the sides, and bears a pair of well-developed, biramous uropods. The last segment is composed of seven plates, one median and triangular, the others lateral, the most proximal of which is very small compared with the others, the two distal plates form the termination.

Length of carapace, 8 mm.
Width of carapace, 11 mm.
Length of cheliped, 19 mm.
Length of first ambulatory leg, 10 mm.
Dredged by Dr. Verco, 17 fms., off Newland Head, S.A.
One specimen, a female, in Adelaide Museum.

Genus *Petrolisthes*, Stimpson.
Sub-genus *Petrocheles*, Miers.

Petrocheles australiensis, Miers. Pl. xxxvi., figs. 1, 1*a*.
Petrocheles australiensis, Cat. Crust., N.Z., p. 61.
Petrocheles australiensis, Cat. Aust. Crust., p. 174.

The body is nearly flat, covered with scale-like prominences, which are small on the upper surface of the carapace, but larger on the appendages. From the scales arise short, harsh hairs, which, again, are more developed on the limbs.

The carapace is obcordate, slightly convex in the transverse direction, less so in the antero-posterior. The cervical groove is well marked and wide. The protogastric region bears anteriorly just behind the orbits two low spines, followed by some scale-like tubercles, more pronounced than those of

the rest of the carapace. Anterior to these spines the front is depressed, triangular, acute at the apex, each side having three strong spines, including the supra-ocular, which is large. The interocular space is more than one-fourth the width of the carapace.

The lateral margins of the carapace are strongly cristate anteriorly, furnished with eight spines, including the post-ocular; these have often a few spinules between them; these spines occupy about three-fifths the length of the lateral border, the postero-lateral remaining portion of which is rounded and marked with some oblique rugæ. The posterior border is strongly insinuate.

The pterygostomial region has a very strong oblique ridge, reaching well behind.

The pleon is broad, the segments marked with transverse, slightly elevated areas, coarsely hairy. The sixth segment is longer than the preceding ones and narrower, the lateral margins being deeply excavated to receive the peduncles of the uropods. The telson is composed of five plates, viz., one large, median, and triangular, two elongate and lateral, and two terminal ovate, with peduncle-like constrictions, and fringed with long, plumose setæ.

The eyes are moderately large, on short peduncles.

The basal joint of the antennule is strongly spined distally, as in *Galathea*.

Three joints of the antennal peduncle are distinct, the first of these is very short, and anteriorly bears a prominence tipped with two or three spines, the second, which is also short, is prominent in front, with one spine and a few spinules, the third, though scarcely shorter, is cylindrical; the flagellum is about as long as the chelipeds.

In the external maxillipeds the ischium is moderately broad, produced at the internal distal angle, and the margin broadly rounded and minutely crenulated, also a little produced at the external distal angle. The merus has the internal lobe only very slightly projecting, above it is a spine, and at the distal end a smaller one. The carpus has two longitudinal ridges on its upper surface, and is a little lobed internally and deeply hollowed below, to receive the process of the following joint. The propodus is much lobed internally, the lobe being hatchet-shaped. The joints bear the usual long, plumose setæ. The exopod is rather slender, reaching about half the length of the merus; it bears a few coarse granules on its outer border.

The chelipeds are long, well developed, very spinose to tuberculate. The merus joint reaches slightly beyond the level of the eyes, and is somewhat compressed, with two small

spines on the distal margin above, and with two or three on the inner surface longitudinally placed, with a large spine at the inner distal angle. The carpus is two-thirds the length of the carapace; it is rounded on the outer side with a row of seven or eight moderately-sized spines; the upper surface, which is nearly flat, bears a median row of a similar number of spines. The upper anterior border has six large, forward-directed spines, and besides these the anterior surface, especially towards the distal end, bears some more or less spiniform, scattered tubercles. The lower anterior border is almost entire, except for the ends of scale-like ridges, which are well marked on the under surface. The propodus is much compressed, the upper or inner margin of the palm is a little shorter than the carpus; it is covered by oblique rugæ, which extend for some distance on the under side. The upper or outer surface has a longitudinal granulate to spinulate ridge nearer the inner border than the outer, and between this and the outer margin is a flat area, covered by dense but very short hairs, with some spinules intermingled. The outer margin is slightly raised, granulate to spinulate, and a little sinuate in outline to the end of the immobile finger. The mobile finger is as long as the inner margin of the palm, it bears a row of spines on the inner margin, these project forwards and a little inwards. There is another row of spines on the outer side, near the cutting edge; the immobile finger has a similar row in the corresponding position. The cutting edges of both fingers are furnished with strong teeth, which become smaller and more numerous distally; an hiatus occupies about two-thirds the length of the fingers, and the tip of the mobile finger is long and hooked, and overlaps its fellow, which is almost straight. The under surface of the propodus is covered with scale-like tubercles and is almost glabrous; it has an indistinct, broad, longitudinal ridge, which corresponds in position to the one on the upper surface.

The three pairs of legs which follow are strong, the first reaches a little further than the end of the carpus of the cheliped. They are very setose, and are covered with the scale-like markings. The meri are compressed with a few strong spines on their anterior margins, and one strong spine near the distal end of the posterior border, and another just above it. The propodi, which are scarcely compressed, have three or four small spines behind, especially one at the distal end. The dactyli are short and stout, with one terminal slightly curved claw and four spines inward from this.

The last pair much reduced in size is minutely chelate, and bears terminally many stiff hairs.

Length of carapace in the median line from tip of rostrum to the insinuation of the posterior border, 23 mm.

Breadth, 23 mm.

Length of cheliped, 56 mm.

It is impossible to look at this species without recognising its strong likeness to the family *Galatheidæ*.

Dredged by Dr. Verco, St. Vincent Gulf; also a specimen from Port MacDonnell, collected by Dr. Torr.

Family GALATHEIDÆ.

Genus *Galathea*, Fabricius.

Galathea setosa, *n. sp* Pl. xxxv., figs. 2, 2*a*, 2*b*.

This species is found with *G. australiensis*, Stimpson, and though closely allied to it is, however, I believe, distinct.

The transverse striæ of the carapace, which are much less numerous than in that species, are, especially on the gastric and hepatic regions, broken up into arcuate lobes or squamæ, from which spring very long, coarse, minutely serrate setæ, along with some shorter ones; these extend on to the rostrum, where they arise from small, round tubercles, and are longer than the rostral teeth. The rostral teeth are somewhat ovato-lanceolate in shape, especially the terminal one. The armature of the surface of the carapace is insignificant; there are two very small, obtuse teeth on the gastric region, placed on the most anterior arch, which are wider apart than the two spines of *G. australiensis;* two similar teeth are placed further back and wider apart than these, while there is one on each hepatic region. The first two teeth only are constant. The lateral spines of the carapace are seven, including the post-ocular, which is small.

The three anterior segments of the pleon, except the first, have deep, transverse sulcations, the posterior margins of which, and also faint transverse ridges close to the anterior margins, are fringed with similar forward-directed setæ, as those on the carapace. The fifth segment has a strong transverse ridge about the middle, the hairs of which and also those of its anterior faint ridge are directed backwards.

The eyes are rather large; they have a fringe of strong setæ at their bases.

The spines at the ends of the antennular joints are long, being visible beyond the eyes.

The flagella of the antennæ are longer than the chelipeds and are furnished with setæ at the internodes. (Those of *G. australiensis* are nearly naked.)

The chelipeds, as compared with *G. australiensis*, are shorter and stouter; they are squamose and clothed with long, coarse hairs, the spines also are longer and not so projecting

outwards. The fingers are nearly as long as the palm, elongate, and becoming more narrowed or acute at the ends; they are excavate, and have no hiatus in either sex, and are minutely serrate on their outer opposable edges. The immobile finger terminates in two strong, hooked teeth, with one more or less rudimentary on each side. The mobile finger has one hooked tooth, with a rudiment on each side.

The following three pairs of legs are very spiny and very setose. The dactyli are strong, with horny, curved claws and marginal spines.

In both species the telson of the male has on each side above the middle a group of strong, corneous bristles; these on stronger magnification appear to be hollow, and have their tips split, and in spirit specimens have a shiny appearance and golden colour. *G. australiensis* varies in colour, specimens from shallow water are greenish or bluish, those from 20-30 fms. are deep red. The present species has a remarkable colouration. The carapace is white in the middle, and towards each side is a band of colour, in which violet, orange, and brown are seen. The sternal surface is orange. The chelipeds are white, with red spots, the fingers are deep red. The legs are banded with violet, orange, and white. The antennal flagella are red.

Although the differences between these two species are small, they appear constant; a moderate series of specimens having been observed with no sign of intermediacy. In practice they are not difficult to separate.

Through the kindness of the Director of the Australian Museum, I have been able to compare this species with *G. aculeata*, Haswell, and note the following differences:—*G. aculeata* is much less setose and spinose on all parts, its rostrum is nearly smooth, and its terminal spine is much slenderer and lanceolate. The joints of the chelipeds are much less robust, the carpi being longer. The fingers are notably longer than the palm.

From *G. magnifica*, Haswell, it differs in the coarse and harsh hairs of the carapace. In the striæ of the gastric region being broken up into arcuate lobes. In the setose, rostrum, eye peduncles, and limbs. The colour markings are also different.

Length of carapace, 5 mm.

Length of cheliped, 10 mm.

Dredged by Dr. Verco, Investigator Straits, S.A., 20-30 fms.

Types in Adelaide Museum.

DESCRIPTIONS OF PLATES.

Plate XXXII.

Paguristes frontalis, M.-Edw.

Fig. 1. Antennal peduncle, side view, enlarged.
2. Mandible, enlarged.
3. First maxilla, enlarged.
4. Second maxilla, enlarged.
5. First maxilliped, enlarged.
6. Large cheliped, enlarged.
7. Appendage of first abdominal somite of male enlarged.

Plate XXXIII.

Fig. 1. *Paguristes brevirostris* n. sp., enlarged.
1*a*. ,, ,, anterior regions, enlarged.

Plate XXXIV.

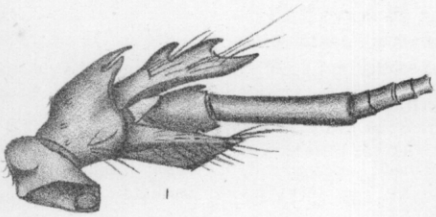
Fig. 1. *Paguristes sulcatus*, n. sp., enlarged.
1*a*. ,, ,, anterior regions, enlarged.

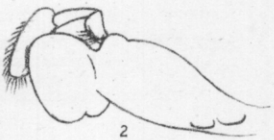
Plate XXXV.

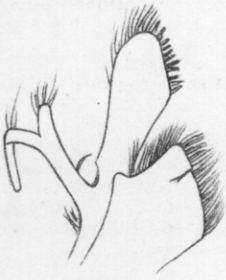
Fig. 1. *Porcellana rostrata*, n. sp., enlarged.
1*a*. ,, anterior regions, enlarged.
1*b*. ,, ,, third maxilliped, enlarged.
2. *Galathea setosa*, n. sp., enlarged.
2*a*. ,, ,, third maxilliped, enlarged.
2*b*. ,, ,, cheliped, enlarged.

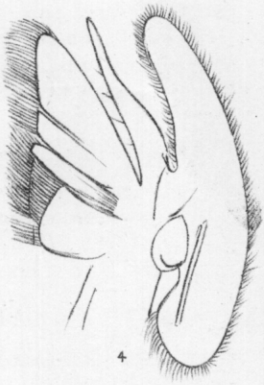
Plate XXXVI.

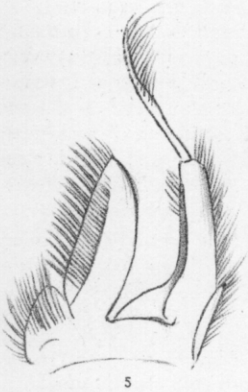
Fig. 1. *Petrocheles australiensis*, Miers, enlarged
1*a*. ,, ,, third maxilliped, enlarged.
2. *Polyonyx transversus*, Haswell, enlarged.
2*a*. ,, ,, anterior regions, enlarged.

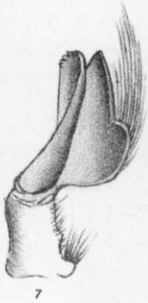






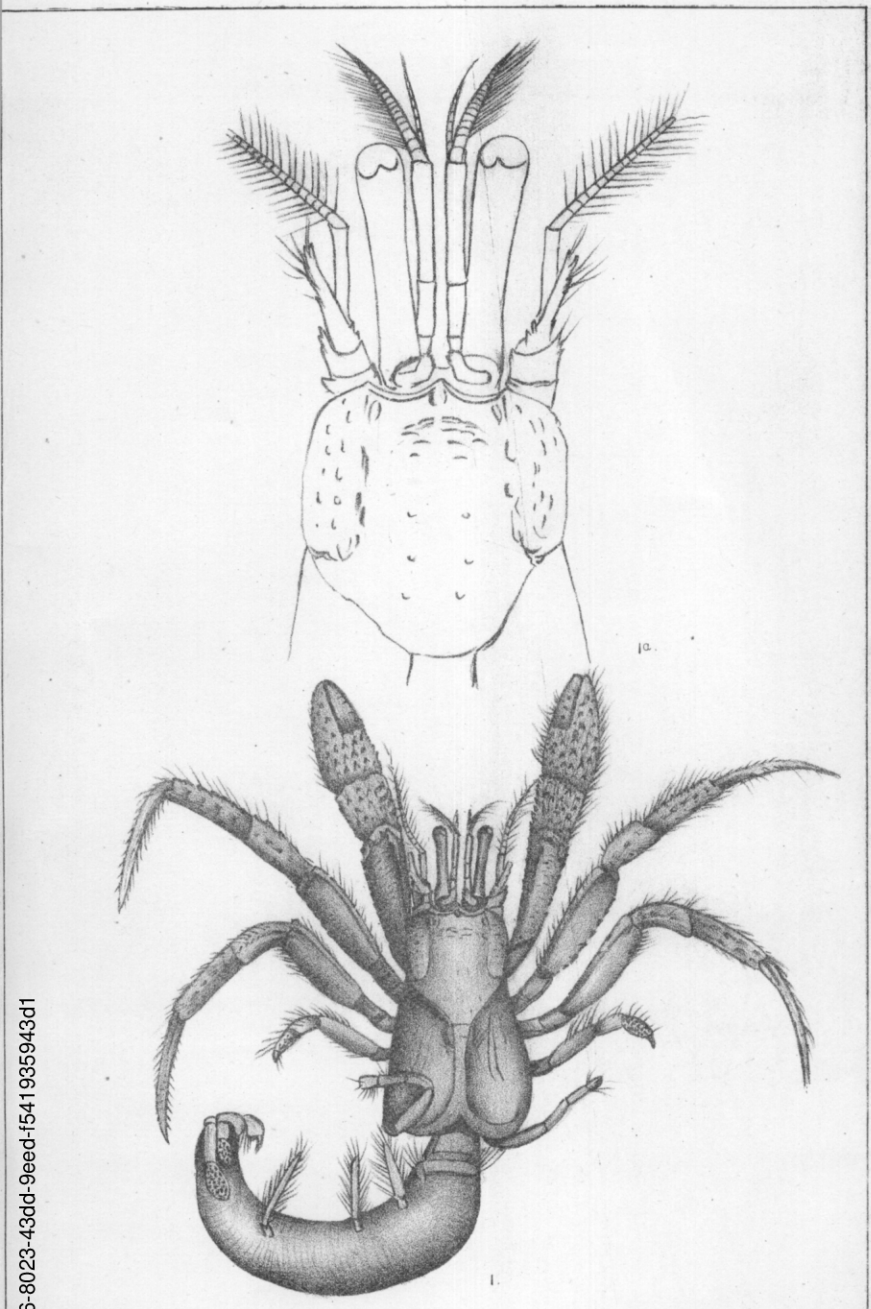






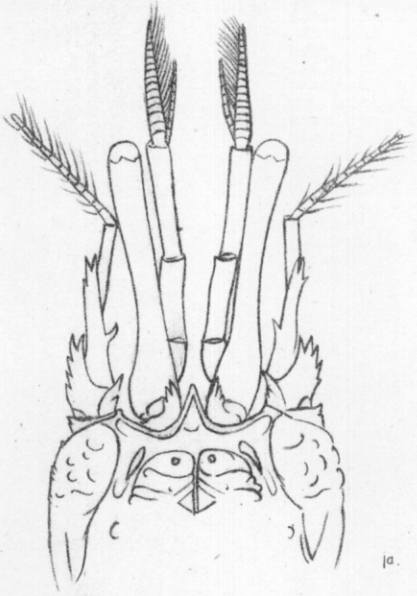
W.H.B. DEL. HUSSEY & GILLINGHAM. LITH.

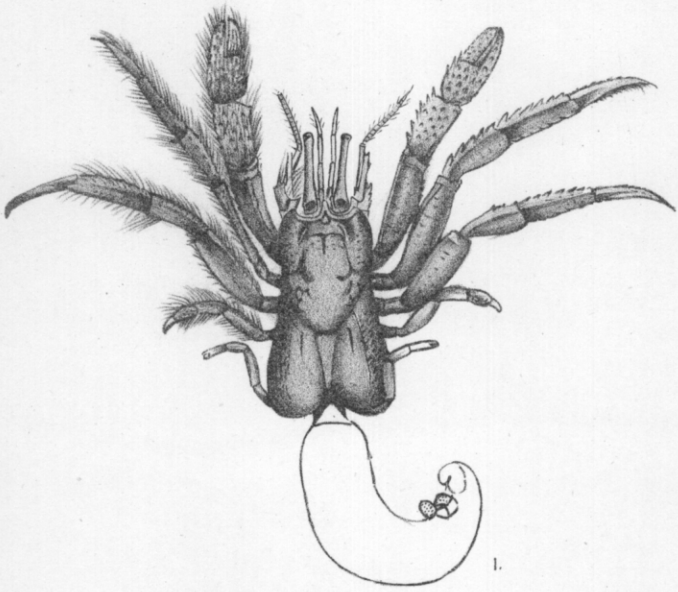
PAGURISTES FRONTALIS.



H.B. DEL. HUSSEY & GILLINGHAM. LITH.

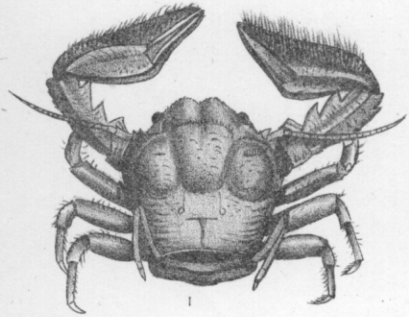
PAGURISTES BREVIROSTRIS.



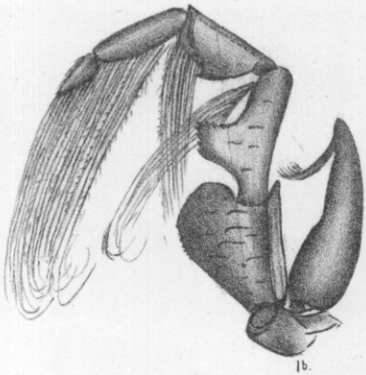


W.H.B. DEL. HUSSEY & GILLINGHAM. LITH.

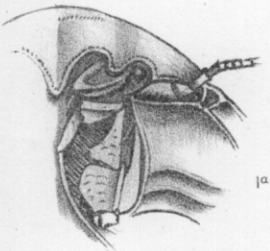
PAGURISTES SULCATUS.



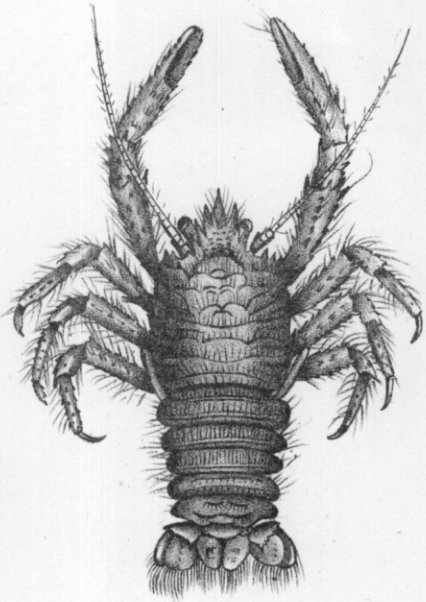
1



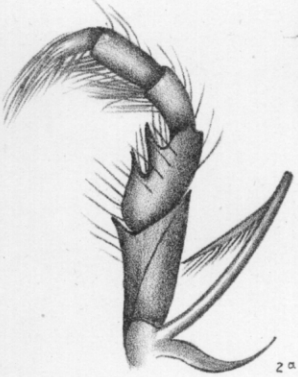
1b.



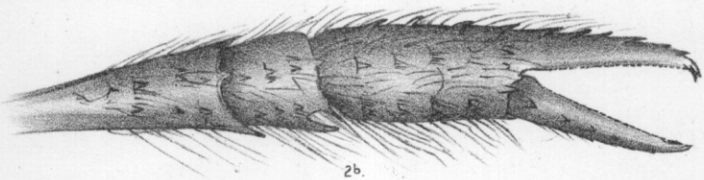
1a



2.



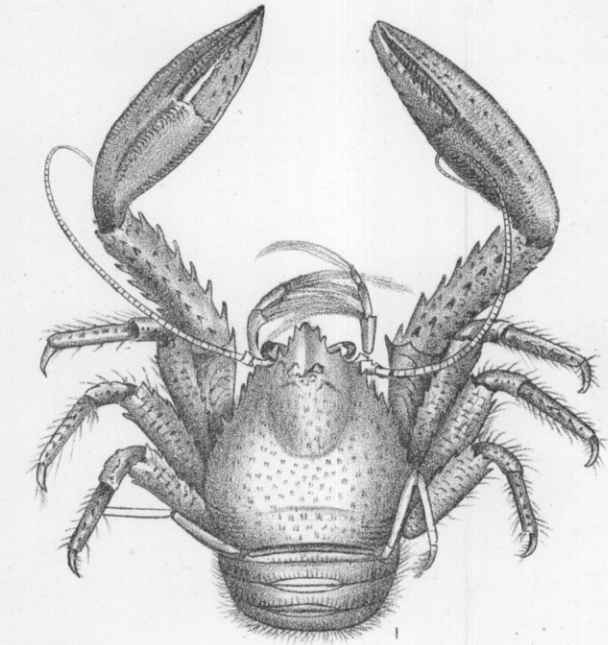
2a.



2b.

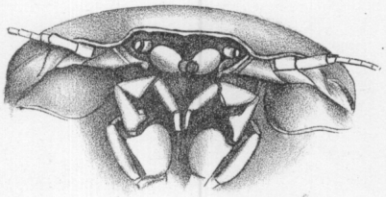
W.H.B. DEL. HUSSEY & GILLINGHAM, LITH.

PORCELLANA ROSTRATA. GALATHEA SETOSA.

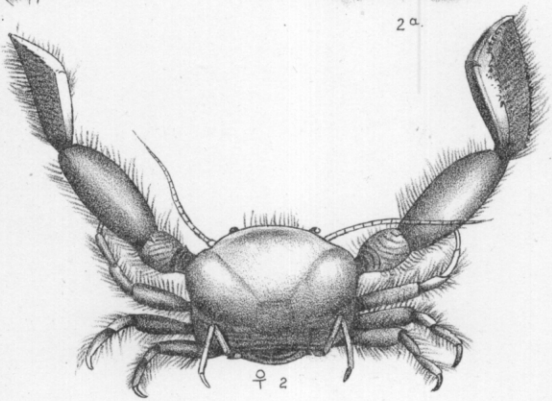


1

1a.



2a.

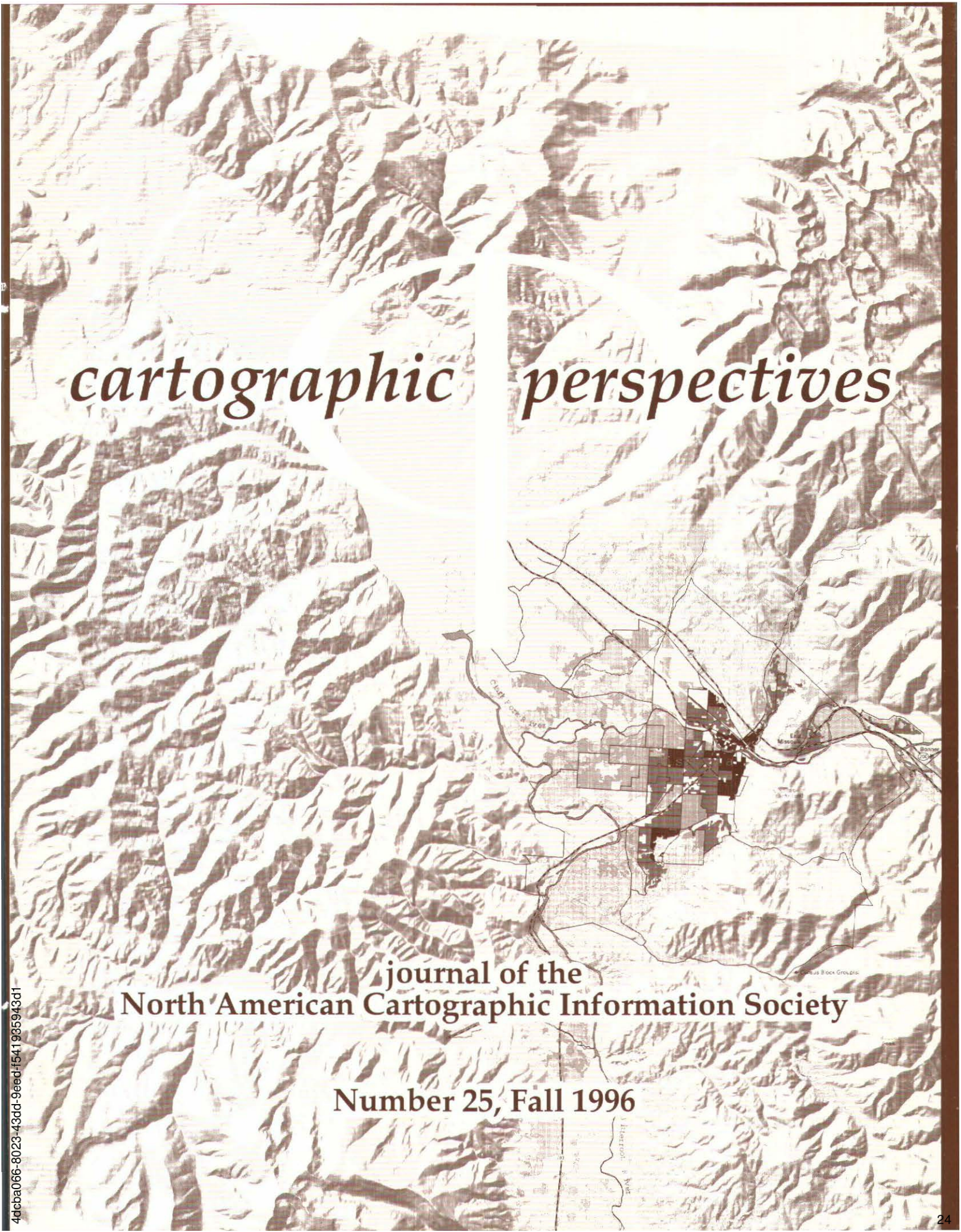


♀ 2

H.B. DEL.

HUSSEY & GILLINGHAM, LITH.

PETROCHELES AUSTRALIENSIS. POLYONYX TRANSVERSUS.



cartographic perspectives

journal of the
North American Cartographic Information Society

Number 25, Fall 1996

journal of the North American Cartographic Information Society

cartographic perspectives

Number 25, Fall 1996

in this issue

messages

MESSAGE FROM THE GUEST EDITOR

Over the next year *Cartographic Perspectives* (*CP*) will have a series of guest editors. We plan on having a permanent editor by the beginning of 1998, but in the interim we are fortunate to have several NACIS members assuming the responsibilities of publishing *CP*. Future guest editors will include Michael Peterson and Gregory Chu, while James Carter and Ute Dymon will guest edit a special issue focusing on Map Use. Jim Anderson has graciously accepted the Assistant Editor's job and will be responsible for all production facets of *CP*. Melissa Lamont (Penn State) has assumed the job of gathering and assimilating all the material that is posted on the map library bulletin board.

Mark your calendars for our next annual meeting, NACIS XVII in Lexington, Kentucky, from October 1-4. We should have a great meeting, just like we did in San Antonio. Over one hundred participants enjoyed the hospitality of one of the more charming and scenic Texas cities last Octo-

cartographic perspectives

journal of the North American Cartographic Information Society

Guest Editor:
Dr. Keith W. Rice
Dept. of Geography & Geology
University of Wisc.-Stevens Point
Stevens Point, WI 54481
(715) 346-2629
fax: (715) 346-3372
e-mail: krice@uwsp.edu

Assistant Editor:
James R. Anderson, Jr.
FREAC
Florida State University
Tallahassee, FL 32306-4015
(904) 644-2883
fax: (904) 644-7360
e-mail: janderso@mailer.fsu.edu

ISSN 1048-9085
Cartographic Perspectives
is published triannually

ber. We also were blessed with the fellowship and camaraderie of faculty and students from Southwest Texas State University. Dennis Fitzsimons, long-time NACIS member, fellow University of Kansas alumnus, and outstanding teacher of cartography was our main host and did a superb job. Conference attendees praised all aspects of the San Antonio meetings, and one and all enjoyed the Saturday evening barbecue. We should have another grand meeting in Kentucky!

As former NACIS president, I also want to thank two officers who recently finished their terms in office. Henry Castner did a marvelous three-year job as Vice-President, President, and Past-President, while Ed Hall devoted six years to keeping our finances solvent as Treasurer. Both served NACIS with a high level of excellence and were commended for their work by the NACIS Board at the San Antonio meeting

As a member of NACIS you probably noticed that your dues for 1997 have gone up. At the Annual Business Luncheon in San Antonio NACIS members passed a resolution to increase dues for all regular members, students, and institutions. The main reason dues were increased is to pay for the cost of *Cartographic Perspectives*. Both paper and printing costs in 1996 rose to the point that the old $28 membership fee wasn't even covering the cost of *CP*. The general consensus of the members in attendance in San Antonio was that $42 was still a bargain for membership in a professional organization with a professional journal. It should be many years before another dues increase is needed.

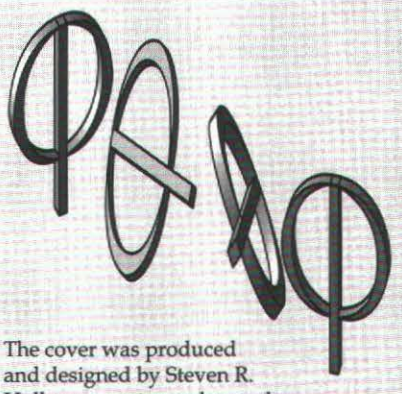
Potentially, one way to prevent another dues increase for quite awhile is to increase NACIS *membership*. If you are a professor, sign up some students. If you are an entrepreneur, librarian, lab technician, or government employee, talk to your colleagues who are not members - and sign them up! Membership forms can be found in the back of *CP*, or just give Chris Baruth (1-800-558-8993) a call and he'll send you some forms.

Finally, it is a curious phenomenon that article submission to cartographic journals is down and yet more research and experimentation with maps is occurring than at any other time in written history. Consider, for example, the advent of Digital Video Disc (DVD). It has a storage space of 8.7 gigabytes and will allow one to create a true multimedia presentation with high definition sound and full-motion video. There are seemingly infinite possibilities of high resolution dynamic map displays that one could produce using DVD. The research potential in cartography using this device is staggering. Yet, will we adequately document our cartographic discoveries?

Cartographic Perspectives is the ideal forum for publishing innovative research. Even though we do not have a permanent editor this year, we still have a very accomplished and capable Editorial Board. Submission can easily be made to the Interim Editor or Mike Peterson during this coming year. (geolib@cwis.unomaha.edu)

Keith Rice
Past President and Guest Editor, CP

about the cover



The cover was produced and designed by Steven R. Holloway, cartographer and geographer at the University of Montana in Missoula, Montana. He delights in making maps with blank places, for what we do not see and know. The series from which it is taken can be found at: http://higuma.wru.umt.edu/posters/default.shtml. In addition, it should be noted that this is a population density map using information from the 1990 census in six classes of density. The map differs from typical choropleth census maps in that the mapping units are independent from the enumeration units. They have applied land cover, land ownership and slope criteria to create the new mapping units. The result is a far more accurate indication of the dispersion of population in the west where there are significant elevation, land cover, and land ownership patterns affecting population distribution.

Males, Females, and Maps: Evaluating Spatial Encoding Strategies

Elisabeth S. Nelson
Department of Geography
San Diego State University
San Diego, CA 92182

Cognitive research suggests that there is a difference in the spatial abilities of males and females. Results of studies that examine way-finding skills indicate that the differences found may be linked to a variation in the types of strategies used in completing spatial tasks. The purpose of this study was to assess the influence of gender on different strategies for encoding spatial information in a map context. An experiment was conducted in which subjects studied a map presented to them using one of three encoding strategies: (1) a control strategy in which they viewed the map as a static representation, (2) a landmark-based strategy in which they viewed a dynamic sequencing of the map that began with landmark locations and built over time to include all map components, and (3) a path-based strategy in which they viewed a dynamic sequencing of the map that began with path locations and built over time to include all map components. Following this study phase, subjects completed a series of map recognition tasks where they indicated whether a presented map was the same as or different from the map they had originally studied. Test maps that differed from the memorized map were modified by either replacing, displacing, or reversing the perspective of a map object. Results indicated that while encoding strategy played a significant role in determining how accurately subjects could perform the recognition task, gender did not significantly influence how well any particular strategy worked for encoding map-based spatial information.

INTRODUCTION

The acquisition of spatial information from a map requires the use of several intricate cognitive processes. Scientists' knowledge of these processes comes primarily from studies conducted in psychology, where researchers have accumulated over fifty years worth of studies on human spatial abilities. Out of this wealth of research, one broad and increasingly challenged generalization is the finding that males are more skilled at executing spatial tasks than females (Maccoby and Jacklin, 1974; Self, et al., 1992; Halpern, 1992). Several of these studies have further suggested that the differences found between males and females are linked to the types of strategies they use when completing spatial tasks. Results of these studies show that females tend to rely more on *verbal-analytic strategies*, in which spatial stimuli are encoded as discrete objects. Males, on the other hand, are more likely to focus on the geometric properties of the environment and encode all spatial stimuli as one interconnected object – *a spatial-holistic strategy* (Cooper, 1976; Paivio, 1986; Galea and Kimura, 1993; Lanca and Kirby, 1995).

". . . one broad and increasingly challenged generalization is the finding that males are more skilled at executing spatial tasks than females."

Are these results applicable to encoding spatial information specifically from maps? Research conducted on the *environmental* acquisition of spatial knowledge is insightful. Results from several of these studies have produced two competing theories of spatial knowledge acquisition in the environment. *Path-based learning* emphasizes the importance of paths or routes in assembling the initial cognitive structure (Appleyard, 1970), while *Landmark-based learning* highlights discrete landmarks as the basic

building blocks (Siegal and White, 1975; Golledge, 1978). Subsequent testing of these theories has shown that women tend to rely more heavily on landmark information in the spatial encoding process. Men, conversely, are more likely to rely on the geometric properties of the area in question (Appleyard, 1970; McGuiness and Sparks, 1983; Miller and Santoni, 1986; Galea and Kimura, 1993). To date, there is little evidence – cartographically or otherwise – to indicate whether such findings might also hold for spatial information acquired from a map. Information of this type, however, is essential to a cartographer's understanding of the cognitive processes used in acquiring and encoding map-based spatial information. The wide-spread use of computers to display spatial information has given cartography the potential to control how that information is presented to map users. The choice of presentation strategy may influence how efficiently the map user can process information (Thorndyke and Stasz, 1982; MacEachren, 1992) and thus needs to be studied carefully from a variety of perspectives. Just as important is an understanding of gender's influence on the effectiveness of these presentation strategies. If gender differences exist and are substantiated in a map environment, then experimental research designs in cartography will need to examine more carefully the role that gender plays as an explanatory variable (Gilmartin and Patton, 1984). With this in mind, the purpose of this study was two-fold: (1) to further previous research examining the potential use of environmental encoding theories for encoding map-based spatial information, and (2) to assess what role gender may play in the effective use of such theories in a map environment.

"The choice of presentation strategy may influence how efficiently the map user can process information . . ."

SPATIAL ENCODING STRATEGIES

Research on spatial knowledge acquisition suggests that it is a gradual process, one that begins with fragments of information about a new locality. Over time, those fragments of information are joined by newly acquired knowledge about the locality until a complete cognitive representation is formed (MacEachren, 1992). What researchers do not agree on are the actual processes used in developing this representation. For example, what are the basic components of the spatial knowledge acquisition process and how is this process facilitated? Research addressing such questions exists primarily for spatial knowledge acquisition in the environment. In fact, both *Landmark-based Learning* and *Path-based Learning* are spatial encoding strategies born of studies that examined spatial knowledge acquisition in an environmental context.

"Path-based Learning proposes that it is the paths or routes in an environment that form the primary framework for the resulting cognitive representation."

Path-based Learning proposes that it is the paths or routes in an environment that form the primary framework for the resulting cognitive representation. After the initial paths are learned, landmarks relative to the paths are believed to be coded and stored. Appleyard (1970) was one of the first to provide empirical evidence for this theory. He asked both short-term and long-term city residents to draw sketch maps of their environment. In comparing the maps of the two groups, he discovered that paths dominated the maps of short-term residents, while long-term residents produced more integrated maps with more landmark information. Devlin (1976) obtained similar results in her study, which examined the sketch maps of Navy wives who had recently moved to a new duty station.

In another study, subjects toured an unfamiliar area and were then tested on their newly acquired spatial knowledge (Garling, et al., 1981). Results showed that subjects were better at remembering a sequence of landmarks along a road that at estimating the locations of those landmarks. Such findings led the authors to conclude that their subjects acquired a knowledge of paths before a knowledge of landmarks. Another

study supporting *Path-based learning* tested the ability of drivers to estimate straight line distances and travel distances for given origin-destination locations within Paris (Peruch, et al., 1989). Results indicated that all drivers estimated the travel distance between two locations as consistently longer than the corresponding straight line distance. These findings were interpreted as supportive of *Path-based learning* . The authors concluded that the drivers in their study based their estimates of travel distance primarily on knowledge acquired from route information, suggesting that route knowledge dominated the initial cognitive structure of the city.

In contrast to *Path-based learning*, *Landmark-based learning* proposes that landmarks are the basic building blocks of the cognitive representation. Knowledge of routes is believed to be developed after landmarks have been encoded and stored in memory. Siegal and White (1975) developed one of the first landmark-based models of learning. Their model consisted of three stages: (1) development of landmark knowledge, (2) development of path-based knowledge, and (3) development of integrated, configurational knowledge. *Anchor Point Theory*, proposed by Golledge (1978), is another landmark-based model. He asserts that the cognitive organization of spatial information is hierarchical, with key landmarks anchoring regions of space and serving as endpoints for the paths in the environment.

" . . . Landmark-based learning proposes that landmarks are the basic building blocks of the cognitive representation."

Both Evans, et al. (1981) and Okabe, et al. (1986) have conducted research that lends support to *Landmark-based learning*. Evans, et al. (1981) studied changes in cognitive maps that occurred with increasing environmental experience. They asked subjects to draw sketch maps of their environment after one week's residence and again after one year's residence. Results of their study indicated that subjects used landmarks as initial anchor points in their cognitive representations and filled in path structures over time within this initial framework. In a study that examined distance and direction estimations made while traversing trails (Okabe, et al., 1986), the authors found that landmarks on trails provided an anchoring effect for subjects. Locations on winding trails were estimated more accurately by subjects when landmarks were present than when they were absent.

Both the *Path-based* and the *Landmark-based* encoding theories result from examining how humans interacted with their environment over time. Since these theories address the process of spatial knowledge acquisition, however, it also seems logical to assess their utility for explaining spatial knowledge acquisition in a map environment. MacEachren (1992) investigated this possibility when he examined how a map's presentation strategy influenced the resulting cognitive representation of that information. He presented a map to *male* subjects under four different conditions: (1) Landmark-based Strategy, (2) Path-based Strategy, (3) Region-based Strategy, and (4) Whole-Map Strategy. Because his study dealt with a two-dimensional graphic, MacEachren hypothesized that strategies derived from environmental encoding theories might not be as effective for map learning as a strategy in which individual map regions were learned incrementally. After assigning each subject to a presentation strategy group, MacEachren had them memorize a map presented to them. They then performed a series of distance and direction estimates using their resulting cognitive map of the area. Study results indicated that subjects who used a Path-based Strategy to memorize the map completed the learning phase of the experiment more efficiently and more accurately than subjects in other groups. However, in the task phase of the experiment, subjects in the Whole-Map group were the fastest at completing direction estimates. The Whole- Map group was also fastest at

completing distance estimates, but this effect was not significant. The author did not find significant differences in accuracy rates between any of the groups.

THE IMPACT OF GENDER ON SPATIAL ENCODING

The gender differences found in cognitive spatial abilities result largely from psychological experiments in which researchers employed a variety of spatial tasks. Because these tasks were so varied and have produced results that often are not comparable, Caplan, et al. (1985) has suggested that a more valid measure of cognitive spatial ability would be a real world way-finding task. Appleyard's research (1970), discussed in the previous section, is one of the older studies to utilize such a strategy. In the analysis of his results, he found that females relied more heavily on landmarks than males when asked to produce sketch maps of the area in which they lived. Appleyard also noted that the maps drawn by females had more errors than those drawn by males. In a similar study, McGuiness and Sparks (1983) asked subjects at a college campus to draw maps of their environment. Their results indicated that females included more landmark information on their maps, while males include more path information. Furthermore, although males provided a more accurate spatial layout of the campus, the authors found that females more accurately displayed distances between locations.

"McGuiness and Sparks (1983) asked subjects . . . to draw maps of their environment. Their results indicated that females included more landmark information on their maps, while males included more path information."

A study by Miller and Santoni (1986) asked subjects to memorize a map and then provide written travel directions for specified origin-destination locations. Like Appleyard (1970) and McGuiness and Sparks (1983), they found that males performed the task more accurately than females, and that females used more landmarks in completing the task. In a more recent study, Galea and Kimura (1993) asked subjects to memorize a route on a novel map, then tested them on their knowledge of landmarks and geometric properties associated with that route. Results showed that females recalled significantly more landmarks than males, and that males scored significantly higher on tests of geometric properties. Furthermore, the authors reported that males initially memorized the route faster and with significantly fewer errors than females. Holding and Holding (1989) obtained similar results in their route memorization study.

Despite the similarities of the above studies, results of other researchers provide an alternative view of this proclaimed gender difference. One study, for example, tested the campus knowledge of freshmen at three weeks, three months, and six months of residence (Herman, et al., 1979). Their results showed that males displayed significantly more landmark knowledge than females, but route knowledge between the two groups was approximately the same.

Perrig and Kintsch (1985) asked subjects to memorize bodies of text describing a town. Texts were written either as one would describe a map of the town (survey style) or as a set of directions for getting around the town (route style). Recall and recognition tasks of the memorized text showed no significant gender differences; however, the authors noted an interesting trend in the responses. Regardless of the type of text memorized, females responded to inferential questions about the text more accurately when the question was framed in the same style as the text they read. Males, on the other hand, responded more accurately to such questions when the question was framed in a survey style for both types of text. The conclusion they reached was that females were more flexible than males in the type of cognitive structure they formed. While females formed cognitive representations best suited to the style of the text memorized, males seemed to insist on using an image representation for both types of texts.

In another study (Ward, et al., 1986), the authors asked subjects to either memorize a map and then provide directions to specified locations or to give directions to those locations while directly viewing the map. Results showed that when left to their own devices, males used more cardinal directions and mileage indicators than females; males also gave more accurate directions than females when the map had been memorized. When prompted to use cardinal directions and mileages, however, both sexes used the concepts equally well. The authors concluded from the findings that gender did not necessarily reflect a difference in how spatial information was constructed, but instead reflected a difference in cognitive styles when a choice was given. Even more recently, an article in the *New York Times* (May 26, 1992) reported on a psychological study in which college students repeatedly navigated mazes. Results of this study indicated that males relied more heavily on directions to navigate the maze, whereas females relied more heavily on landmarks. However, the article did point out that both sexes could navigate the maze equally efficiently, indicating that their cognitive structures of the mazes were similar and that differences were ones based purely on differences in cognitive styles.

Ward, et al. (1986) concluded . . . "that gender did not necessarily reflect a difference in how spatial information was constructed, but instead reflected a difference in cognitive styles . . ."

METHODOLOGY

This study manipulated spatial encoding strategies to determine their effect on the ability of males and females to recognize various mapped objects. Ninety subjects at the University of South Carolina participated in the experiment. Subjects received either monetary compensation or extra credit for courses in participating geography and psychology classes.

The Target Map. The target map used in the experiment consisted of a simple street pattern and pictorial landmarks, and was presented in black and white on a computer screen (Figure 1). The map was designed to fit onto the screen so that map features were represented clearly and legibly. Verbal labels were excluded from the map to provide as much control over experimental variables as possible.

The Test Groups. Subjects were divided into three groups on the basis of the learning strategy they used when viewing the target map. Within each group approximately half the subjects were male and half were female. The learning strategies, designed to manipulate how subjects

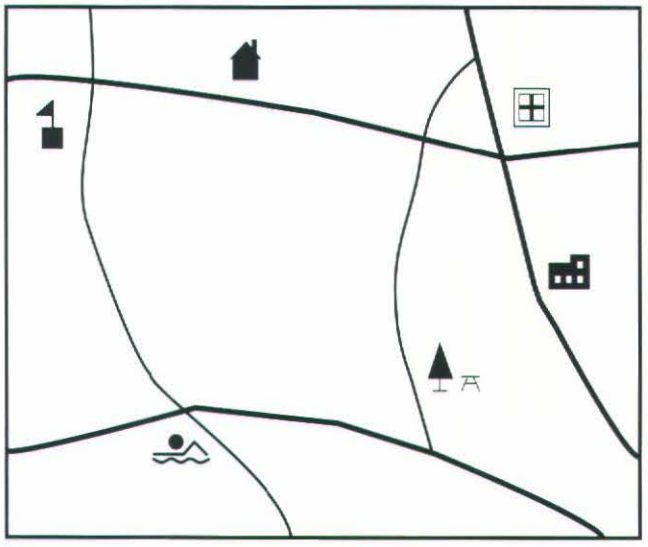


Figure 1. Target map.

"The learning strategies, designed to manipulate how subjects acquired spatial information from a map, were modeled after those MacEachren used in his 1992 study."

acquired spatial information from a map, were modeled after those MacEachren used in his 1992 study. The Static Map group served as the control group; subjects who studied the target map using this strategy saw it as a static representation that remained on-screen for three minutes (Figure 1).

Subjects assigned to the Landmark-based Strategy group studied a series of seven separate map segments designed to emulate the theory of *Landmark-based Learning*. Segment presentation was controlled by computer; each segment was displayed briefly before being replaced by the next segment, and succeeding segments were built on information presented in the previous displays. For example, the first segment in the Landmark-based cycle (displayed for three seconds) consisted of three primary landmarks (Figure 2a). Following this segment, the computer displayed three more segments, where each segment consisted of one of the primary landmarks along with a secondary landmark (Figure 2 b-d). These segments were also displayed for three seconds each. The last three segments, presented for six seconds apiece, each consisted of a pair of primary landmarks along with secondary landmarks and connecting roads (Figure 3 a-c). The entire cycle lasted for 30 seconds, and landmarks were presented more frequently than roads in the presentation process. Subjects studied this presentation cycle six times for a total of three

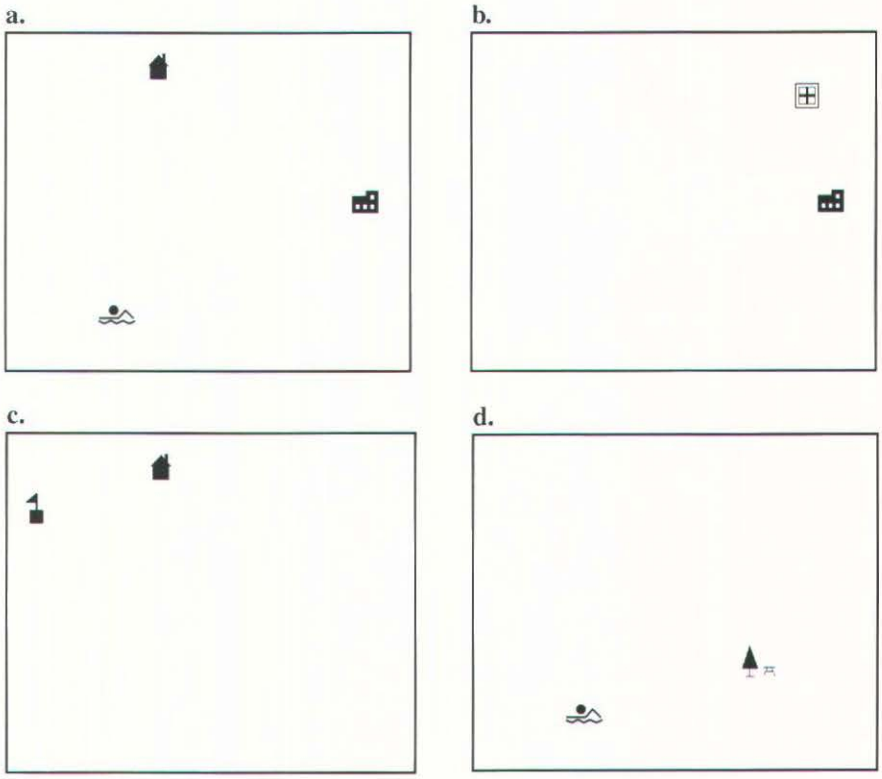


Figure 2. Landmark-based learning, segments 1-4.

minutes, which equaled the amount of time subjects in the Static Map group spent studying the target map. Subjects assigned to the Path-based Strategy group experienced a similar process, except that the segments used in these groups emulated *Path-based Learning* (Figures 4 and 5).

Testing Procedure. After assigning a subject to one of the test groups, the task administrator instructed the subject on the steps of the experiment. Subjects then participated in a preliminary session using a practice

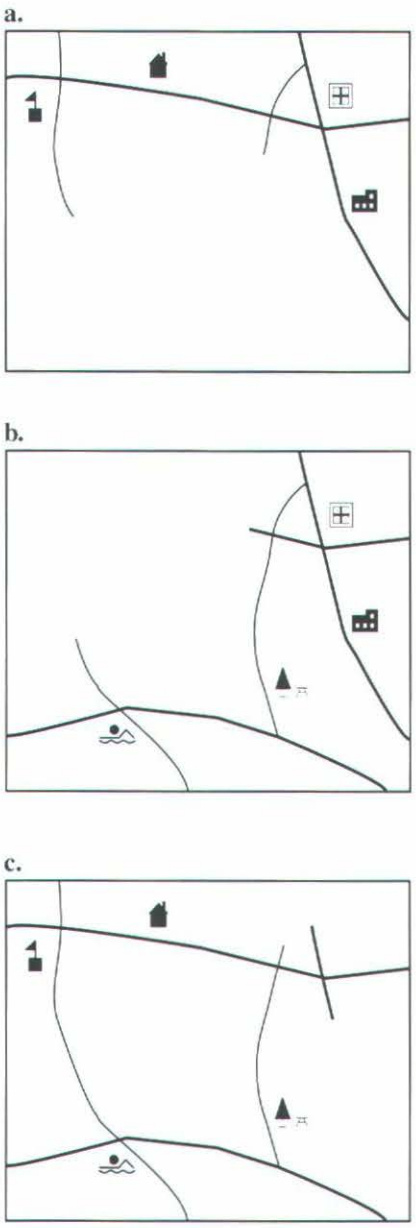


Figure 3. Landmark-based learning, segments 5-7.

map to further familiarize themselves with the process. The test procedure consisted of two phases: in the first phase, each subject studied a target map that was presented to them by computer. Map presentation corresponded to the learning strategy of the subject's test group. Following this presentation, each subject viewed a series of test maps and was asked to determine whether each map was identical to or different from the target map they had just studied.

The test maps that differed from the target map were modified in one of six ways. These modifications can best be described as changes consisting of either the replacement, perspective reversal, or displacement of either a landmark or a road on the target map. Replacement objects were designed to be thematically related to the objects they replaced (i.e., replacing a park symbol with a forest symbol), as well as visually similar to the original object (Figure 6). Objects on the test map that were reversed in perspective were essentially mirror-images of the original map object (Figures 7). Both landmarks and roads could exhibit this effect, although to differing degrees. To alternate the perspective of a landmark, a mirror-image of the symbol was constructed. Perspective reversals of roads required a slightly different strategy. Because roads are connected to one another and have the attribute of length, constructing a mirror-image of a segment destroyed the overall network of road connections. Therefore, to achieve a reversal-like effect, road width was alternated from thin to thick or thick to thin. Displaced objects on the test map were moved in relation to the same object on the target map (Figure 8). Displaced landmarks were moved so that only relations to other landmarks were violated; relations between these symbols and the road network remained intact. Conversely, roads were displaced so that relations to landmarks remained intact, but relations to the road network were violated.

For each test map presented, subjects indicated whether that map was the same as or different from the target map they had originally studied. Subjects responded to each map by pressing the appropriate key on the computer keyboard to record their answer. The dependent variable used in this study was the percentage of correct responses. Each subject com-

"Map presentation corresponded to the learning strategy of the subject's test group. Following this presentation, each subject viewed a series of test maps and was asked to determine whether each map was identical to, or different, from the target map . . ."

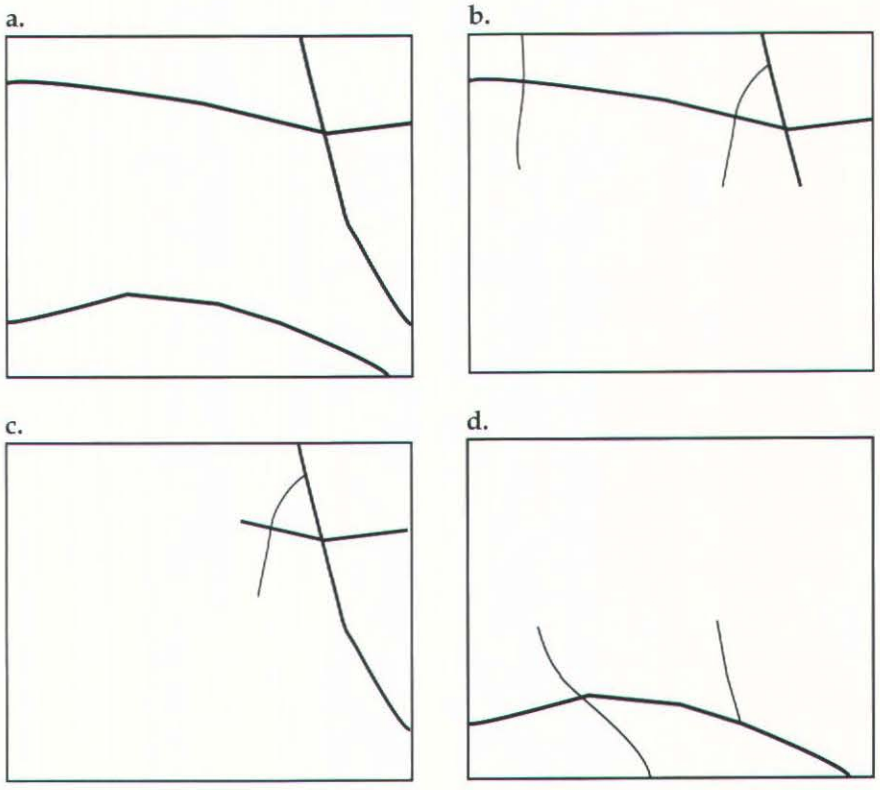


Figure 4. Path-based learning, segments 1-4.

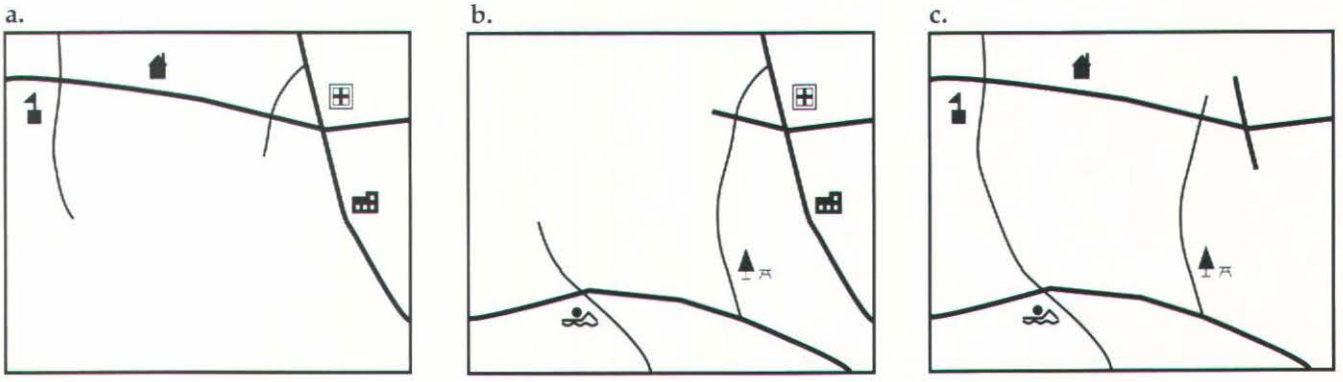


Figure 5. Path-based learning, segments 5-7.

pleted 48 map recognition trials; 24 maps were identical to the target map studied and 24 maps differed from the target map. Of those maps that differed, 12 were modified by changing a landmark (4 replacements, 4 reversals, 4 displacements) and 12 were modified by changing a road (4 replacements, 4 reversals, 4 displacements).

HYPOTHESIS

Hypotheses were generated to test the influence of encoding strategies on the ability to detect changes in mapped objects and to assess the role that gender plays in this process. Because MacEachren (1992) found no significant differences in accuracy between his presentation strategy groups, it was hypothesized that similar results would occur for the map task in this study.

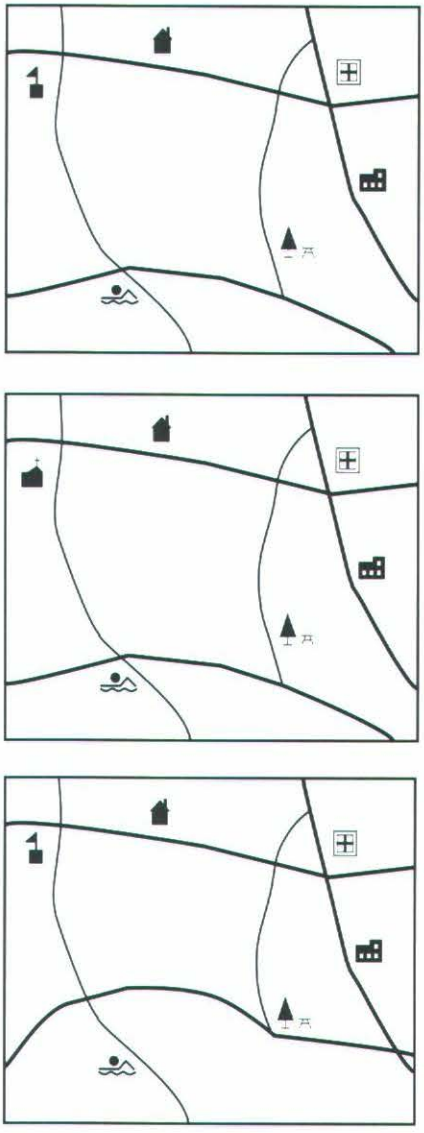


Figure 6. Target map (top), test map with replacement symbol foil (middle), and test map with reversal road foil (bottom).

Research on gender differences in environmental spatial knowledge acquisition (Appleyard, 1970; McGuiness and Sparks, 1983; Miller and Santoni, 1986) suggests that females may rely more heavily on landmarks than their male counterparts in encoding spatial knowledge. Thus, it was also hypothesized that females using the Landmark-based learning strategy would: (1) perform the recognition task more accurately than males using that strategy; and (2) specifically recognize changes in landmarks more efficiently than males using that strategy.

ANALYSIS AND RESULTS

The data for the dependent variable were aggregated over all subjects and across all variables to minimize data abnormalities. Only "Different" responses were considered in the analysis because the focus of this study was on the ability of subjects to detect modified test maps. The accuracy data were analyzed using a General Linear Model (GLM) analysis of variance (ANOVA). The main effects for the model were Learning Strategy (3 levels), Gender (2 levels), and Map Object (6 levels). All possible interactions were analyzed. The model was significant [$F(35, 108) = 2.74$, $P > F = .0001$] and explained 47% of the variance in subject accuracy rates (Table 1). Two main effects reached significance in the analysis.

" . . . Learning Strategy played a significant role in subject responses."

As Figure 9a shows, both males and females using the Path-based learning strategy were considerably less accurate in detecting modified map objects. Differences between subjects using the Static Map learning strategy and the Landmark-based learning strategy were less striking. As expected, analysis of this variable confirmed that Learning Strategy played a significant role in subject responses [$F(2, 141) = 4.90$, $P > F = .0092$]. *Post hoc* comparisons of the means of the three test groups indicated that accuracy rates for subjects using the Static Map learning strategy did not differ significantly from those using the Landmark-based learning strategy [$T(94) = 0.70$, $P > T = .4845$]. Subjects using the Path-based learning strategy, however, were significantly less accurate than subjects using both the Static Map learning strategy [$T(94) = 2.99$, $P > T = .0034$] and the Landmark-based learning strategy [$T(94) = 2.29$, $P > T = .0239$].

"Subjects using the Path-based learning strategy . . . were significantly less accurate than subjects using both the Static Map learning strategy and the Landmark-based learning strategy."

Males and females, regardless of the learning strategy employed, did not differ widely in the accuracy of their responses to the recognition task (Figure 9b). ANOVA results verified that this main effect variable did not play a significant role in explaining the overall accuracy of subject responses [F(1,142) = 0.23, P>F = .6314]. Furthermore, there was no significant interaction of gender with Learning strategy, as had been hypothesized, or with any other of the independent variables.

Figure 9c shows that replaced objects were easier to detect in the recognition task than reversed or displaced objects. Furthermore, subjects found displaced landmarks easier to detect than displaced streets and reversed streets easier to detect than reversed landmarks. ANOVA results confirmed that Map Object was a significant effect [F(5,138) = 14.34, P > F = .0001. *Post hoc* comparisons of means for the six different types of changes that could occur on a test map indicated the following: (1) subjects were significantly more accurate in detecting reversed streets than reversed landmarks [T(46) = 2.95, P>T = .0038]; (2) subjects were significantly more accurate in detecting displaced landmarks than displaced streets [T(46) = 5.99, P>T = .0001]; (3) subjects were significantly less accurate in detecting reversed landmarks than replaced landmarks [T(46) = 4.68, P>T = .0001] or displaced landmarks [T(46) = 4.10, P>T = .0001]; and (4) subjects were significantly less accurate in detecting displaced streets than replaced streets [T(46) = 6.10, P>T = .0001] or reversed streets [T(46) = 4.85, P>T = .0001].

" . . . replaced objects were easier to detect in the recognition task than reversed or displaced objects."

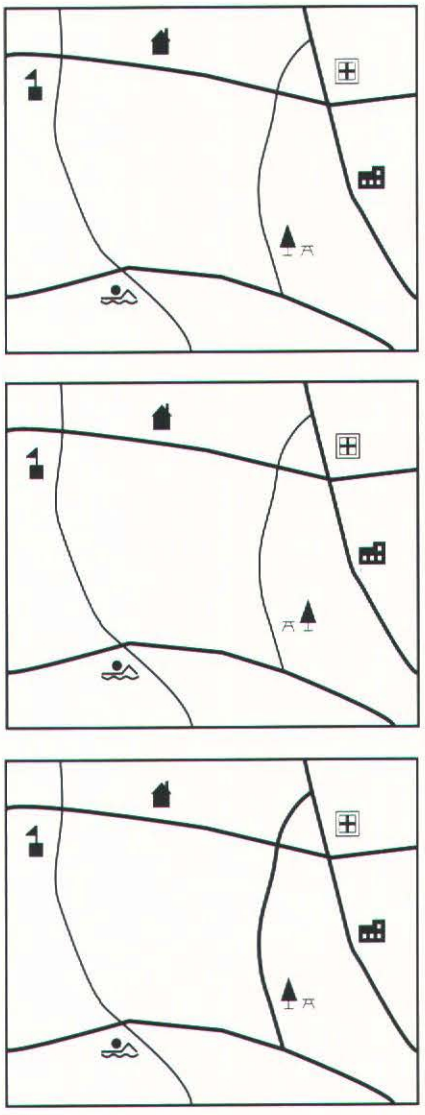


Figure 7. Target map (top), test map with reversal symbol foil (middle), and test map with reversal road foil (bottom).

DISCUSSION

A number of researchers have examined the interaction of encoding strategies in an environmental context. Fewer, however, have attempted to apply such theories to spatial information acquired directly from a map. The results of the research described above contribute to the knowledge accumulated on spatial knowledge acquisition and gender in the map environment. In contrast to MacEachren's (1992) results, this study found that subjects who studied the target map using either the Static Map or Landmark-based learning strategies detected changes in map objects significantly more accurately than subjects who used the Path-based learning strategy to study the map (Figure 9a). Such results suggest that

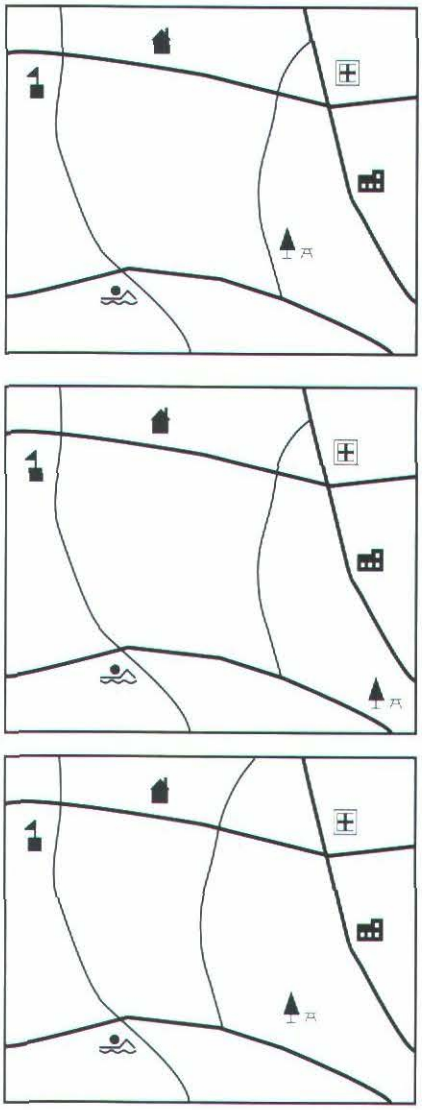


Figure 8. Target map (top), test map with displacement symbol foil (middle), and test map with displacement road foil (bottom).

the Landmark-based learning strategy and *Anchor Point Theory* (Golledge 1978) transfer better from an environmental context to a map context than the Path-based learning strategy, at least when the task is to recognize changes in a mapped area. Why are there discrepancies between these findings and those of MacEachren's? One plausible explanation is that the different task requirements of the two studies played a role in which types of encoding processes worked best. MacEachren's distance and direction estimates are linear tasks and may be better matched to an encoding process that emphasizes linear components. With the map recognition task, subjects were searching for changes to isolated objects on the map; perhaps a task such as this is better matched to an encoding process that emphasizes point locations.

It is also possible that differences in the design and presentation of the experimental maps used in both studies played a role in producing these contrasting results. The number of streets and landmarks on MacEachren's maps were unbalanced, with the maps having more streets than landmarks. Subjects, then, who used a Path-based learning strategy to

" . . . results suggest that the Landmark-based learning strategy and Anchor Point Theory transfer better from an environmental context to a map context than the Path-based learning strategy . . ."

Independent Variables	DF	F Value	P>F
Gender	(1,142)	0.23	.6314
Learning Strategy	(2,141)	4.90	.0092
Map Object	(5,138)	14.34	.0001
Learning Strategy x Gender	(2,138)	0.41	.6637
Map Object x Gender	(5,132)	0.44	.8192
Learning Strategy x Map Object	(10,126)	0.45	.9173
Learning Strategy x Gender x Map Object	(10,108)	0.66	.7548

Table 1. General linear model with Accuracy rate as the dependent variable (R^2=.47).

"Gender, contrary to the hypothesis put forth, did not significantly influence the accuracy of subject responses to the recognition task."

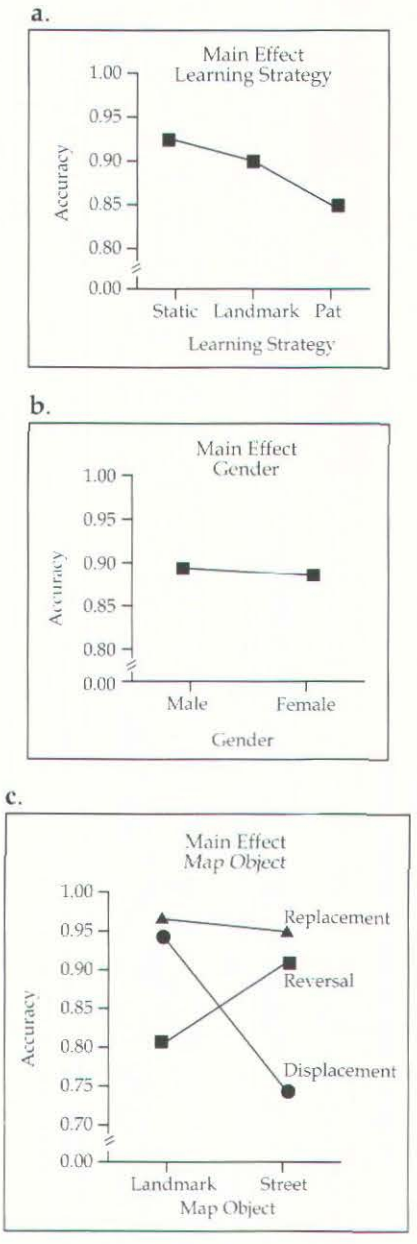


Figure 9. Results of accuracy rate analysis. Each graph shows how a main effect or interaction effect was related to accuracy.

study the map were initially exposed to more information than subjects using the Landmark-based learning strategy, a situation that was avoided in this study. Furthermore, all subjects in MacEachren's study saw the map in its entirety at some point during the simulation process. In this study, only subjects who studied the map using the Static Map learning strategy saw the map in its entirety. The Landmark-based and Path-based learning theories do not include holistic encounters with the environment as part of the learning model. Thus, subjects who studied the target map using similar learning strategies were not exposed to such a display.

Gender, contrary to the hypotheses put forth, did not significantly influence the accuracy of subject responses to the recognition task (Figure 9b). Both males and females were equally accurate in recognizing changes in map objects during the test phase of the experiment. Furthermore, females using the Landmark-based learning strategy did not exhibit an advantage in responding to the recognition task, whether the modified map object was a landmark or a street. While this is certainly not an exciting conclusion, it is worth noting because it will help geographers to evaluate the need to consider gender an explanatory variable in future studies. As Caplan, et al. (1985) has pointed out, the lack of significant differences in gender-based studies may be published less often than results that are significant. Within the context of this study, then, it appears that gender differences and gender styles do not significantly influence the ability of subjects to use one spatial encoding strategy over another. Of course, the task used in this study was a simple one and indicative of only one of many that the typical map user may need to perform. Certainly, further studies should be conducted that examine a variety of common map-based tasks in conjunction with these types of spatial encoding strategies.

An unexpected, but nonetheless interesting finding in this study is the difference in difficulty that subjects encountered in detecting various object modifications. The lack of interference in detecting replaced objects is clearly explained by examining the effect of Map Object on subject

responses (Figure 9c). Subjects, regardless of the learning strategy used when studying the target map, found replaced objects easier to detect than displaced and reversed objects. Given that replaced objects were designed to be both visually and conceptually similar, the near ceiling performance of subjects in detecting these objects is striking. Furthermore, there is a huge discrepancy in the ability of subjects to detect reversed landmarks over reversed streets as well as displaced streets over displaced landmarks. Such anomalies help explain why the variance for the overall GLM model is so low. A secondary analysis using individual trials in place of Map Object showed that much of the variance not accounted for in this analysis can be explained by differences in individual trials.

Why was it so much easier for subjects to detect replaced objects? Perhaps the Landmark-based and Path-based learning strategies did not interfere as severely with the coding of object identities as object locations and object perspectives. With these particular strategies, segmentation of the map during the encoding process might very well introduce fuzziness into the locational coding of landmarks and streets. Even though the map was presented in segments, however, individual map objects were not fragmented, which may have enhanced the ability to encode object identities. Furthermore, the poorer coding of object perspectives could have resulted from a filtering process in which only the most important object characteristics were coded.

" . . . subjects found landmark displacements and street reversals easier to recognize than street displacement and landmark reversals."

These speculations, of course, do not explain why subjects found landmark displacements and street reversals easier to recognize than street displacements and landmark reversals. There are two plausible explanations for these results. First, the pictorial landmarks and street segments on the map presented considerably different types of graphic information. Symbols were easily recognizable, isolated objects; streets, on the other hand, were graphically abstract and were most likely perceived as an integrated network of segments rather than as isolated lines. If the streets were seen as a network, then the displacement of a street would have been less perceptible than the displacement of a symbol, especially since street displacements only violated street relationships. The difference in responses to reversal foils may lie in the way reversals were implemented for symbols and roads. For symbols, perspective reversal was accomplished by producing a mirror-image of the symbol; for streets, segments were reversed by alternating line thickness to approximate a reversal characteristic. Perhaps the alternation of line thickness was simply easier to detect than mirror-images of symbols.

CONCLUDING REMARKS

In this age of computer display systems, the variety of potential presentational strategies for maps compels us to evaluate their effectiveness carefully. Three possible presentation strategies were examined in this study for their effectiveness in encoding and remembering a simplified map consisting of a street network and pictorial landmark symbols. Results of the study, in contrast to the work of MacEachren (1992), indicate that subject performance of a simple recognition task was worst for subjects who used a Path-based learning strategy to study the target map. This suggests that this method of encoding, at least for recognition tasks emphasizing point locations, may pose disadvantages for completing the task with high levels of accuracy. Subjects who studied the map using a Landmark-based learning strategy, on the other hand, produced responses that did not differ significantly from subjects who studied the map using the Static Map learning strategy. It might be hypothesized, then, that *Landmark-based Learning* is a viable map encoding alternative given this comparability in levels of accuracy for task responses. Of

" . . . Landmark-based learning strategy . . . produced responses that did not differ significantly from subjects who studied the map using the Static Map learning strategy."

course, additional research is needed before such a hypothesis could be fully accepted. For instance, it would be particularly interesting to assess the applicability of these encoding processes for a variety of map reading tasks, as well as for encoding a variety of map types.

The study did not find any gender-based differences in the ability to use these encoding strategies to learn map-based spatial information. This lack of significant difference should be viewed as a positive finding for the discipline of cartography. An established difference in the cognitive ability of males and females to complete map-based tasks would certainly make the job of producing effective maps for the general population much more difficult. More gender-based studies should be conducted in cartography, however, before such findings are considered a foregone conclusion. Map use requires a variety of spatial abilities, and cartographers have not yet conducted a sufficient number of studies that establish what role gender plays in these activities as a whole.

The significant influence of Map Object on subject responses creates several new questions for cartographers in the realm of spatial cognition. Maps consist of multiple graphic elements; the suggestion that their individual characteristics may be processed differently indicates a need to assess how the map reader interacts with each of these element types. Research that investigates the mental processing of map elements, both individually and as a complete spatial unit, may shed more light on this finding. The cognitive processes essential to acquiring , storing and using map information are still not clearly understood. As computer technology continues to evolve, cartographers will need to gain a more comprehensive understanding of these cognitive processes if we hope to make a successful transition into the digital environment.

ACKNOWLEDGMENTS

I am indebted to the following organizations for their monetary support: the National Science Foundation, Grant SBR-9500196; Sigma Xi's Grants-in-Aid of Research; and the University of South Carolina, Educational Foundation Student Research Fund. I am also grateful for the support and advice I received from Dr. Patricia Gilmartin, Dr. Robert Lloyd,Dr. Theodore Steinke, and Dr. Robin Morris.

REFERENCES

Appleyard, D. 1970. Styles and methods of structuring a city. *Environment and Behavior*. 2: 100-16.

Caplan, P.J., G.M. MacPherson, and P. Tobin. 1985. Do sex-related differences in spatial abilities exist? *American Psychologist*. 40: 786-799.

Cooper, L.A. 1976. Individual differences in visual comparison processes. *Perception and Psychophysics*. 19: 433-444.

Devlin, Ann S. 1976. The "small town" cognitive map: adjusting to a new environment. Environmental Knowing: Theories, Research, and Methods, edited by Gary T. Moore and Reginald G. Golledge, 58-66. Stroudsburg, PA: Dowden, Hutchinson, and Ross.

Evans, G.W., D.G. Marrero, and P.A. Butler. 1981. Environmental learning and cognitive mapping. *Environment and Behavior.* 13(1): 83-104.

Galea, L.A., and D. Kimura. 1993. Sex differences in route learning. *Journal of Personality and Individual Differences.* 14(1): 53-65.

Garling, T., E. Lindberg, and T. Nilsson. 1981. Memory for the spatial layout of the everyday physical environment: factors affecting rate of acquisition. *Journal of Environmental Psychology.* 68: 177-86.

Gilmartin, P.P., and J.C. Patton. 1984. Comparing the sexes on spatial abilities: Map-use skills. *Annals of the Association of American Geographers.* 74: 605-619.

Golledge, R.G., 1978. Learning about urban environments. In Timing Space and Spacing Time, edited by T. Carlstein, D. Parkes, and N. Thrift, vol. 1, 76-98. London: Edward Arnold.

Halpern, D.F., 1992. Differences in cognitive abilities. Hillsdale, N.J.: Lawrence Erlbaum.

Herman, J.F., R.V. Kail, and A.W. Siegel. 1979. Cognitive maps of a college campus: a new look at freshman orientation. *Bulletin of the Psychonomic Society.* 13(3): 183-186.

Holding, C.S., and D.H. Holding. 1989. Acquisition of route knowledge by males and females. *The Journal of General Psychology.* 116: 29-41.

Lanca, Margaret, and John R. Kirby. 1995. The benefits of verbal and spatial tasks in contour map learning. *Cartographic Perspectives.* 21:3-15.
Maccoby, E.E., C.V. Jacklin. 1974. The psychology of sex differences. Stanford, CA: Stanford University Press.

MacEachren, A.M. 1992. Application of environmental learning theory to spatial knowledge acquisition from maps. *Annals of the Association of American Geographers* . 82:(2): 245-74.

McGuiness, D., and J. Sparks. 1983. Cognitive style and cognitive maps: sex differences in representations of a familiar terrain. *Journal of Mental Imagery.* 7(2): 91-100.

Miller L.K., and V. Santoni. 1986. Sex differences in spatial abilities: strategic and experiential correlates. *Acta Psychologica.* 62: 225-235.

Okabe, A., K. Aoki, and W. Hamamoto. 1986. Distance and direction judgment in a large-scale natural environment: effects of a slope and winding Trail. *Environment and Behavior.* 18(6): 755-772.

Paivio, A., 1986. *Mental representations: a dual coding approach.* New York: Oxford University Press.

Perrig, W., and W. Kintsch. 1985. Propositional and situational representations of text, *Journal of Memory and Language.* 24: 503-518.

Peruch, T., M.D. Giraudo, and T. Garling. 1989. Distance cognition by taxi drivers and the general public. *Journal of Environmental Psychology.* 9(3): 233-39.

Self, Carole M., Gopal Sucharita, Reginald G. Golledge, and Sarah Fenstermaker. 1992. Gender-related differences in spatial abilities. *Progress in Human Geography.* 16(3): 315-342.

Siegal, A.W., and S.H. White. 1975. The development of spatial representations of large scale environments. In Advances in Child Development and Behavior, edited by H.W. Reese, 10-55. New York: Academic Press.

Thorndyke, P.W., and B. Hayes-Roth. 1982. Differences in spatial knowledge acquired from maps and navigation. *Cognitive Psychology.* 14: 560-89.

Thorndyke, P.W., and C. Stasz. 1980. Individual differences in procedures for knowledge acquisition from maps. *Cognitive Psychology.* 14: 560-589.

Ward, S.L., N. Newcombe, and W.F. Overton. 1986. Turn left at the church, or three miles north: a study of direction giving and sex differences. *Environment and Behavior.* 18(2): 192-213.

Adjusting and Separating Map Colors Using PhotoShop™

As more and more maps are being prepared for display on CRTs, our need for a method to convert them into printable or slide form is increasing. A screen capture of the image can be manipulated in PhotoShop to select appropriate colors. A finishing program such as FreeHand can be used for adding high-quality lettering, placing appropriately on the page, and creating color separations or a slide file. Different applications require creativity in solving specific problems, but the method is versatile and easy to apply.

Judy M. Olson
Department of Geography
Michigan State University
East Lansing, Michigan 48823

THE PROBLEM

You have a map displayed on a CRT. You need a high-quality copy of the map for conventional process-color printing or for making a slide, but a) the program that produces the display does not produce color separations, or b) the color capabilities of the software prevent you from using the colors you need, or c) you are displaying a (copyright-free) GIF image from the World Wide Web and you need to crop and annotate. With the increased use of GIS software and the Web, you may be increasingly finding yourself with images that need transformation. How do you convert the diverse images we can produce on CRTs into high-quality printable form or into slides? And how do you transform the colors into selections of which you can be proud instead of apologetic? The logical choice of software seems to be PhotoShop, but what does one do with it to get the well-colored image in the appropriate format?

I recently had just such a problem. CRT maps had been used in a testing project (Olson and Brewer, 1997) and had been produced on a computer system no longer available. Fortunately, the programs had been written in QuickBASIC, a copy of which was still available, and no map had more than about ten colors on it. Not so fortunately, we had been using a smart terminal that had its own subroutines to produce eight-bit color and we had carefully selected and tweaked the colors to adhere to certain schemes and constraints. The nine standard colors available in QuickBASIC did not even resemble the logical series we had used in the testing project. The problem was to produce a set of color separations for publication that would simulate reasonably well the colors used in the testing project.

A SOLUTION

Here is a method that works to convert CRT-displayed maps into printable or slide form. Readers are spared the many blind alleys taken along the way in developing this sequence.

1) Use a printed color chart to choose the CMYK (cyan, magenta, yellow, black) percentage combinations that will be needed to produce the desired colors. CRT colors cannot be reproduced exactly, and colors that look right on the CRT do not necessarily look right

when printed. There is no substitute for using a good printed color chart.

2) You will not normally need this step, but in my case I had to revise the QuickBASIC programs to omit calls to subroutines that were specific to the original output terminal. I assigned an arbitrary color to each different color on each map. In cases where the number of colors exceeded 8, I reused colors, making sure that the lines separating units were unique (i.e., I did not reuse the line color for anything else). All lettering (which was fortunately sparse) was omitted by commenting out the relevant lines in the QuickBASIC program.

"There is no substitute for using a good printed color chart."

3) Display the map on a CRT and screen capture it using a shareware program such as Graphix or, if it is displayed in a Windows environment, press Print Screen. I used Graphix to capture each map as either a GIF or PCX file; either format worked well. (I could not use the "Screen Display" option in QuickBASIC to display the map for capture but had to display using the Run command. This meant I captured any messages on the screen as well as the map, but I scaled the image so the messages fell outside the map area.)

4) Open the GIF or PCX capture file in PhotoShop (I used PhotoShop 3.0 residing on a Power Macintosh 8100/100 with 96 Mb of RAM and 650 Mb hard disk). Use the eraser to clean up any unwanted messages or extraneous marginal marks if any.

"Display the map on a CRT and screen capture it using a shareware program such as Graphix or, if it is displayed in a Windows environment, press Print Screen."

5) Use the Rectangular Marquee from the Toolbox to window the exact area of the graphic that you wish to retain. (My background color was black and I wanted the rectangular area of each of 15 maps to be exactly the same size on the final product, which meant this step was crucial.) Double-click on the Rectangular Marquee to bring up the dialogue box in which you can set the style to Constrained Aspect Ratio and specify a width and height. (In my case, I used 2.6 by 1.75, as the final image was be that size in inches. It is only the ratio that is important here, however. For slides, use 3 by 2 as the aspect ratio.) Use the tool with the Option key pressed for extending from the center of selection. Noting your choice of center on a given try, adjust and retry. If more background area is needed to get the proper window, increase the Canvas Size (Image menu). When the Marquee window is satisfactory, pull down the Edit menu and select Crop.

6) If you need to add new colors (such as I did when the number exceeded 8), click (once) on the Foreground Color square to open the Color Picker dialogue box. Specify a new (arbitrary at this point) color. Selecting a color that is simply very different from the rest can make this step easier. After closing the Color Picker, double-

click on the Paint Bucket and be sure the Anti-alias feature is deselected (to prevent a blurry map). Click the Paint Bucket in each area to be filled with the new color.

7) Save the file so you do not have to deal with the unwanted lettering, the cropping, or the duplicated colors again.

8) By default, the file opened in "Indexed Color" Mode. It is not possible to accomplish the remaining modifications using that mode. Bring down the Mode menu and select CMYK. Save the file in PhotoShop format with a modified file name so as to preserve the GIF or PCX file as a backup.

9) In CMYK Mode, change the colors as follows:

   a) Double-click the Magic Wand to bring up its dialogue box. Make sure the Anti-alias box is deselected and the tolerance is zero.
   b) Select a legend box or map unit that is the color you wish to change.
   c) In the Select menu, select Similar to pick up all other areas of the same color.
   d) Use the Eyedropper tool to sample the selected color. The color then appears as the current Foreground Color in the Toolbox.
   e) Single click on the Foreground Color in the lower part of the Toolbox to open the Color-Picker dialogue box. Type in the CMYK values desired and press Return (or click OK).
   f) At this stage, the new color is in the Foreground color box only. Press Option and Delete to change the colors in all the selected areas to the new color.
   g) Repeat steps *b* through *f* for each of the other colors needing adjustment.
   h) Save the file again (still in PhotoShop format) so you have all the changes included. This will serve as a backup file.
   i) Use Save As in the File menu and choose the TIFF format and a modified filename. Upon clicking Save, the TIFF dialogue box opens; select LZW compression. Uncompressed files are extremely large (mine were 14-20 times the compressed size), and the compressed versions work well.

10) Use FreeHand (I used version 5.0, on the same Mac) or similar graphics package as the finishing software. In FreeHand, select Place from the File menu and select the TIFF image you saved. Click in some convenient (arbitrary) point on the page for placement. Choosing the Object Inspector (first icon in the Inspector window) you can specify the x,y location of the lower left corner and the size desired (2.6 x 1.75 inches in my case), and press

"Use the Eyedropper tool to sample the selected color. The color then appears as the current Foreground Color in the Toolbox."

"Press Option and Delete to change the colors in all the selected areas to the new color."

"Uncompressed files are extremely large (mine were 14-20 times the compressed size), and the compressed versions work well."

Return. Alternatively, you can use the scaling tool and then drag the image to the desired location.

11) Add lettering in a higher layer using the convenient type features in FreeHand or similar software.

12) Be sure to save the file at this stage (FreeHand format), so you have a complete copy of your work.

13) The next step depends on whether your map will be printed or made into a slide.

   a) If the map is to be printed, produce a color proof and examine the colors carefully.
   b) If the map is to be made into a slide and the film recorder is not directly accessible, be sure you have the appropriate printer driver on your machine for whatever film recorder is available. Use it to save the FreeHand file in the new format. In our case, we use the printer driver that produces Binary Lasergraphics™ Language (extension .BLL). The file can then be taken to the film recorder.

14) Make revisions if needed. Use the PhotoShop format files to do so. Save not only the revised PhotoShop file but also the TIFF file with the *same names* you used before. Replacing the originals prevents old versions from becoming confused with new ones, it saves disk space, and (very important) the FreeHand file you created will automatically use the *new* version.

"Replacing the originals prevents old versions from becoming confused with new ones, it saves disk space, and (very important) the FreeHand file you created will automatically use the new version."

PITFALLS

In PhotoShop one has to be cautious about duplicate colors. If, for example, the second box in the legend is 100% cyan and one wishes the color in the first box to be 100% cyan, the second legend color must be changed first. Otherwise, both the first and second colors become equal and all of them are selected upon trying to isolate only one of them.

Due to the conversion from vector to bitmap format when a screen capture is made, lines are not consistent in width. Most of ours were one pixel but some were two. I used the pen tool in PhotoShop to correct

	C	M	Y	K	B&W
background:	0	0	0	100	0
No harvest:	0	10	30	0	10
0.1-49:	0	40	60	0	20
50-99:	0	65	85	10	35
100-399:	0	80	95	40	50
400-999:	0	100	100	50	70

Table 1.

some of them, but the variation was not particularly bothersome in the case of these maps because the final size of each map was small.

The illustrations I was producing had several maps (7 or 8) on each final page. The FreeHand file plus all the associated TIFF files for each page fit onto one 1.44 Mb diskette. Had we not used the LZW compression, file size of some individual TIFFs, much less the whole set, would have been too large for a single diskette.

Although readers are generally spared the blind alleys here, there is one that is so tempting that I must warn you against it. When you are in Index Color mode in PhotoShop, you can open up the Color Table and change several colors at once before closing it. It lures one into thinking this is an easier means of color adjustment, but it is fraught with problems. The worst is that the color designations change automatically (without warning to you; you have to reopen the color table and read the numbers to see that it did not accept what you typed in). Although the automatically-modified color may look fine on the screen, the resulting color proofs can be a huge disappointment. The use of the Color Table process in Index Color mode turns out to be wasted time.

"Although readers are generally spared the blind alleys here, there is one that is so tempting that I must warn you against it."

To try the steps outlined above to modify a map in PhotoShop, we offer a sample file that can be downloaded from the internet: pilot.msu.edu/user/olsonj/nwestmap.gif. The colors in the original file are arbitrary. There is no need for adding colors (Step 6 above), but you may want to try that with just one map unit and then undo the Paint Bucket fill. FreeHand or similar software can be used to finish the map with lettering. Table 1 shows some potential specifications for the map. The CMYK values

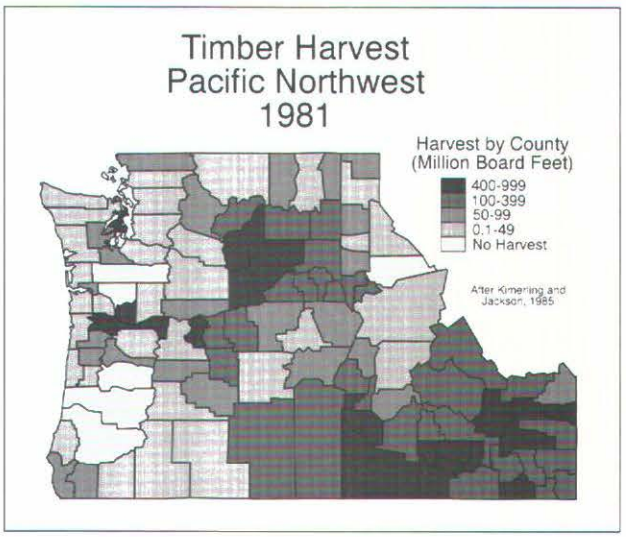


Figure 1. A printed map prepared using the methods outlined.

would be used for a color version; the B&W values produced the black-and-white version shown in Figure 1.

As it becomes more and more important to transform maps from one format to another, we need to know the combinations of commands that allow us to reach our goals. It was a significant investment of time and effort in manual reading, trial and error, and asking questions of others who use PhotoShop before I succeeded in understanding how simple a

process can be employed to convert CRT maps into printable form or into a form suitable for good slides. Perhaps the summary of steps involved will save time on the part of others attempting similar conversions. Perhaps, too, the maps we see in print and projected on screens during professional presentations will meet higher quality standards than the compromises to which we have had to become accustomed of late.

REFERENCES

Kimerling, A. Jon, and P. L. Jackson. 1985. *Atlas of the Pacific Northwest*, 7th ed. Corvallis, OR: Oregon State University Press.

Olson, Judy M. and Cynthia A. Brewer. 1997. An Evaluation of Color Selections to Accommodate Users with Color-Vision Impairments," *Annals of the Association of American Geographers*, 87(1), pp. 103-134.

ACKNOWLEDGMENTS

I want to thank Cindy Brewer (Penn State); Mike Lipsey and Dick Groop (Michigan State); Jim Moore (Northern Illinois); Josh Hane, Rich Worthington, and Dan Maher (University of Wisconsin); a PhotoShop consultant; and all others who at some time in this process helped get me over one hurdle or another.

cartography bulletin board

THE SE MAPS PROJECT

by James R. Anderson, Jr., Director
Florida Resources &
Environmental Analysis Center
Florida State University

On July 15 through July 26, a workshop was held at Clemson University to discuss the development of middle school instructional materials and related cartographic products to investigate the interrelationships among geology, land use, history, cultural diversity, and environmental concerns. Participants came from several southeastern states and included teachers, university faculty, and state agency personnel. Funding for the workshop and the development of curriculum materials is being funded by a National Science Foundation Grant awarded to Clemson University.

The SE (SouthEast) Maps project is an outgrowth of a resource package developed in South Carolina and titled SC Maps. The original South Carolina materials use infrared aerial photographs, Landsat satellite images, state base maps, topographic maps, and soils maps as resources to help study the state's human and geological history.

In South Carolina, ten study sites were selected from five landform regions with physical features clearly visible from high resolution aerial infrared photographs and satellite images. Using these images and related map products, middle school students learned to interrelate the state's geological formation, environmental concerns, historical events, mathematics skills, and cultural development through a variety of activities including storytelling. A SC Maps Portfolio has been developed that contains classroom sets of laminated maps and photography, wipe off pens, and a teaching manual outlining a variety of cooperative learning activities.

The purpose of the SE Maps project is for students to make connections between:

- Geologic events that have resulted in the state's five landform regions.
- Drainage system, wetlands, and landform regions that have had an impact on the state's historical events and cultural diversity.
- Economic trends and regional differences that have resulted in the diversity of the state's industries, agriculture, and tourism.
- Historical events, regional customs, and cultural diversity interrelated through storytelling.
- Mathematical applications using state statistical data, map reading skills, probability, and ordered pairs.
- Environmental concerns and the recognition that it is their responsibility as citizens to appreciate, use wisely, and preserve the state's unique natural resources.

SC Maps is a collaborative effort initiated by Peggy Cain with the State Department of Education, James (Chip) B. Berry, III, South Carolina Department of Natural Resources, Land Resources Division, and John Wagner, Clemson University, Earth Sciences Department.

Using the South Carolina project as a model, SE Maps will produce a regional curriculum package. The regional package could then serve as a template for individual states to build upon while developing their own local study sites to produce a customized state version of the instructional materials. The SE regional package can also serve as a model for future curriculum development of similar programs in other regions of the country.

All Southeastern states were invited to send a team of developers to the workshop. At least one team member was to have had experience working with cartographic products and at least one team member was to represent the state's Department of Education. Participants were given information on the development of the South Carolina materials and criteria for the selection of study sites in their states. Each state team will be made up of a coordinator, development team to write the curriculum materials, and resource persons.

During the coming year, each state will develop materials for sites selected in their states. During the summer of 1997, a follow-up workshop will be held to compare local products and finalize the SE Maps package. During the fall of 1997 the materials will be field tested in selected schools.

For additional information, please contact: John Wagner, Ph.D., Department of Geological Sciences, Clemson University, Box 341908, Clemson, SC 29634-1908. E-Mail: SCMAPS-L@CLEMSON.EDU.

THE NEW NATIONAL CENTER FOR HEALTH STATISTICS ATLAS OF UNITED STATES MORTALITY

Linda W. Pickle, Michael Mungiole, Gretchen Jones, Andrew A. White

by James R. Anderson, Jr., Director
Florida Resources & Environmental Analysis Center
Florida State University

Thematic maps published in earlier atlases have helped epidemiologists to identify cancer *hot spots* in the U.S. by providing a visualization of the geographic patterns

of mortality not apparent from tabular statistics. Field studies designed to test hypotheses generated by these earlier atlases led to such notable findings as the associations between snuff dipping and oral cancer, and shipyard asbestos exposure and lung cancer.

In light of the demonstrated utility of the cancer atlases, the National Center for Health Statistics (NCHS) is preparing an atlas for the leading causes of death in the U.S. for the period 1988-1992. New features of this atlas include geographic units based on health care patterns, innovative statistical modeling of rates, and the use of cognitive experiments to guide the design of maps and page layout. It also discusses design issues important for mapping death rates using examples from the atlas.

In 1995 the NCHS commissioned Deasy GeoGraphics, Penn State University, directed by David DiBiase, to assist in the production of its *Atlas of United States Mortality*. The Atlas will consist of 72, two-page, four color, choropleth maps, along with graphs, text, and other maps. Color schemes were developed for NCHS by Dr. Cynthia Brewer, along with a reliability hatching scheme designed by Dr. Alan MacEachren. Deasy GeoGraphics' participation in the project included converting digital map files produced by NCHS, into PostScript documents compatible with high-resolution digital imagesetting, thus ensuring an accurate representation of the work done by Drs. Brewer and MacEachren. The atlas should be available by early 1997.

Material contributed by Linda W. Pickle (NCHS) and William Vancura (Penn State University). ❑

map library bulletin board

Compiled by Melissa Lamont
Pennsylvania State University

CARTOGRAPHIC USERS ADVISORY COUNCIL MINUTES

Thursday May 9, 1996
Library of Congress
Geography and Map Division

Gary Fitzpatrick, Geographic Information Systems Specialist, started the day by taking the Council on a tour through the *Center for Geographic Information*. The G&M Division recognized that industry partners would be needed to help incorporate emerging technologies into existing services. The Madison Council, a Library of Congress friends group, offered a $30,000 grant to create the Center. In January of 1995 nine GIS industry leaders attended the first organizational meeting. They decided that membership in the Center would require a five thousand dollar annual contribution and appropriate donations of software, hardware and support. The Center now has twelve members and seven associate members.

The G&M Division also received funding through the National Digital Library Program (NDL), designed to preserve "core historic Americana." The G&M Division has hired four employees for the Center for Geographic Information and has identified several collections to scan for preservation including: panoramic views, land ownership maps, railroad maps, fire insurance maps, civil and revolutionary war maps and general US maps. The staff of the Center are scanning the maps at 300 dpi using a color flatbed *Tangent* scanner. Because of the size and relative fragility of maps, the G&M Division is the only division doing in-house scanning. The scanned images are being stored on tape at the Division and will be made available via the Internet in the future. The Information Technology Service of the Library of Congress will handle the Internet display and transfer of the map images. The images are not geo-referenced. Staff of the Center consider geo-referencing an intellectual process, one which users will want to complete for themselves.

The Center also has two color ink jet plotters for output. **James Dyson, Automation Operations Coordinator**, demonstrated the scanner and plotter for the Council. The scanned and printed maps provide a high quality, inexpensive surrogate for reference. Although the scanner can handle up to 600 dpi, the lesser resolution is more than adequate to display details, and the files are significantly smaller and therefore easier to transfer and store. At the moment the Center is unable to offer patrons the ability to manipulate the digital image. They hope to move in that direction in the future.

The G&M Division will indicate the availability of the digital image in the MARC record. For those scanned images without records, they will create smaller "reasonable" level records. The NDL project plans call for 5 million items at the Library of Congress to be scanned. Those 5 million items are expected to require 32 terabytes of storage, of those 24 terabytes will come from the G&M Division alone.

A third aspect of the digital initiative at the G&M Division offers public access terminals for electronic mapping. Three X-Window workstations located in the Reading Room, run a variety of mapping software. The Division hopes to offer terminals and services to the Congressional Research Service in the future. Mr. Fitzpatrick

emphasized that corporate partnerships and donations have allowed the G&M Division to move into digital technologies much more quickly. Incorporating all the new computing power into the Library and developing new lines of communication have been challenging.

Ralph Ehrenberg, Chief of the Geography and Map Division of the Library of Congress noted that the past few years have seen a number of new developments for the Division. The Philip Lee Phillips Society will work with map societies on a state and regional level. The Society has 150 members at the present.

Mr. Ehrenberg noted that the National Digital Library Program for Cartographic Information has secured four full time positions for scanning historic maps. They plan to scan 50 to 60 thousand maps by the turn of the century. Mr. Ehrenberg also highlighted the Center for Geographic Information and the public GIS facility. The Library of Congress Summer map project will also be held this year.

Jim Flatness, Head, Acquisitions Unit, emphasized that LC is still acquiring maps and atlases on a world-wide basis. Approximately 120,000 items were retained last year including those exchanged with other nations. Mr. Flatness mentioned that transfers from the Department of State and the Defense Mapping Agency were high in the past year. Border changes necessitated new mapping and the agencies removed previous editions. LC retained about 30 to 40 percent of the transferred maps. He also emphasized that not all federal agencies are complying with automatic distribution policies. Likewise, not all commercial products are deposited. The Acquisitions unit monitors both situations. The Unit purchased new maps of Russia. In addition, the Madison Council has obtained several historic maps in the past year. In addition, the Division is concentrating on collecting materials that document mapmaking, especially American maps and mapmakers.

Barbara Storey, Head, Cataloging Unit, noted that arrearages have been reduced, particularly the atlas backlog. Two staff have been added to the Cataloging Unit. Presently 13 staff catalog maps, 3 catalog atlases and 1 staff person concentrates on digital materials. The Cataloging Unit will also update records for scanned images. Further, the Unit is working with the Department of State and the Defense Mapping Agency to create MARC level cataloging for their agencies' holdings. DMA already does some in-house cataloging.

Gary Fitzpatrick added that he is a member of the Coordinating Committee of the Federal Geographic Data Committee, and that Mr. Ehrenberg is on the Steering Committee. Mr. Fitzpatrick noted that maps and other material displayed at the Environmental Systems Research Institute annual conferences are now located at LC. Mr. Fitzpatrick and Mr. Flatness emphasized that they will need to coordinate to work toward new approaches to acquiring digital data. The GIS industry has expressed concern about archiving, a need that may be filled by recent developments at the G&M Division.

Friday May 10, 1996
U.S. Government Printing Office

The Friday, May 10, 1996 meeting of the *Cartographic Users Advisory Council* opened at the Government Printing Office at 9 am. **Gil Baldwin, Chief, Library Division, US Government Printing Office (GPO)** welcomed the Council and made some general announcements. He introduced GPO staff members attending the CUAC meeting as guests. Mr. Baldwin chronicled for the Council the sequence of events beginning last year with the U.S. Congressional mandate that GPO identify measures necessary for a successful transition to a more electronic Federal Depository Library Program. This transition was announced and discussed at the Depository Library Council meetings in Memphis last October. Comments were solicited from the Depository Library community before a mid December draft plan was due back to Congress. A draft transition plan was published in Administrative Notes on December 29, 1995 and discussed again at the American Library Association (ALA) Midwinter meetings in San Antonio in January 1996. Comments have been solicited on each of many Task Force Reports since then.

The draft transition plan has now become the Federal Depository Library Program: Information Dissemination and Access Strategic Plan, FY 1996-FY 2001. Mr Baldwin is currently working on the final version of this plan. Currently the report includes no specific references to cartographic information. He invited and encouraged CUAC members to send comments to him before May 24, 1996, so that he can include this information in the final plan.

The current strategic plan gives us a longer time frame, until 2001, to move to an all electronic depository program. It will incorporate some of the same values in the program that we have had all along. It will place more emphasis on coordination among various players to assure long term access and archiving, i.e. the libraries, GPO, and the National Archives and Records Administration (NARA). GPO's electronic storage facility is in very early planning stages. Some other agencies have approached GPO and expressed an interest in playing a part in this.

There are changing expectations of libraries in the FDLP. The deadline for new service level requirements, i.e., Internet access is Octo-

ber 1, 1996. CUAC will provide Mr. Baldwin with special equipment requirements for cartographic data and mapping software. CUAC's concern about training needs were discussed, and Mr. Baldwin asked that we provide him with language to that effect in our minimum equipment requirements document that we submit to him.

The concept of *'most appropriate format'* as discussed in the Strategic Plan was discussed. Mr. Baldwin asked CUAC to submit our recommendations. But he pointed out that GPO has no ability to influence agencies and the format of the products they provide. CUAC should talk directly with the agencies about specific products. Concern over National Archives and Records Administration (NARA) archiving cartographic data was discussed. It has been announced at the recent Federal Depository Conference that NARA would archive data that could be converted to ASCII format and that has documentation. Since this would not be appropriate for a large quantity of cartographic data there is concern that it would not be archived.

The digital version of the soil maps have been deposited at Cornell. These were not in the depository program. Mr. Baldwin pointed out that this information would have been useful back at the time they were working on the Task Reports. Denise Stephens will investigate further. Mr. Baldwin concluded his remarks by encouraging CUAC input into the final Strategic Plan.

Ms. Robin Haun-Mohamed, Chief Depository Administration Branch, GPO announced that the cartographic products now distributed by Defense Mapping Agency (DMA) and US Geological Survey (USGS) to Depository Libraries will continue. However, there have been problems in having agencies respond to the GPO study on a *"more electronic federal depository library program."*

Increasingly, GPO is seeing more information being issued electronically by governmental agencies. Agencies are expecting cost savings by issuing many small documents and pamphlets on CD-ROM, but publication by CD-ROM has led to cataloging problems. Digital Orthophoto Quadrangles (DOQ) and Digital Raster Graphics (DRG) are coming out quickly. Originally they were to be produced on a 1 degree by 1 degree quadrants. In response to GPO and library input, these are now issued by state. This is an example of how an agency has altered its publication plans to aid in public accessibility.

Fugitive documents are still a problem for GPO, DMA's Digital Chart of the World is a prime example. In addition, documents, once firmly within the depository program are now disappearing. National Oceanographic and Atmospheric Administration's (NOAA) Tide Tables are now available on CD-ROM for $90.00. Agencies are not required to distribute materials that fall into the category of "internal use". The Airport Obstruction Charts have been eliminated from the Depository Program for that reason.

In the transition to a more electronic depository program GPO wants to reduce/eliminate duplication of formats. If the primary dissemination of a particular piece of government information has been determined by the issuing agency to be the World Wide Web, GPO will not distribute a fiche or paper edition. Rather GPO will try to point to the web site from its own homepage. Agencies themselves have shown that they are not always seriously concerned with the archiving/preservation of information once it has been superseded or revised, nor do they think it is GPO's concern. GPO's authority is also being questioned when it comes to controlling/cataloging electronic information sites. Agency pamphlets that are used heavily by library patrons are usually the first to be posted on an Agency's web site and not printed.

Agencies often do not focus on their primary audience for this information. Information files can be huge, requiring mainframe computers. The impact on libraries and users of such products as DOQs, DRGs, and Magellan data is rarely factored in. Ms. Haun-Mohamed is also concerned about the public/private cooperative efforts in disseminating government information. A title, for example, the Bureau of the Census' Current population Report on Hispanic Population, has always been available to depository libraries from the agency through GPO. The agency collected the data and promised GPO copies, then said no copies would be available because it was available on the Census' web site. Ultimately a private group, the Association of Hispanic Publications, with some help from Philip Morris, Inc., took the Census data, added "value" by reformatting the data and published it under the title *Hispanic-Latinos: Diverse People in a Multicultural Society*. This title has been copyrighted and is available for sale. This has been happening more and more.

John Stevenson asked Ms. Haun-Mohamed about world maps from DMA not coming to GPO for cataloging, but simply distributing the World maps to depository libraries selecting these maps. Ms. Haun-Mohamed said that GPO now has copies to catalog. Denise Stephens asked about a new edition of Landview software. Robin will check to see if a new version is available. Melissa Lamont asked Robin for more information about a GPO/private consortium to take on the problem and responsibility of long-term storage and public access to cartographic materials.

DMA Representative, **Jeanie Thackery, Chief, DMA Libraries** noted that DMA is undergoing reorganization. The new Customer Service Team (led by Lt. Cmdr. Dianne Edson) is probably the most appropriate current contact for CUAC. While no final decision has been reached, DMA is planning to be merged into a new agency, **NIMA (National Imaging and Mapping Agency)**. Executive authorization is pending. On a positive note, the reorganization has put all DMA libraries under a single head (Ms. Thackery). A new move to encourage the participation of MLS librarians is hoped to enhance DMA's mostly cartographer-base libraries. 170 staff are employed. DMA now has a WWW presence (http://www.dma.gov/) and plans to use it to broaden its accessibility.

As a producer of information, DMA is capable of emergency response activities. An example is the rapid development and distribution of the special Bosnia map. The map was key in supporting deployment of military personnel to the area. Ms. Thackery quickly worked to find answers to the queries made by CUAC regarding the availability of the DCW (Digital Chart of the World) and other products. The following memo begins to answer some of the Council's questions concerning DMA production and distribution practices.

Date: *10 May 1996*
From: *LCDR Dianne Edson, USN*
Defense Mapping Agency
Federal Agencies Customer Support Team
Subject: Response to CUAC Questions

What is the status of the revised Digital Chart of the World? Will it be distributed as part of the Depository Library Program? If not, how might it be obtained?

The revised Digital Chart of the World is called Vector Smart Map (VMAP) level 0. It will be available at the end of September It has not been determined yet if it will be part of the Depository Library Program. It will be available for public sale through the US Geological Survey at a cost of about $140 (final price will be set in July/August).

Has DMA developed an outlook for the future of paper publications? (Will the nautical charts, for example, continue to be distributed in paper?)

DMA is migrating toward producing a database of global geospatial information and services (GGI&S), which will ultimately be queried for specific information by each user. Eventually, a customer will get the information they want and print out the map or chart themselves at whatever scale and size they want. In the meantime, paper products will not go away for awhile.

With respect to electronic products, how will metadata and other useful textual information be stored/disseminated?

Vector format digital products include a "layer" or coverage that contains the metadata. The user can query a point or feature and the metadata will appear in a window. Raster format digital products will have metadata appear in a pull-down menu on request.

How can the Council help to promote access to both paper and electronic DMA products?

The DMA Customer Help Desk can be reached at 1-800-455-0899. This number represents a single point of contact for the general public to ask questions about DMA products and services. DMA also has a Home Page on the World Wide Web: http://www.dma.gov. The Council can disseminate this information to reach a wider audience.

Several products listed in the new DMA newsletter, NAVIGATOR, have not been seen by most cartographic information users. What is their availability to the public?

The NAVIGATOR listed many DMA products. We will review the list for releasibility and method of distribution and provide a consolidated response at a later date.

As information managers, we are concerned about the impact of proliferating electronic publications on general access. As a distribution agency, has DMA formulated a vision of this issue?

As a Combat Support Agency, DMA's primary mission is to provide GGI&S to Department of Defense activities. Any time the public can "bonus off" products we make for the military, we are directed to make those products available. This is subject to classification and release issues. Public sales of our products are handled, by signed Memoranda of Understanding, by the National Ocean Service for aeronautical and nautical products and by USGS for topographic products. We are currently working on agreements with each of these agencies to handle the public sale of digital products once they become available in large quantities. Please address any questions you may have concerning these matters to LCDR Dianne Edson, USN, DMA/OGCF, at (703) 2755749 or via email at EdsonD@dma.gov.

Regarding DCW, it has been renamed Vector Smart Map (VMAP), Level 0. It's depository status is undetermined at this time. It will, however, be sold at $140.00 by USGS and release is expected in September 1996.

The JOG (Joint Operational Graphics) remains in limbo. This title is jointly produced with the cooperation of foreign governments (scale 1:250,000). Efforts to determine its status will be made. Efforts will also be made to determine the status of the 1:250,000-scale PAIGH map series (Pan American Institute for Geography and History).

Awareness of the NAVIGATOR, the new DMA newsletter is not wide among federal information distributors. Its listing of several generally unknown DMA electronic titles has generated questions about availability for general public distribution. This list also includes the former DCW (now Vector Smart Map, or VMAP). We have been promised follow up on our request for information about these items.

Eliot J. Christian, Chief, Data and Information Management, Information Systems Division, US Geological Survey discussed the history and structure of the Government Information Locator Service (GILS). GILS is an Internet locator and a standard for searchable records. GILS records identify public information resources within the Federal Government, describes the information available in these resources, and assists in obtaining the information. They serve as a label to point to the location of information on the Internet. Record production is decentralized at the product development level with a fair amount of openness that does not constrain the way the information is managed or presented and does not constrain how the locator record is structured. The search protocol is key to allowing queries for the various data products across agencies and networks and obtaining reliable results. The flexibility of the GILS standard has precipitated its adoption on the international level with Canada ((http://www.access.gpo.gov/su_docs/gils/gils.htm), Australia (http://kaos.erin.gov.au/general/gils/erin_gils.html), the United Kingdom and Japan adopting GILS along with U.S. federal and state agencies complying at some level.

GILS is available from the GPO Access Home Page or directly at (http://www.access.gpo.gov/su_docs/gils/gils.html).

Mr. Billy Tolar, Federal Geographic Data Committee noted that two of the major activities of the FGDC in implementing the National Spatial Data Infrastructure, which is intended to bring spatial data producers and users together, are the creation of standards and a spatial data clearinghouse. For our discussion Mr. Tolar concentrated on the FGDC Metadata Standard, which documents spatial data sets.

A simple definition of metadata is that information you want to know about someone else's data. Metadata is the information that makes data useful to others. It describes the content, quality, condition and other characteristics of data. Uses of metadata include organizing and maintaining databases, providing information to data catalogs and clearinghouses, and providing information to aid data transfer. What it does not do is provide a means to organize information in a computer system, prescribe the method of transfer, or dictate how the data are presented to the user.

The FGDC has developed Content Standards for Digital Geospatial Metadata Workbook. Mr. Tolar suggests that the Workbook version of the standard is perhaps easiest to use and to comprehend. The standards have been in use for 2 years and are up for review. Mr. Tolar would like to get input from the library community. The standards as well as Mr. Tolar's presentation are available at the following (URL = http://www.fgdc.gov).

The FGDC is also looking for additional nodes on the Clearinghouse. The Clearinghouse function of the FGDC provides a distributed network of geospatial data producers, managers, and users linked electronically. For more information and software see the FGDC website.

Hedy Rossemeisl is the National Mapping Division's new Senior Program Advisor for Data and Information Delivery, replacing Gary North, who has retired. She presented an overview of USGS's web pages (USGS estimates that there are 100,000 agency pages up), indicating that USGS is treating the web as "virtual storefront" or sales points for information. She mentioned that National Water Data Conditions, previously published in an abridged format on a *monthly* basis, is now available complete on the web as is the Geographic Names Information System (GNIS). She was unaware about how this information is being archived.

The U.S. Biological Survey has been absorbed into USGS, and constitutes a Biological Division within the Survey. It was suggested that Depository Libraries should be included as a link on web pages that describe access to USGS products, along with sales information. USGS is discussing print-on-demand capabilities with 3M; it is hoped that this discussion will result in low cost efficient printing in large format from digital products. When asked what "low-cost" meant, Ms. Rossmeisl replied "under $5,000" for a plotter. The indexes and map inventory will be online soon.

When asked whether, with all this digital emphasis, there was any focus on paper, Ms. Rossmeisl replied that USGS was still planning to support the paper products. She said that 7.5-minute topographic series quadrangles would continue, and that DRGs will NOT be the only way libraries will re-

ceive data. DRGs are considered to be a one-shot deal USGS has made no plans for updating them. All of them will be available on the Internet within a year. The CD-ROM will also be available for distribution. It is recognized that current DRGs are fine for backdrops, but not necessarily the best resolution for print-on-demand or GIS manipulation.

The *Global Land Information System* (GLIS) includes access to indexing of Landsat data, including online ordering capabilities. The question of quad name changes that are reflected on indexes but for which no map has yet been produced was raised but not answered. The status of Professional Paper 1200 and the currency of GNIS updating were also raised as topics, but not answered. Jim O'Donnell will continue to work on both questions.

It was proposed that CUAC take a position on paper and digital accessibility. CUAC discussed dual format distribution for the near future. Many libraries cannot afford the computer and printing equipment necessary to handle large data sets such as the *DRGs*.

Paper distribution through the DLP and web access to digital formats may circumvent the strict interpretation of dual distribution. USGS plans to make all of its data available for free in the Spatial Data Transfer Standard (SDTS), and to charge for data in other formats (such as ARC/INFO). Digital Elevation Models are on track to be available/distributed in this way. A request was made that Alaska and Antarctica indexes be updated. Currently there is no index to Alaska 7.5' quads.

Joel Morrison, Chief, Geography Division, U.S. Bureau of the Census, addressed issues dealing with the move to increased use of electronic formats and the elimination of most published reports. Planning is well under way for Census 2000, so questions or concerns should be directed to the Bureau of the Census as soon as possible.

For Census 2000, the Bureau of the Census proposes to:

- Make every effort—from simpler, user-friendly forms to the design of field operations—to count every household.
- Implement an open process that diverse groups and interests can understand and support.
- Eliminate the "differential undercount" of racial and ethnic groups.
- Produce a "one-number census" that is right the first time and that unites us as a Nation rather than dividing us as litigants.

Among the strategies to achieve these goals:

- Build partnerships
- Keep it simple
- Use technology intelligently
- Use statistical methods

Data collected in Census 2000 will be designed to display with the appropriate map so that users will be able to easily locate Census geographical units. Census 2000 could be the last attempt to count every person in the country as part of a snapshot. Population counts may become obsolete. The American Community Survey, beginning in 1999, will replace the long form questions of the decennial census by using sample data. Redistricting by 2010 might be compiled by the Bureau based on the administrative records of a variety of agencies.

The Census will compare the 120,000,000 addresses in its master file with local governments' lists before the counts are made. About 39,000 local jurisdictions were sent requests to update their data. For Census 2000, the Bureau will initiate a new strategy: instead of controlling the number of forms to prevent duplicate counting, the country will be blanketed with forms, e.g., forms mailed to residences and distributed in malls. Statistical methods will be used to eliminate duplicate responses. Completed paper forms will be handled once, scanned, shredded, and destroyed, and images will be stored. Forms will be collected in localities until 90% have responded and an additional 9% will be extrapolated from follow up survey results. Postcards will be sent to all addresses notifying the residents of the form to come. Following the form, another postcard will be sent as a reminder. If there is no response, a second form may be sent and the resident reminded by telephone. The idea is to greatly reduce the need for enumerators in the field.

The Census has sought input from data users, who have strongly urged the Bureau to make historical data accessible online for comparison purposes. The Bureau acknowledges that many users want to compare data from several decennial censuses (e.g., 1980-2000) and to this, access to at least twenty years of historical data will be required. The Bureau will separate its collection and tabulation functions. This separation is intended to facilitate cost-efficient data collection and to make comparable tabulations possible.

The Census is employing technology to improve its work. Database models, e.g., TIGER/line files, will gradually improved through use of Global Positioning System (GPS) technology. Not every address will be plotted using GPS for Census 2000 as there is no budget to upgrade the TIGER. TIGER/line files will be updated as the collateral effect of other data collection efforts. The Bureau is working to design second and third generation database models and sees TIGER as a 1980s database built on 1970s concepts. The Census sees promise in its prototype ORACLE relational database, which might be easy to use with GIS programs such as ArcInfo. It is also working to make its own internal database object oriented while protecting

confidential information with a firewall.

Many familiar printed reports will be eliminated in favor of low cost or free customized reports. Updates may be entered as other data is gathered as a collateral effect. It has been announced that Census 2000 will only be available electronically, but it is possible that there may be a few printed reports. Data will be made available through the Data Access and Dissemination System (DADS). Mr. Morrison indicated that one concept in development would allow users to draw a polygon and to get demographics for the area described.

Census 2000 will allow separate tabulations. For example, Indian nations whose territory crosses state lines will receive tabulation for their entire area and will not have to add values for the various states as in the past. Census 2000 will be distributed in pre-defined products, simple user-defined products, and complex user-defined products. Census plans to make available a retail products CD-ROM containing 1990 Census data and software for under $100 to encourage users to learn simple mapping techniques. Later, these users might download data from the Internet.

Other points mentioned by Mr. Morrison include the use of the Internet for a variety of tasks, including promotion, market research, custom product generation, and online ordering (among others). Geography will be the integrating factor, and confidential personal data will be protected. The Bureau of the Census is concerned with data integrity, metadata, documentation, and standards. The Bureau is responsible for gathering data used by other federal agencies, and has an interest in cost recovery.

Fred Anderson, Chief of the Distribution Division of National Ocean Survey was the last presenter of the day. He was accompanied by **Sharon Kemp, Chief of the Inventory Management Group**, which is responsible for providing NOS products to GPO for distribution to depository libraries. Mr. Anderson described the organization of the National Ocean Survey (NOS) and possible future changes. These may include moving aeronautical charting to the Federal Aviation Administration (FAA) and combining the Coast Survey and the National Geodetic Survey as a quasi-governmental corporation. If aeronautical charting is not moved to the FAA, it would be added to the corporation. Noting the size and complexity of the National Oceanographic and Atmospheric Administration (NOAA) and the number of products released by various sections of the agency, Mr. Anderson suggested that CUAC develop additional contacts within the NOAA.

Carol Beaver, Director of the Office of Aeronautical Charting and Cartographic, has retired. Terry Faydon, Captain in the NOAA Corps is acting Director. The following items have been discontinued from the Depository Library Program: Airport Obstruction Charts and Obstruction Data Sheets. (Item 0192-A-02) These charts that were produced for the FAA and NOS received a waiver to discontinue them from the Depository Library Program as a cost saving measure.

Tide and Tidal Current Tables (Items 0190-91, 0196-99). These have been cut due to a halt in funding. NOS is producing a $90 CD-ROM with the data in postscript format. This has been purchased by two commercial firms who are publishing books to replace the NOS publications. NOS is also providing 3 day tide information on the World Wide Web.

Bathymetric Map Products (Item 0191-B-17). These were discontinued due to lack of funding. They will be reproduced and sold by the national Geophysical Data Center.

New Items in the Depository Library Program:

- Atlanta Olympics Helicopter Route Chart (Item 0192-A-14). After the Olympics, a new edition will be produced without the Olympics information.
- Dallas-Fort Worth Helicopter Route Chart (Item 0192-A-14). Planned for October 1996.
- Aeronautical Chart User's Guide (Item 0193-B). Shipped about a year ago.
- NOS Catalogs of DMA Nautical Products (Item 0378-E-11). 9 volumes of DMA Nautical Products available for public sale from NOS.
- NOS Catalog of DMA Aeronautical Products (Item 0378-E-08) DMA Aeronautical products available for public sale from NOS.

Changes to the items in the Depository Library Program:

- IFR/VFR Low Altitude Planning Chart (Item 0192-A-08). Replaces IFR/VFR Wall Planning Chart and the Flight Case Planning Chart.
- U.S. Terminal Procedures Publications. Effective with the April 25, 1996 edition, this will be published in both loose-leaf and glue bound editions. The Depository Libraries will receive the glue bound edition.

The two day Cartographic Users Advisory Council meeting went beyond the discussions with representatives of map producing agencies. In the course of the meeting, CUAC members prepared guidelines for the increased hardware and software requirements necessary to utilize some of the spatial data now being distributed through the Federal Depository Library Program. CUAC members were concerned that the newly announced guidelines for public access work stations in Federal De-

pository Libraries were unrealistic for the demands of electronic spatial data. CUAC's recommendations, compiled by members Donna Koepp and Melissa Lamont, were sent to Gil Baldwin, Chief, Library Division, U.S. Government Printing Office (GPO) and have since been published in the Administrative Notes, the Federal Depository Library Program's newsletter, as "Spatial Data Supplement to Recommended Minimum Specifications for Public Access Work Stations in Federal Depository Libraries." (Administrative Notes, v.17-#08-06/15/96, p.14-15. ❑

FREE LIBRARY of PHILADELPHIA MAP COLLECTION

by Richard Boardman
Free Library of Philadelphia
Maps Librarian
(215) 686-5397

The Map Collection of the Free Library of Philadelphia houses the most comprehensive collection of maps and geographically related reference sources in the Philadelphia area. Within the collection can be found over 130,000 current and historical maps covering every area of the world, hundreds of reference sources in the fields of cartography, cartobibliography, geography, history, place names and map librarianship, and a collection of city plans worldwide.

Because the Map Collection is contained within a large public library, our patrons constitute a diverse group of users. Over the course of a year, the collection is used by students (mostly undergraduate and graduate), architects, city planners, urban historians, genealogists, hikers, travelers, businesses of various types, lawyers and others. One particular group, environmental consultants, has made increasing use of the collection over the past few years.

Current regulations place responsibility for environmental violations with the property owner of record. Because of this designated responsibility, current and potential property owners must demonstrate that they have performed "due diligence" in investigating past use of their property for potential environmental hazards (the vast majority of these investigations involve commercial property). Because most commercial property transactions involve a lending institution, they are often the agent for the investigation. Banks typically contract the site analysis to a local environmental consulting firm.

The Map Collection, over the past few years, has made a deliberate effort to provide a wide variety of cartographic resources for those firms performing the site surveys. Much of the material used has been acquired over the years while additional resources have been purchased to further expand our holdings in this area. At this point in time, the Free Library has become known as the cartographic resource location for environmental consultants performing site surveys in the Philadelphia metropolitan area.

A typical historical site survey may involve a variety of materials. Sanborn Fire Insurance maps are almost always consulted (both current and older editions). Even earlier city, county and regional real estate atlases may also be searched. Historical industrial site plans and land use maps have also proven to be very useful. Contemporary and back-date aerial photographs have become an integral part of site investigations and our coverage is expanding as the need grows. To round out the site analysis, flood, wetlands, geology and hydrology maps are often viewed.

In the future, the Map Collection hopes to expand its geographic coverage for these resources as the need arises. We also hope to work with this constituency to obtain new reproduction equipment which in turn will enable us to serve them even better. The collection is open 9:00 A. M.-5:00 P. M., Monday through Friday. ❑

ILLINOIS STATE UNIVERSITY MAP COLLECTION

by Vanette Schwartz
Milner Library
Illinois State University
(309) 438-3486

When you live in a town called Normal, people just cannot resist making jokes or asking silly questions. Is Normal a real place? Are the people there really normal? Is anything there abnormal? Must be a dull place — everything is normal! One thing in Normal, however, that is definitely not normal is the Illinois State University Map Collection.

Illinois State University is a campus of about 19,300 students; approximately 85% are undergraduates and 15% are graduate students. The university is served by one main library; the current library facility was built in 1976. Milner Library's public service areas include the General Reference and Documents division along with four subject divisions, Humanities, Sciences, Social Sciences, and Education.

The Map Collection is housed in the Social Sciences division on the fourth floor of the library. Reference service for the collection is provided at the Social Science reference desk, adjacent to the collection. Additional maps in microform and on compact disk are held in the government documents collection on the second floor of

Milner Library. The collection provides support for a variety of academic programs, including undergraduate majors in geography and geology and a specialized master's degree program in geohydrology. In addition the collection serves local and regional business users, as well as the research and travel interests of students and members of the community.

Milner's Map Collection is a very large paper collection, containing about 400,000 items. The collection was developed over a period of some 25 years by William W. (Bill) Easton, who was the first map librarian at Milner. Until his retirement in 1989, Bill was often a colorful figure at meetings of map librarians.

U.S. and Canadian topographic maps are the main strength of the collection. Topographic sheets are collected for every state, with the major emphasis being on Illinois and the Midwest. The Map Collection is also a depository for Canadian maps, and a sizable part of the collection is Canadian topographic sheets. Due to Bill Easton's interest in and travels to Australia, the collection also contains many Australian topographic maps.

Another area of strength is atlases. In addition to general world atlases, major atlases are held for many individual countries. Selected historical atlases are included as well as specialized local area and county atlases. A CD-ROM workstation with electronic atlases is also available. Plat books for each of the 102 counties in Illinois are held in a special area of the Map Collection. Paper copies of plat books are held from the late 1950's to the present. Earlier editions of county atlases and plat books are held on microfilm with county histories from the 1880's through the early 1900's.

The Map Collection also includes many aerial photos, primarily for counties in central Illinois. Most Illinois aerial photos date from the 1940's, 50's and 60's, with later photos available for the local area. Aerial photos from some counties in Kentucky, Ohio and Pennsylvania are also available. State and city maps comprise another area of the Map Collection. Road maps are held for each state in the U.S. and the Canadian provinces. City maps are collected for most major cities in the U.S. and around the world; maps of smaller cities, primarily in Illinois, are also available.

Although located in Normal, the Map Collection at Illinois State University is far from normal in size or content. It is rather a unique and rich source of many different types of cartographic materials for students, faculty and the public at large. ❑

UNIVERSITY OF ARIZONA LIBRARY

by Christine Kollen
University of Arizona Library
(520) 621-2597

There have been numerous changes at the *University of Arizona Library* the past three years. In October 1993, the Library officially moved to a new organizational structure which was the result of a 19 month review of its structure. This review was precipitated by several factors including continual state budget problems and serials inflation, implementation of the Library's integrated information system, changing information technology, and the recent arrival of Carla Stoffle, Dean of Libraries. One of the assumptions influencing the re-design was that the Library would be structured to allow greater flexibility in staffing. There were insufficient staff to work on the front lines and this was critical in the shift to a customer focus. As a result, several service points (both reference and circulation) were combined in order to better serve the Library's customers. Reference service for cartographic materials is now provided at both the Main and Science-Engineering reference desks. All staff who work on these desks have been trained to provide basic reference service for cartographic materials. In-depth reference assistance is still handled by subject specialists.

About one year ago, the *Map Collection* and *Media Center* areas were remodelled. The entire area was opened up and a combined Maps, Media, and Reserve Book Room circulation desk and security gate were installed. The staff in this area, called Short Term Circulation, can assist customers in finding an item if they know the call number, title or author. If they need additional assistance, they need to go to either the Main or Science-Engineering reference desk. In addition, my office is still in the Map Collection and customers can stop by for consultation.

Last month we began our Geographic Information Systems (GIS) service. We have one computer in Main reference dedicated to GIS. This computer has ESRI's ArcView software loaded and provides access to the TIGER files and Census data. We've created several pre-designed maps that show African-American, Hispanic, and Asian-American populations in Tucson and Arizona and also Education and Income for Tucson and Arizona. These pre-designed maps are available to anyone walking up to the computer. Each pre-designed map has an icon associated with it so a person can click on an icon and bring up a map for manipulation and printing. At the computer, we've provided basic information on GIS, ArcView, and our GIS service and instructions on how to manipulate and print the pre-designed maps. If customers are interested in a different geographic area or different social or economic data, then they need to make an

appointment with one of the Library's GIS specialists. Soon we will be providing access to spatial data sets in Arc/Info format that have been produced on campus in the College of Agriculture. These data sets will be accessed through the campus network and viewed at the GIS computer using ArcView. In addition, there will be another GIS computer installed in the Science-Engineering reference area that will have ArcView software loaded and provide access to science related spatial data. ❑

reviews

BOOK REVIEW

How to Lie With Maps, 2nd ed.
Mark Monmonier, University of Chicago Press, 1996, xiii and 207 pp., references, appendix, index. $36.00 hardback (ISBN 0-226-53420-0); $14.95 paper. (ISBN 0-226-53421-9)

Reviewed by Karen M. Trifonoff
Department of Geography and Earth Science
Bloomsburg University
Bloomsburg, PA 17815

Spatial information abounds in today's world. We are bombarded with maps in all settings; in school, at work, at home and at play. Everything from political upheavals to weather phenomena such as hurricanes and tornadoes call for maps to explain, clarify and illustrate the event. Personal computers come with atlases as part of the software bundle and desktop mapping is commonplace in business and industry. Tourist centers have touch screen multimedia presentations with regional and local directional maps designed to guide the viewer to the desired location. Yet, this information can easily be manipulated and twisted to fit the ends of the map maker at the expense of the map user.

The naiveté map reader, however, can be educated and entertained by reading Mark Monmonier's second edition of *How to Lie With Maps*, which familiarizes map users with the problems and pitfalls that can occur when creating or using a map. It is not a volume to instruct in cartographic methods, but rather one to raise the reader's awareness of the cartographic process. It is an engaging volume written in a casual style for the general public. The second edition has thirteen chapters including brief introductory and epilogue chapters, an appendix on latitude and longitude, a list of references and an index. One change from the first edition is an expanded chapter on color with a series of new color plates. Other additions include a forward by Harm DeBlij, a chapter on mapping bureaucracy focusing on the United States Geological Survey and a chapter on the use of maps in multimedia presentations.

The informal yet informational style of the brief introductory chapter sets the tone for the volume and elaborates on the central theme: that all maps must tell little white lies because they are scale models of a three-dimensional object on a two-dimensional surface. This challenges any preconceived ideas the map reader may have about the authenticity of most maps and encourages the reader to develop a new perspective on maps. The next two chapters on map elements and generalization bring the reader up to speed on many of the basic principles of cartography: map projections, symbolization, visual variables, generalization of point, line and area symbols and data classification.

The core of the volume, however, lies in the following five chapters dealing with mistakes that can occur on maps, both intentional and unintentional. Chapter Four, 'Blunders that Mislead', reinforces the idea that generalization and selection cause maps to tell lies. Therefore the caveat *map user beware* should preface many maps. Specific chapters on the use of maps in advertising, planning, politics and the military contain information on potential mapping problems that can arise in each area. These chapters will be of interest to specialists in each field and give historical perspective to the development of mapping. There are also suggestions for how one might influence local government officials through communicatively effective maps. For example, Chapter 6, 'Development Maps (or How to Seduce the Town Board)' provides an instance of how a property owner could use maps to demonstrate how a new planned tax assessment is too high.

Chapter 9, 'Large-Scale Mapping, Culture, and the National Interest', is new to the second edition. It introduces the reader to mapping in bureaucracies, specifically the United States Geological Survey. The Survey originated in 1879 as part of a project to map public lands west of the 100th meridian. This mapping survey was mainly performed by those trained in mapping at military academies, and thus the definitions of features included on the maps reflect this connection. For example, the author notes that including green tint on topographic maps was originally for military purposes. For instance, the definition of a woodland was defined as, "an area of normally dry land containing tree cover or brush that is potential tree cover...[that is] dense enough to provide cover for troops." Other issues addressed in this chapter include the problems associated with the development of standards and specifications for a map series (such as 7.5 minute quadrangles),

developing a set of uniform map symbols for a specific scale, including politically correct names, and designing appropriate fonts and symbols. Comparison of symbols used in the United States and other countries is also addressed.

The discussion of classification begun in Chapter Three is continued in Chapter Ten, 'Data Maps: Making Nonsense of the Census.' This chapter gives clear examples of how data classification and areal aggregation can affect geographic pattern. Classification of choropleth maps with equal intervals, quantiles and natural breaks is logically discussed and clearly illustrated. The use of a number line to investigate the nature of the distribution is one technique or method of examining the data that might not occur to novice map users. The reader is urged to be aware that any map is the result of a series of choices regarding classification, aggregation and symbolization. Therefore, any map is just one of many maps that could have been made. Changing the choices will change the look and message of the finished product.

Color plates have been added to the expanded chapter entitled 'Color: Attraction and Distraction.' Information on additive and subtractive primaries and differences between emitted and reflected light expand the reader's understanding of how color works. Plate Seven contains a color version of a map included in the political propaganda chapter (Chapter 7). By showing the location of a proposed incinerator with concentric circles of red shading from dark to light, the reader is provided with a vivid image of the incinerator's impact on the surrounding area. Comparison of the color map with the same map in black and white provides a clear example of the effective use of color. Equally impressive are the contrasting hues to show qualitative differences on Plate Four, the color sequences for choropleth maps on Plate 6 and an illustration showing simultaneous contrast on Plate Ten.

Another new chapter, 'Multimedia, Experential Maps, and Graphic Scripts' is timely, given the recent proliferation of interactive computer presentations. Through an example of a hypothetical statistical business mapping program the reader is guided through a series of choices in order to obtain a finished map product. Options under the map user's control are the choice of variable, geographic area, time period, and display options including number of classes and colors. Control of the map is thus shared by the mapmaker and map user, with the mapmaker setting the limits or choices the map user is given. The author encourages the map user to be aware of a program's limitations in handling map data, to ask questions, be curious, and try a variety of options to get at the underlying meaning of the data.

A major strength of Monmonier's book are the excellent examples in the planning, advertising, political and military chapters. In particular, the advertising chapter has a light tone with clear examples and perhaps some new ideas for those working in this field. The attempt to appeal to a broad base of professionals and people with varying interests and backgrounds should be applauded. The use of the color plates in the second edition greatly enhances the color chapter, at the cost of slightly increasing its price. Another welcome change from the first edition is an expanded bibliography that breaks down sources for each chapter. The list includes many volumes readily accessible in larger public libraries and journals available in most university libraries. The index is very useful and complete.

There are only a few minor editorial problems within the volume. First, the chapter summaries tend to be somewhat uneven. For example, Chapter Six, 'Development Maps', gives a clear, concise summary paragraph, but in Chapter Four, 'Blunders that Mislead' there is only a ending discussion of a figure. Second, some re-organization might improve the content structure. For instance, the two and one-half page appendix on latitude and longitude is short enough to be included in Chapter Two with little disruption to the flow of thoughts in that chapter. Chapter Ten also might be better placed following the chapter on generalization as it expands on classification ideas introduced in Chapter Three. Third, some of the figures, particularly in Chapter 9, have been reduced to a point where their effectiveness is diminished. A series of four topographic maps in Figure 9.7 designed to illustrate an interesting anecdote on the appearance and disappearance of a railroad through four different editions of the same quadrangle, are illegible. As it stands now, the black contour lines dominate the maps and identification of cultural features, such as the railroad in question, are impossible to distinguish. This story would benefit from clearer illustration, either through enlargement or the addition of color. Fourth, the addition of the color plates is generally effective, but unfortunately, the printing process has generated a purple color instead of blue. The text refers to a sequence of blues and the plate clearly shows a series of purple colors. The double ended hue plan is to show red at one end and blue at the other and instead it is red and purple. The problem is one of minor inconsistency between the text and the plates and should be corrected for future printing runs. Finally, one missing item that would be useful is a glossary. Many words are italicized when first used in the text, but these should be placed in a glossary, for the benefit of the cartographic novice. All of these prob-

lems are all minor and will not distract the average reader nor diminish the books effectiveness.

In his introductory chapter Monmonier includes a statement of purpose: "This book's principal goal is to dispel this cartographic mystique and promote a more informed use of maps based upon an understanding and appreciation of their flexibility as a medium of communication." The author has more than succeeded in achieving this goal. *How To Lie With Maps*, despite its somewhat cynical tone, is a positive contribution to cartographic literature. It can be used as a review volume for cartography students, who tend to enjoy the relaxed, conversational style. The discussion of visual variables in Chapter Three, for example, is a clear and concise summary that provides a good review. This will hopefully encourage students to be aware of map blunders and to be more critical in their interpretation and evaluation of maps. It should also be a required volume for planners, business professionals, advertisers and others creating maps for the general public.

Monmonier is to be applauded once again for raising the cartographic consciousness of the general public. DeBlij's closing comments in the forward concisely sum up the book: "This fascinating volume deals with such serious issues in a lively, often humorous, always engrossing way. Read it, and the maps you view henceforth will have new meaning." ❑

ATLAS/SOFTWARE REVIEW

Atlas de Suelos de la Republica Argentina. Aeroterra S.A. Buenos Aires: Fundación ArgenINTA, Instituto Nacional de Tecnología Agropecuaria, 1995. Atlas can be purchased from WBA Trading Limited, Inc., P.O. Box 2501, Kensington, MD 20981-2501 ($200). System Requirements: CD-ROM drive, IBM DOS format, Windows 3.0, PC 386, 4 MB RAM.

Reviewed by: Nicholas Dunning, Department of Geography, University of Cincinnati, Cincinnati, OH 45221-0131

The CD-ROM Soils Atlas of Argentina is the result of a cooperative effort between a government office, the National Institute of Agricultural Technology (INTA), and a private company, Aeroterra S.A. This effort was led by Carlos Scoppa and Gustavo Macarini of INTA, and Carlos Viola and Omar Baleani of Aeroterra S.A. The CD-ROM atlas was produced by digitizing and updating information from the book form of the *Atlas de Suelos de la Republica Argentina* published by INTA in 1985. This task involved digitizing 1:500,000 and 1:1,000,000 scale soils data and adjusting the information to the Gauss Kruger Coordinate System, Zone 3. However, a tremendous amount of useful ancillary data was also been added to the CD-ROM atlas that significantly increases its utility.

The digitized soil maps have been subdivided by provinces and can be called up either at the national or provincial scale. The associated soils database contains 31 information fields. These fields include Soils Cartographic Units and the Orders, Suborders, and principle components of Groups which comprise these units. These categories correspond to the USDA Comprehensive Soil Taxonomic System which is now being adopted in Argentina and worldwide. A corresponding image file (in a separate subdirectory) contains photographs of both contextual landscapes and soil profiles for most of the soil orders. Other information fields include principle, secondary, and tertiary limitations of the soil units, and a productivity index of the soil units. Information is also given for the drainage, hydric characteristics, fluvial erosivity, eolian erosivity, slope, salinity, sodicity, and superficial and subhorizon textures of the principle components of the soil groups.

In addition to the cartographic soil data and associated soil data base, the atlas contains a wealth of related data. Supplemental physical geographic information includes topography (300 meter contours), hydrography (principle water courses), subterranean groundwater basins, and various types of climatic data (Koeppen climate types, mean annual temperature, minimum and maximum average temperature, mean annual precipitation, average mean humidity, and average atmospheric pressure). These data are in both cartographic and tabular form. In a separate subdirectory national coverage of LANDSAT 5 imagery is included. LANDSAT TM images are also contained in this subdirectory, but only of selected areas. Additonally, the atlas incorporates cartographic and tabular data on political divisions, population centers, highways, railways, and airports.

Supporting textual information is supplied in a separate subdirectory. The text includes information on the creation and use of the atlas, data sources, and descriptive and analytical data on Argentine soils.

The principal utility of the atlas is its flexibilty in data manipulation and combination. For example, one can easily overlay a national or provincial soil map with isoline data on topography, temperature, or precipitation to quickly portray the effects of these variables on the spatial variability of soil development. A user can then easily call up images of the landscapes and profiles associated with these soils and corresponding textual information.

The atlas includes a spanish language version of ArcView 1.0 which allows any user simple access. However, users with ArcView 2.0 or higher can directly import the CD-ROM data. This reviewer easily perused the atlas using ArcView 2.1 which offers significant improvements in efficiency over the included 1.0 version.

The principal limitation of this atlas is one of scale. Data are derived from sources at 1:500,000 or 1:1,000,000 scales and in many cases have been generalized even further during digitization. Users are limited to rather coarse portrayals of data at either a national or provincial level. Therefore one cannot examine such critical relationships as soils and land use except in a highly limited and rudimentary fashion.

The atlas is also not without some data problems. For example, in some cases where multiple images of certain soils are indicated in the index and text only a single image can be called up under various headings.

On the whole, this atlas offers a comprehensive overview of the distribution of soils in Argentina. The inclusion of both soils and a wide variety of other data, and the relative ease with which these data can be combined increase the utility of the atlas as a research and teaching tool. This atlas should be of interest to anyone with an interest in the influence of important soil forming factors on the spatial variation of soil development or the influence of soils on human spatial patterns. The atlas should also be of interest to scholars and students of Argentina and Latin America in general. ❑

ATLAS/SOFTWARE REVIEW

Atlas Estadistico Republica Argentina. Instituto Nacional De Estadistica Y Census. Buenos Aires: Aeroterra S.A., 1995. 300 pp., 141 maps, $250 (both the book and CD-ROM). The book can only be purchased with the CD-ROM, but the CD-ROM can be purchased separately ($200). Atlas can be purchased from WBA Trading Limited, Inc., P.O. Box 2501, Kensington, MD 20981-2501, fax (301) 984-9323, email (wbrooner@cais.com)

System Requirements: PC 386 or higher, Windows 3.0 or 3.11, 4MB RAM (8MB recommended), 12MB disk space to install software (additional 250MB disk space for database if desired, or may be accessed from CD-ROM), color monitor, CD-ROM drive. The CD ROM includes Arcview 1.0 (in Spanish) to allow simple user access; users with ArcView 2.0 or higher can directly import the CD-ROM data.

Reviewed by
Robert South
Department of Geography
University of Cincinnati

The *Statistical Atlas of Argentina* is a compendium of data presented in a colorful series of thematically arranged maps. The Atlas is organized in three parts: (1) an introductory series of maps devoted to national characteristics, (2) a more detailed presentation of demographic and social indices, and (3) economic data. All of the maps in the Atlas (141 maps) are national outline maps printed page size (approximately 8 1/2" X 12"), and with the exception of the introductory series, are accompanied by a preceding page of explanatory text.

The introductory section of the *Statistical Atlas of Argentina* is an overview of national characteristics. There are eleven maps in this section, and appropriately the first map is a political map of Argentina by province. This is followed by several physical maps: morphology, vegetation, climate, mean temperature, and major river systems. The later part of this introductory section is devoted to transportation-networks: airports, the railroad system, pipelines, and major highways.

Part Two of the Atlas presents a series of maps (62) on demographic and social statistics. This section is introduced by several pages of text that primarily discusses population growth and historic trends including immigration. National census population data 1895-1991 are presented in a table as well as a graph depicting population growth by region. Most of the maps provide a detailed spatial presentation of demographic data and social indices. Each map is accompanied by a preceding page of text which highlights and summarizes the mapped data. There are eleven thematic sections in this part of the Atlas. The first set of maps is devoted to a variety of population themes (14 maps) as exemplified by population density, percent urban population, and birth & death rates. This set is followed in order by thematic maps on households (percent households headed by women, for example), education, health, employment, housing (percent housing connected to public water supply), social issues (percent population sixty years and older receiving pensions), leisure activities (density of video stores and libraries by province), and tourism-principal tourist destinations.

The third and largest section of the Atlas consists of 68 maps devoted to economic topics. The section is prefaced with several pages of statistical tables and text on national economic indices pertaining

to gross internal product (PBI), public sector expenditures, and imports-exports. The first set of thematic maps consists of mapped agricultural data and comprises the most comprehensive series of maps in the Atlas devoted to one topic (30 maps). With few exceptions most of the agricultural maps are choropleth maps with superimposed proportional circles which accentuates spatial patterns. This series is introduced with several maps on the agricultural sector-number of operating farms, total acreage planted, total pasture land-followed with maps of specific agricultural products—wheat, corn, sunflowers, cattle as well as other agriculture topics (number of tractors, for example).

Following agriculture are maps on mineral production and industry. Argentina is generally considered one of the "newly" industrialized nations and the importance of this theme is reflected in the numbers of maps (22 maps on industry). Mineral production includes maps on metal and nonmetal production by value, and semiprecious stones. Maps on the secondary sector include oil and gas production and reserves, manufacturing and manufactured products (wood, paper, publishing,). The remaining maps in this series comprise an eclectic group of economic themes: energy, commerce and services, communications, public finance, and exports by province (in percent).

The *Statistical Atlas of Argentina* provides an overview of considerable statistical data mapped at a national scale. Particularly useful as a general reference is the introductory series: political, physical, and transportation maps. The Atlas is well organized by subject area and related themes are color referenced. With the exception of the introductory series nearly all the maps are choropleth maps, and the selection of color to denote spatial intensity of activity in all the maps is quite pleasing.

Detail in a map depends upon scale, however, and for many of the thematic maps in the Atlas this presents a problem. All of the maps use the same outline of Argentina, but much of the data is mapped by province as opposed to more detailed administrative or geographic units (departments),undoubtedly a result of data availability. Of the 141 maps in the Atlas, ninety-two(62 percent) are national maps by province, but only the most generalized information can be gleaned from mapped data at this scale. Most of the maps at a more detailed unit scale are on two topics: population (10 maps) and agriculture (23 maps). Thus, this series presents not only the most information, but is also the most comprehensive in terms of number of maps devoted to one topic. Particularly noteworthy are maps on population density by department with a detailed inset of the federal capitol (Buenos Aires, p. 23), and a series of colorful crop maps: wheat production on the Pampas and soybeans along the Parana (pp. 173-177).

Additional information is provided on the agricultural maps by the interesting use of proportional circles and dots superimposed upon the choropleth pattern. For example, a choropleth map of sheep production depicts average number of herds for sheep by department, and superimposed on each department is a proportional circle depicting number of sheep (p. 187). It would be helpful, however, if the Atlas contained an index map of departments by name. It should be noted that all maps have the primary source of data noted, thus for any serious researcher, the search for more detailed information has been greatly facilitated.

The *Statistical Atlas of Argentina* provides a wealth of geographic information on Argentina. The Atlas comprises a particularly useful set of maps on general features followed by 130 thematic maps grouped into nineteen topical areas. This Atlas contains maps on everything from literacy rates to sunflowers. While detail may be lacking for many subject areas, the breadth of mapped information is impressive. Many thematic maps, however, included were probably selected because of data availability rather than relevancy of the subject. Nevertheless, the Atlas will be a useful reference for a diverse readership seeking information on a variety of topics. The highlight of this statistical Atlas is the series of maps on Argentine agriculture, impressive not only for the breadth of coverage but also scale of presentation.

Editor's Note: William (Bill) Brooner, of WBA Trading Limited, requested that additional information about the *Atlas Estadistico Republica Argentina* be provided for readers interested in the CD. The following is the excerpt that Mr. Brooner provided:

The *Atlas Estadistico Republica Argentina* is the first publication by the Instituto Nacional de Estadistica y Censos (INDEC) which presents their statistical data base with its corresponding geographic reference for each province and Department of Argentina.

The Atlas Estadistico includes a printed publication(reviewed by Professor South), digital data on the CD-ROM, and ArcView 1.0 which permits use of the database to analyze and generate additional regional thematic maps. The CD-ROM contains not only the geographic view presented in the publication, but also all of the cartographic and tabular data necessary to generate new maps according to user-defined criteria through ArcView 1.0 (included on th CD-ROM) or any upgraded versions of ArcView. It also contains a data manager for exporting information

and analyzing tabular statistical data.

The CD-ROM contains three graphical interfaces which facilitate use of the data base: display maps at departmental, provincial or national levels; consult tabular information in customized EXCEL tables; and view detailed commentaries on any of the displayed information.

Installation and operating instructions for the CD-ROM are presented in the Atlas. The CD-ROM contains all of the mapped data, at departmental and provincial levels which have been aggregated to national level in the published Atlas, along with the statistical (attribute) data in customized EXCEL tables. The CD-ROM also contains eight Landsat TM and NOAA sateliite images which are not published in the printed edition.

With the digital data users can realize the flexibility and ease of creating new thematic maps, from department to national level through overlaying, combining, and analyzing any of the georeferenced social, demographic, economic, or other data contained in the Atlas Estadistico using ArcView. In addition, the georeferenced data in the Atlas Estadistico may be registered and combined with any of the georeferenced data contained on the Atlas de Suelos de la Republica Argentina.

Readers seeking more information on this CD can check ESRI's home page under products and solutions: http://www.esri.com/base/data/catalog/wba/wba_des.html ❑

SOFTWARE REVIEW

Geoscope
Version tested: 1.0, US$150. From LMSOFT, 1280 Bernard St. W., Suite 401, Outremont, Québec H2V 1V9, Canada. Phone: (514) 948-1000. Fax: (514) 948-0511. e-mail:info@lmsoft.ca

Reviewed by Mark D. Schwartz
Department of Geography
University of Wisconsin-Milwaukee

System Requirements: The program will run on a PC with a 286 or better processor (640KB or more RAM for minimal operation, 1.4 MB RAM or more for optimal operation), VGA graphics adapter, 40 Mb hard disk (7-8.2 MB free), Microsoft-compatible mouse, and CD-ROM drive (ISO 9660). The evaluation was done on a Gateway Pentium 133-MHZ system, with 32 MB of memory, and a Matrox MGA Millennium video card with 2 MB WRAM.

System Considerations: It is important to underscore that this program was written for the DOS environment. I found it rather quaint to be back working with a program that was designed for DOS (i.e. works with less than 2MB RAM), yet also interesting to discover it also uses a CD-ROM drive. Although these minimum standards may allow it to run on older pc's, the DOS environment does impose considerable restrictions on access speed. For example, it took several minutes to load an image file from the regional data CD-ROM. Once I got used to these serious limitations, I found that the program had a lot to offer. Program flow control is almost exclusively *point and click*, and the graphics are surprisingly good for this constrained situation. Nevertheless, I do not recommend running this program under any version of Windows, but in DOS alone (a big problem if you have already converted to Windows 95). I tried running it from an icon in Windows for Workgroups version 3.11 and kept getting general protection faults.

Software Support: The software and a 12 minute video which describes it can be obtained from: Maxine Leverett, Educational Technology Rep., Addison-Wesley Publishers, P.O. Box 580, 26 Prince Andrew Place, Don Mills, Ontario M3C 2T8, Canada. Phone: (416) 447-5101. Fax: (416) 447-7755. E-mail: maxinel@aw.com (There may be other sources for obtaining the software as well, but this reviewer is not aware of them.)

Geoscope defines itself as an *Interactive Global Change Encyclopedia*, since it allows the user interactive access to various images, text, tabular data, and diagrams. The program starts on the premise that you are arriving back at planet Earth from an extended stellar voyage, and dock with the orbiting Earth Observation Station. After entering the station, you take your seat in front of the *control panel* which allows you access and view data about Earth and analyze its features. This control panel concept is important, as the icon of a chair is displayed on most screens, allowing a quick return to the main menu. All of the data files used by the program are on one of the two included CD-ROMs (one for global data and the other for regional data). Data files must be moved from the CD-ROMs to the hard disk before they can be used. The usage of temporary hard disk space is termed the *Workspace* and is an integral component to data accessibility. The program offers a File Management Module to supervise this process.

Four other modules control the various program options:

1. Explore—This module facilitates viewing the impressive col-

lection of images, tabular data, and other information contained in the program CD-ROM library. Data are available as long-term averages, and in many cases average monthly values as well. At the global scale, for example, one can access average temperature, precipitation and ozone images, ocean plankton, elevation and soils data, wave heights and sea surface temperatures, economic, population, land use, and agricultural data, and numerous others. Regional data include many of the same kinds of information for whole continents, or selected aspects for small areas, such as weather sequence animations, and Landsat multi-spectral scanner (MSS) and Thematic Mapper (TM) images in various bands.

2. Edit—Here are all the features of a basic image display and manipulation system. Images can be displayed and zoomed, and their display palettes manipulated. Point, line, and polygon digitizing is possible, and map features (legend, scale, etc.) can be added. From my perspective, this area contained one of the most disappointing aspects of the program. After doing all the work to create an interesting visual display of information, it can only be saved as a file for display in DOS graphics mode, or as a screen dump to the printer. I found myself wishing I could export these images in JPEG or GIF format, or allowing import into other programs.

3. Analyze-This module provides the basic features of a image processor that you would find in a remote sensing program (histograms, mask, resize, overlay, image algebra, mosaic, etc.). Again, the inability to export processed products outside the program seems a serious limitation.

4. Scenario—Series of slides are *connected* in a tree structure, allowing one to step through a process in a visually interesting and informative way. For example, there are slide presentations addressing remote sensing, ice caps, Bangladesh, and several others. These could potentially be quite useful in introductory geography courses, or as part of self-paced student exercises.

In summary, I found *Geoscope* to be an impressive program, considering the constrained operating system for which it was designed. The concept and design of the program are sound and useful in either the educational or home computing environment. I would not have hesitated to recommend it five years ago (had I encountered it then), but today I am reluctant. Certainly, there are a great many older computers worldwide that could put this program to good use. Unfortunately, I suspect that in the current college computing environment it would not be a prudent purchase. The vendor, however, informed me that a Windows version of this innovative system may be available next year. My recommendation is to wait and see if Geoscope *for Windows* becomes a reality, and then give it serious consideration. ❑

NACIS news

NACIS OFFICERS

President: Michael Peterson
Department of Geog/Geology
University of Nebraska-Omaha
Omaha, NE 68182
(402) 554-4805
FAX: (402) 554-3518
email: geolib@cwis.unomaha.edu
Term expires: October 97

Vice President: Patricia Gilmartin
Department of Geography
University of South Carolina
Columbia, SC 29208
(803) 777-2989
FAX: (803) 777-4972
email: gilmartin-pat@sc.edu
Term expires: October 97

Secretary: Craig Remington
Department of Geography
University of Alabama
Box 870322
Tuscaloosa, AL 35487
(205) 348-1536
FAX: (205)348-2278
Term expires: October 97

Treasurer: Sona Andrews
Univ. of Wisconsin-Milwaukee
P.O. Box 413
Milwaukee, WI 53201
(414) 229-6057
FAX: (414) 229-2481
email: sona@csd.uwm.edu
Term expires: October 98

Past-President: Keith Rice
Department of Geography
University of Wisc.-Stevens Point
Stevens Point, WI 54481
(715) 346-4454
FAX: (715) 346-3624
email: krice@uwspmail.uwsp.edu
Term expires: October 97

NACIS EXECUTIVE OFFICERS

Christopher Baruth
AGS Collection
P.O. Box 399
Milwaukee, WI 53201
(800) 558-8993
FAX: (414) 229-3624
email: cmb@csd.uwm.edu

Sona Andrews
University of Wisc.-Milwaukee
P.O. Box 413
Milwaukee, WI 53201
(414) 229-6057
FAX: (414) 229-2481
email: sona@csd.uwm.edu

Susan Peschel
AGS Collection, P.O. Box 399
Milwaukee, WI 53201
(800) 558-8993
FAX: (414) 229-3624
email: sqp@gml.lib.uwm.edu

NACIS BOARD OF DIRECTORS

James Anderson, Jr.
FREAC, 361, BEL
Florida State University
Tallahassee, FL 32306
(904) 644-5447
FAX: (904) 644-7360
email: janderso@garnet.cc.fsu.edu
Term expires: October '97

Cynthia Brewer
Department of Geography
302 Walker Building
Pennsylvania State University
University Park, PA 16802-5011
(814) 865-5072
FAX: (814) 863-7943
email: cbrewer@essc.psu.edu
Term expires: October 97

Barbara Buttenfield
Department of Geography
CB-360
University of Colorado
Boulder, CO 80309
(303) 492-3618
email: babs@colorado.edu
Term expires: October 97

Jeremy Crampton
Department of Geography
George Mason University
Fairfax, VA 22030-4444
(703) 993-1217
email: jcramto@gmu.edu
Term expires: October 97

Valerie Krejcie
4020 W. Kirk
Skokie, IL 60076
(847) 677-1881
email: t-krejcie@nwu.edu
Term expires: October 98

Thomas Patterson
306 Foxridge Dr., SW
Leesburg, VA 22075
(304) 535-6020
FAX: (304) 535-6144
t-patterson@nps.gov
Term expires: October 98

Joseph Stoll
Dept. of Geography & Planning
University of Akron
306 Carroll Hall
Akron, OH 44325-5005
(330) 972-7621
email: joestoll@uakron.edu
Term expires: October '98

Kathryn Thorne
Dept. of Geography & Geology
Belknap Hall
Mansfield University
Mansfield, PA 16901
(717) 662-4612
FAX: (717) 662-4364
email: kthorne@mnsfld.edu
Term expires: October 98

NACIS Board Meeting
October 2, 1996
San Antonio, Texas

The following members of the Board were present: Officers Keith Rice, Mike Peterson and Craig Remington; Board Members Pat Gilmartin, Jeremy Crampton, Jim Anderson, Cynthia Brewer, Glenn Pawelski, Barbara Buttenfield and Carolyn Weiss; Executive Director Chris Baruth. The meeting began at 3:10 with approval of the Minutes of the April 2, 1996 conference call.

Election Results
Chris announced the election of Pat Gilmartin as Vice President, Sona Andrews as Treasurer, and new Board Members Joe Stoll, Kathy Thorne, Valerie Krejcie, and Tom Patterson.

San Antonio
The Board expressed their appreciation to Dennis Fitzsimons and his students for the work done on local arrangements. Dennis reviewed the schedule and logistics of events taking place in San Marcos. Chris reported that the necessary mailings and hotel arrangements for the meeting went smoothly and that pre-registrations indicated that attendance would be close to the norm.

President's Report
Keith discussed the recommendations of the Dues Subcommittee and will call for a vote to raise dues to $42.00 annually at the Business Meeting. A general discussion concerning the finances of The Society ensued, concluding with the need to maintain a vigilant watch upon our resources.

NACIS Web Site
Mike addressed the limited information available at the site and solicited ideas from The Board for improving and expanding the content. Suggestions included examples of map products, papers presented at the conference, past articles from *Cartographic Perspectives*, and employment opportunities. Mike will canvas the members attending the meeting for further input. He also reviewed a few minor adjustments in the program and thanked Sona for her help in printing this material.

Treasurer's Report
Owing to the absence of Ed Hall, the Treasurer's Report turned to a discussion of ways to expand the membership of The Society. It was noted that an increase in dues should not be a substitute for the continued attention this matter deserves.

Future Meetings
Suggestions for the 1998 meeting site included Williamsburg, Kansas City, Madison and Fort Collins. These sites will be further investigated and discussed at the Winter Board Meeting.

Cartographic Perspectives
The search for Sona's successor remains unfulfilled and as a result *C.P.* will have guest editors for the upcoming year. The manuscript flow to the journal has improved and much of the content for edi-

tions during this period of transition is complete. Jim Anderson will handle the production from Tallahassee. All necessary business being discussed, the meeting was adjourned at 5:20 p.m.

Submitted,
Craig Remington
NACIS Secretary

NACIS Business Meeting
October 3, 1996
San Antonio, Texas

Beginning at 1:00 p.m., Keith Rice thanked Dennis Fitzsimons and his students for their efforts as well as Sona Andrews, Chris Baruth and Mike Peterson for their work on the program. Chris spoke of Keith's leadership as President and thanked those leaving the Board for their service. The results of the election were announced and new office holders in attendance were recognized. Keith asked the members for nominations for positions coming open next year. Mike recognized the meeting participants from Austria and welcomed them to Deep in the Heart of Texas. Keith discussed the need to raise the annual dues and received suggestions from the membership concerning the costs and content of *Cartographic Perspectives*.

Following this discussion a motion was offered and seconded to raise the dues to $42.00 annually effective January 1, 1997. The motion carried, 84 to 1. The Guest Editors for *C.P.* were announced. Keith thanked the conference participants and we adjourned to a walking tour of the Alamo City at 1:33 p.m.

Submitted,
Craig Remington
NACIS Secretary

NACIS Board Meeting
October 4, 1996
San Antonio, Texas

The following members of the Board were present: Officers Mike Peterson, Pat Gilmartin, Sona Andrews, and Craig Remington; Past President Keith Rice; Board Members Jim Anderson, Jeremy Crampton, Glenn Pawelski, Cynthia Brewer, Joe Stoll, Kathy Thorne, Valerie Krejcie, Tom Patterson, and Barbara Buttenfield; Executive Director Chris Baruth. The meeting was called to order at 3:35 p.m.

After introductions, Mike asked for comments on the program and some suggestions were offered to facilitate next years meeting. Dick Galbreath from Lexington was introduced and presented a report on hotel accommodations. The Radisson Hotel downtown was the preferred location. Dates are limited to either the first or the last week in October. The Executive Officers will notify the Board of the confirmed dates. The Board reviewed deadlines and responsibilities for the Lexington program and meeting.

Discussion once again turned to site selection of a 1998 meeting site. Kansas City, Williamsburg, Fort Collins, Madison and Chicago were considered for further study. There was some concern that we were behind schedule on this process.

A motion was made to have the Office of the Executive Director generate a membership directory once every two years. Passed .

The Editorial Board for Cartographic Perspectives met in order to subdivide the components of the journal in an effort to spread the responsibilities of production. This is necessitated by the guest editorships for the coming year.

A motion was made to set up a winter meeting of the Board in Chicago. Passed. Valerie will investigate accommodations convenient to OíHare.

Pat asked that a more detailed accounting of our expenses be generated by our new Treasurer. Sona agreed and suggested that work on a strategy to recruit more members is key to maintaining the vitality of the Society. After agreement on the success of the San Antonio gathering, the meeting was adjourned at 5:25 p.m.

Submitted,
Craig Remington
NACIS Secretary

cartographic events

May 13-17, 1997
GPS/GIS '97, "Mapping to Manage"
Annapolis, MD and Chesapeake Bay
Contact: GPS/GIS '97, 8120 Woodmont Ave., Suite 300, Bethesda, MD 20814. Voice 301-664-8000. Fax 301-657-2468.

June 22-28, 1997
18th International Cartographic Conference
Stockholm, Sweden
For more information call: 46 (26) 153 000, or Fax 46 (26) 653 160.

July 20-24, 1997
URISA 97
Metro Toronto Convention Centre, Toronto, Canada
Contact: Peter Croswell, Executive Consultant, Plan Graphics, Inc., plcroswell@aol.com or Sandra Crutcher, Coordinator, Information Resource Services, City of Scarborough, Canada, urisaoc@inforamp.net.

August 14-18, 1997
1997 Canadian Cartographic Association Conference and Annual Meeting
St. John's, Newfoundland
Contact: CCA/ACC 1997; c/o Geography Department, Memorial University of Newfoundland, St. John's Newfoundland, A1B 3X9, or contact Gary McManus for more information. Voice 709-737-8996, Fax 709-737-4000.

October 1-4, 1997
NACIS XVII
Lexington, Kentucky
Contact: Chris Baruth, AGS Collection, P.O. Box 399, Milwaukee, WI 53201. Voice 800-558-8993, Fax 414-229-4380, cmb@csd.uwm.edu.

October 26-30, 1997
GIS/LIS 1997
Cincinnati Convention Center, Cincinnati, Ohio
American Congress on Surveying and Mapping, 301-493-0200, Fax 301-493-8245.

announcements

ARC VOYAGER

ArcVoyager is a package of carefully selected data, ArcView projects, and a comprehensive help file, all tied together, and designed to work with ArcView 2.1. There are parallel versions for Windows or Macintosh, and ArcView 3 versions of ArcVoyager are now being developed. After downloading and installing ArcVoyager, schools and libraries should be able to use ArcVoyager immediately; users should be able to build custom world, US, and state maps with little "outside guidance" needed. The "4-tiered" approach is designed to give users a defined pathway for learning GIS, while letting them pick the topics of exploration from a rich suite of prepared choices.

The first version of ArcVoyager has been completed by ESRI, and is now available for free public download (the full downloads are large). You can read more about ArcVoyager, download a small self-running presentation (for Windows or Mac) about it, or download the entire package, from this address, http://www/esri.com/base/markets/k-12/voyager.html.

MAPublisher

MAPublisher by Avenza Software Marketing, Inc. is a suite of filters that bridges Geographic Information System (GIS) technology to high-end graphics/high resolution printing and electronic publishing technology making cartographic quality map production faster, easier and better. Avenza supports the fact that performing GIS graphics tasks is best done in the right environment—a powerful graphics program like Macromedia FreeHand or Adobe Illustrator. MAPublisher takes you into this environment effortlessly, and with the right GIS data management tools to facilitate the map production process. Using this fast, intuitive system, your map can transcend the ordinary and become a work of art.

MAPublisher incorporates GIS object management tools such as selection criteria, attribute handling, and selection and query logic operators, all within a high-end graphics software environment. MAPublisher v2.0 allows users to import vector data (shapes, boundaries, routes, elevations, etc.) from MapInfo mid/mif files, ARC/INFO generate files, ArcView shape files, DXF files, and USGS Digital Line Graph (DLG) files with all attributes intact for further customization and analysis within Macromedia FreeHand 5.0 or 7.0 for Windows 95 or Windows NT. With the raster support of FreeHand 5.0/7.0 and a registration filter within MAPublisher, users can also import geo-referenced JPEG and TIFF files. Macintosh users can use this suite of filters for Adobe Illustrator (5.0 or later). Files can be imported from PC, Mac, or UNIX. Output is immediate to all Postscript printing devices and to all digital publishing file formats.

MAPublisher 2.0 for Freehand (Windows 95) and MAPublisher for Adobe Illustrator (MAC) is $125.00. For additional information contact Avenza Software Marketing at (800) 884-2555 or http://www.avenza.com.

GLOBE VERSION 0.1

The National Geophysical Data Center (NGDC) is pleased to announce the first release of data from the Global Land One-Kilometer Base Elevation (GLOBE) Project. This project is an international effort to develop a global digital elevation model (DEM) on a nominal 1-kilometer grid. The goal is to represent the Earth's entire land surface. Project scientists will compile available DEMs at a gridding of 1-km or smaller; the remaining areas will be covered by the best available data.

GLOBE Version 0.1 covers approximately 60% of the Earth's land surface, using a 30 arc-second latitude-longitude grid (somewhat finer than one kilometer spacing on the ground). These data were developed cooperatively between the U.S. Defense Mapping Agency (DMA) and NGDC for the GLOBE Project.

You may obtain current GLOBE release information by accessing http://www.ngdc.noaa.gov. Select "Solid Earth Geophysical Data" and then "Topography." GLOBE Version 0.1 (product number 1090-G27-000) is available from NGDC for $275.

CALL FOR PARTICIPATION

XVII Annual Meeting of the NORTH AMERICAN CARTOGRAPHIC INFORMATION SOCIETY

Lexington, Kentucky
October 1 - 4, 1997

The NACIS Program Committee invites your participation in this meeting by:

giving a paper
organizing a session
developing a panel discussion
conducting a workshop
preparing a poster or exhibit

Posters, paper sessions, workshops, and panel discussions are now being organized on a variety of topics, including cartographic animation, multimedia presentations, cartographic design, map librarianship, free-lance cartography, and cartographic activities on the Internet. Start planning your participation now.

Persons interested in participating should develop a proposal or abstract which includes the author's name, professional address, telephone number, e-mail address, and a description not to exceed 250 words. Student participation is encouraged.
Proposals should be sent to:

Pat Gilmartin
Department of Geography
University of South Carolina
Columbia, SC 29208
Phone: (803) 777-2989
FAX: (803) 777-4972
email: gilmartin-pat@sc.edu

PROPOSALS and ABSTRACTS SHOULD BE RECEIVED BY APRIL 30, 1997
Participants will be notified by July 1, 1997 of the acceptance of their abstracts or proposals.

Lexington is located in the heart of Kentucky's bluegrass country, a region known for its bourbon whiskey, burley tobacco, Thoroughbred horses, and, of course, bluegrass - both the music and the plant. Also the site of the University of Kentucky's main campus, Lexington is easily accessible by interstate highway and commercial airlines. We look forward to seeing you at the upcoming conference - our 17th and sure to be as interesting, informative, and as much fun as NACIS meetings always are.

EXCHANGE PUBLICATIONS

Cartographic Perspectives gratefully acknowledges the publications listed below, with which we enjoy exchange agreements. We continue to seek agreements with other publications.

ACMLA Bulletin. Published triannually by the Association of Canadian Map Libraries and Archives. Offers article, reviews, and news on cartography and map library related issues. Contact: Colleen Beard, Brock University Map Library, St. Catherines, Ontario L2S 3A1 Canada.

ACSM Bulletin. Published six times a year by the American Congress on Surveying and Mapping. Offers feature articles, regular commentaries, letters, and news on legislation, people, products, and publications. Contact: Membership Director, 5410 Grosvenor Lane, Bethesda, MD 20814; (301) 493-0200.

Baseline. Published six times a year by the Map and Geography Round Table, American Library Association. Contact: Editor Nancy J. Butkovich, Physical Sciences Library, 230 Davey Laboratory, Penn State University, University Park, PA 16802; (814) 865-3716; e-mail:njb@psulias.psu.edu

Bulletin of the Society of Cartographers. Published twice a year, the *Bulletin* features articles on techniques and ideas applicable to the Cartographic Drawing Office. Contact: Pamela Spoerry, Department of Geography, University of Cambridge, Dowing Place, Cambridge, CB2 3EN, England.

Cartouche. A quarterly publication offering news and announcements to members of the Canadian Cartographic Association. Contact: Canadian Cartographic Association, c/o Weldon Hiebert, Geography Department, University of Winnipeg, Manitoba, R3B 2E9, Canada; (204) 786-9483; fax (204) 786-1824; e-mail: weldon.hiebert@winnipeg.ca.

Cartographica. A quarterly journal endorsed by the Canadian Cartographic Association/Association Canadienne de Cartographie that features articles, reviews, and monographs. Michael Coulson, Editor. ISSN 0317-7173. Contact: University of Toronto Press Journals Department, 5201 Dufferin Street, Downsview, Ontario, M3H 5T8 Canada; (416) 667-7781.

Cartographic Journal. Biannual Journal of the British Cartographic Society. Includes research articles, 'shorter' articles, official records of the Society, book reviews, and a list of recent cartographic literature. Contact: Hon. Secretary, Charles Beattie, 13 Sheldrake Gardens, Hordle, Lymington, Hants, SO4 10FJ, England.

Cartography. Biannual Journal of the Australian Institute of Cartographers. Each issue contains two parts: the Journal proper and the Bulletin. The Journal contains original research papers, papers describing applied cartographic projects, reviews of current cartographic literature, and abstracts from related publications. ISSN 0069-0805. Contact: John Payne, Circulation Manager, GPO Box 1292, Canberra, A.C.T. 2601, Australia.

Cartography Specialty Group Newsletter. Triannual publication of the Cartography Specialty Group of the Association of American Geographers. Features news, announcements, and comics. Contact: Ann Goulette, Editor, Intergraph Corporation, 2051 Mercator Drive, Reston, VA 22091-3414; (703) 264-7141; e-mail: ann@pluto.ne1300.ingr.com.

Cartomania. The quarterly newsletter of the Association of Map Memorabilia Collectors. Offers a unique mix of feature articles, news, puzzles, and announcements of interest to cartophiles. ISSN 0894-2595. Contact: Siegfried Feller, Publisher/Editor, 8 Amherst Road, Pelham, MA 01002; (413) 253-3115.

Geotimes. Monthly publication of the American Geological Institute. Offers news, feature articles, and regular departments including notices of new software, maps and books of interest to the geologic community. Articles frequently address mapping issues. ISSN 0016-8556. Contact: Geotimes, 4220 King Street, Alexandria, VA 22302-1507.

GIS World. Published monthly, this news magazine of Geographic Information Systems technology offers news, features, and coverage of events pertinent to GIS. Contact: John Huges, Managing Editor, GIS World, Inc., 155 East Boardwalk Drive, Suite 250, Fort Collins, CO 80525; (303) 223-4848; fax: (303) 223-5700.

Information Bulletin. Triannual publication of the Western Association of Map Libraries. Contains features, atlas and book reviews, WAML business, and news. Contact: Mary L. Larsgaard, Executive Editor, Map and Imagery Laboratory, UC-Santa Barbara, Santa Barbara, CA. 93106; (805) 893-4049; fax: (805) 893-8799, 4676, 8620; e-mail: mary@wash.uscdic.ucsb.edu.

Mapline. A quarterly newsletter published by the Hermon Dunlap Smith Center for the History of Cartography at the Newberry Library. This newsletter contains notes, announcements, recent publications, calendar, and short essays on topics of interest to the history of cartography. ISSN 0196-0881. Contact: James R. Akerman, Editor, *Mapline*, The Newberry Library, 60 West Walton Street, Chicago, IL 60610.

Perspective. This newsletter of the National Council for Geographic Education (NCGE) is published five times a year in October, December, February, April and June. News items related to NCGE activities and geographic education are featured. Contact: NCGE, Leonard 16A, Indiana University of Pennsylvania, Indiana, PA 15705; bitnet: clmccard@iup.

FEATURED PAPERS

Each issue of *Cartographic Perspectives* includes featured papers, which are refereed articles reporting original work of interest to NACIS's diverse membership. Papers ranging from theoretical to applied topics are welcome. Prospective authors are encouraged to submit manuscripts to the Editor or to the Chairperson of the NACIS Editorial Board. Papers may also be solicited by the Editor from presenters at the annual meeting and from other sources. Ideas for special issues on a single topic are also encouraged. Papers should be prepared exclusively for publication in *CP*, with no major portion previously published elsewhere. All contributions will be reviewed by the Editorial Board, whose members will advise the Editor as to whether a manuscript is appropriate for publication. Final publication decisions rest with the Editor, who reserves the right to make editorial changes to ensure clarity and consistency of style.

REVIEWS

Book reviews, map reviews, and mapping software reviews are welcome. The Editor will solicit reviews for artifacts received from publishers. Prospective reviewers are also invited to contact the Editor directly.

TECHNICAL GUIDELINES FOR SUBMISSION

Literature cited should conform to the Chicago Manual of Style, 14th ed., University of Chicago Press, Chapter 16, style "B." Examples of the correct citation form appear in the feature articles of this issue. Authors of Featured Papers should submit four printed copies of their manuscript for review directly to Dr. Michael Peterson, Chair of the *CP* Editorial Board, Department of Geography, University of Nebraska - Omaha, Omaha, Nebraska 68182. Manuscripts are reviewed by a minimum of two referees. The recommendations of the reviewers and the Chair of the *CP* Editorial Board are sent to the Editor of *CP*. The Editor will contact all authors to notify them if their paper has been accepted for publication and if revisions are necessary prior to publication. The following technical guidelines should be followed for all accepted manuscripts (these guidelines also apply to book, map, and software reviews).

Material should be submitted in digital form on 3.5" diskettes. Please send a paper copy along with the disk. Text documents processed with Macintosh software such as *WriteNow, WordPerfect, MS Word,* and *MacWrite* are preferred, as well as documents generated on IBM PCs and compatibles using *WordPerfect* or *MS Word*. ASCII text files are also acceptable.

PostScript graphics generated with *Adobe Illustrator* or *Aldus FreeHand* for the Macintosh or *Corel Draw* for DOS computers are preferred, but generic PICT or TIFF format graphics files are usually compatible as well. Manually produced graphics should be no larger than 11 by 17 inches, designed for scanning at 600 dpi resolution (avoid fine-grained tint screens). Continuous-tone photographs will also be scanned.

Materials should be sent to: Dr. Sona Karentz Andrews, Editor- *Cartographic Perspectives*, Department of Geography, 3210 N. Maryland Avenue, University of Wisconsin-Milwaukee, Milwaukee, WI 53211; (414) 229-4872, fax: (414) 229-3981; e-mail: sona@csd.uwm.edu.

COLOPHON

This document was desktop-published at the Florida Resources and Environmental Analysis Center, Florida State University, using Apple Macintosh computers. Word processing was accomplished primarily with *Microsoft Word 6.0* ; page layout with *PageMaker 6.0*. Graphics not rendered with *Aldus FreeHand , Adobe Illustrator, Corel Draw, or ATLAS*GIS* were scanned from paper originals using a desktop scanner. The *PageMaker* document was output at 2400 dpi. The bulletin was printed by offset lithography on Warren Patina 70# text stock. Text type is set in Palatino, a face designed by Herman Zapf.

NACIS membership form

North American Cartographic Information Society
Sociedad de Información Cartográfica Norte Americana

Name/Nombre: _____

Address/Dirección: _____

_____

_____

Organization/Afiliación profesional: _____

_____

Your position/Posición: _____

Cartographic interests/Intereses cartográficos: _____

_____

Professional memberships/Socio de organización: _____

_____

_____

Membership Fees for the Calendar Year*/
Valor de nómina de socios para el año:
Individual/Regular: $42.00 U.S./E.U.
Students/Estudiantes: $20.00 U.S./E.U.
Institutional/Miembros institucionales:
$72.00 U.S./E.U.

Make all checks payable to/
Manden sus cheques a:
NACIS
AGS Collection
P.O. Box 399
Milwaukee, Wisconsin 53201

***Membership fees include subscription to *Cartographic Perspectives* .**

The North American Cartographic Information Society

(NACIS) was founded in 1980 in response to the need for a multidisciplinary organization to facilitate communication in the map information community. Principal objectives of NACIS are:

§ to promote communication, coordination, and cooperation among the producers, disseminators, curators, and users of cartographic information;

§ to support and coordinate activities with other professional organizations and institutions involved with cartographic information;

§ to improve the use of cartographic materials through education and to promote graphicacy;

§ to promote and coordinate the acquisition, preservation, and automated retrieval of all types of cartographic material;

§ to influence government policy on cartographic information.

NACIS is a professional society open to specialists from private, academic, and government organizations throughout North America. The society provides an opportunity for Map Makers, Map Keepers, Map Users, Map Educators, and Map Distributors to exchange ideas, coordinate activities, and improve map materials and map use. *Cartographic Perspectives*, the organization's Bulletin, provides a mechanism to facilitate timely dissemination of cartographic information to this diverse constituency. It includes solicited feature articles, synopses of articles appearing in obscure or non-cartographic publications, software reviews, news features, reports (conferences, map exhibits, new map series, government policy, new degree programs, etc.), and listings of published maps and atlases, new computer software, and software reviews.

FREAC
Florida State University
Tallahassee, FL 32306-4015

Gustavo Adolfo Ixtepan Gómez
gixtepan@sistemascontino.com.mx
Firmado

4dcba066-8023-43dd-9eed-f5419359943d1

HOJA DE AUDITORÍA

ID DEL DOCUMENTO:	4dcba066-8023-43dd-9eed-f541935943d1.
NOMBRE	
FECHA DE CREACIÓN	05-12-2024 11:50 am
FOLIO	SDSP6533

Ver este documento en CONTISIGN

Validar este u otro documento

Persona que firma: Gustavo Adolfo Ixtepan Gómez
Correo electrónico: gixtepan@sistemascontino.com.mx
Dirección IP: 187.251.212.179
Fecha y hora de firma: 05-12-2024 11:52 am
Firma interna: 6hWIiaZfdD2dzz3FSYCVip1AwYMh7HnKG0KKYCVhaYs=