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COPY EDITING: *Daniel P. Huffman*

ABOUT THE COVER: *Map illustrating the plan of the defenses of the Western Frontier, by David Burr. See page 57.*

LETTER FROM THE EDITOR

These letters I write as Editor of *Cartographic Perspectives* are becoming an annual event for me, and this is good news! *CP* traditionally dedicates one of its three annual opening letters to insights from the President of NACIS, and I thank Alex Tait for his informative contribution in the last issue. In the past few years, we've also been fortunate enough to hear from outstanding Guest Editors in a second letter. They provide our readers with their unique and insightful viewpoints on subject matter of interest to the cartographic community, as well as recruit high quality content. Anthony Robinson and Rob Roth delivered on both fronts in their special issue on Cognition, Behavior, and Representation in the previous issue (CP 77) available online at **bit.ly/1LMYUAZ**.

For the issue following this one, I feel fortunate that David Fairbairn has agreed to be Guest Editor of a volume dedicated to Cartographic Education. David serves as Chair of the International Cartographic Association's Commission on Education and Training, and I hope that this collaboration can help us to continue to build connections between our organizations. I can't think of a better time to undertake such an endeavor than during the 2015–2016 International Map Year, an initiative of the ICA dedicated to the celebration of maps and their unique role in our world (**mapyear.org**). In addition to a *CP* issue crafted in collaboration with the ICA, the 2015 Annual Meeting of NACIS will feature special events to celebrate International Map Year.

If you're thinking my responsibilities as Editor are becoming too cushy, feel free to dismiss these concerns. The last time I wrote my annual letter was not a year but a mere nine months ago. This is thanks to a steady stream of content from contributors, as well as the ongoing efforts of the Section Editors and anonymous reviewers generous enough to contribute their expertise and donate their time to the editorial and review processes. None of this work, however, would grace the pages of *CP* in so professional or attractive a manner if not for the tireless efforts of my Assistant Editor Daniel Huffman.

Yet writing a letter every nine months is not all I do for *CP*. I also oversee the Student Peer-Reviewed Paper Competition; and by oversee, I mean that I see the outcome of the hard work of the student authors, reviewers, and judges. This year we had a record number of entrants, with a student-authored paper appearing in each of the three issues of 2014! The Official Rules (**dx.doi.org/10.14714/CP74.1013**) require that I put together a committee of judges from my Editorial Board. Mark Monmonier and Michael Peterson were kind enough to serve, each reviewing all three papers and completing the scoring rubric.

I'm pleased to announce that Maxim Rylov, a recent Ph.D. student at Heidelberg University in Germany, is the first author of the winning article, "Pairwise Labeling of Geographic Boundaries: An Efficient and Practical Algorithm" (found on page 5, or online at **dx.doi.org/10.14714/CP79.1212**). Mark Monmonier stated that the article is "impressively useful and lucid, and a valuable contribution to our literature." Michael Peterson pointed out how the authors tackled the difficult issue of map labeling, and found the article "well presented and illustrated."

Maxim and his co-author Andreas Reimer are honored to win the award with its cash prize of $1,350, cite the contributions of the anonymous reviewers for their comments focused on improving the original manuscript, and thank the editorial team for conscientious and hard work. Also, I'm happy to note that 1) their research has been viewed more than 500 times on the *CP* web site, and 2) Google Scholar links directly to the *CP* web site for free and easy access to this article. Both of these milestones have already occurred despite the fact that the issue in which their article appears is only now being published. Our open access journal offers strategic advantages for authors interested in producing timely and findable publications!

The second peer-reviewed article in this issue is the latest installment by Adele Haft on Kenneth Slessor's poem "Mermaids," the fourth from his sequence The Atlas. I'd encourage everyone to accompany Adele on an exploration of this "…riotous romp through seas of fantastic creatures, and a paean to the maps that gave such creatures immortality." No better literary companion exists. Adele is a veritable rock star on *CP*'s web site, with her five works on Slessor having been viewed more than 50,000 times to date.

Other stops in this issue include a tour of the Birmingham Public Library's cartographic collection led by George Stewart, and Jerry's Map, a masterpiece created over 50 years by Jerry Gretzinger. I also hope you'll enjoy the interview Student Board Member Lauren Tierney conducted with long-time NACIS member and former President Jim Meacham as much as I did. Martin von Wyss reports on a workflow suitable for printing 3D landform models that is rich in experience and detail. Finally, our reviews are excellent ways to find out about new publications on subjects as diverse as 19th century American cartography, mapping Mormonism, and Spanish Cosmography. I thank Section Editors Terri Robar, Laura McCormick, Lisa Sutton, Alex Tait, and Andy Woodruff for their continued efforts to seek out and edit such excellent contributions.

Patrick Kennelly
Editor of *Cartographic Perspectives*

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Pairwise Line Labeling of Geographic Boundaries: An Efficient and Practical Algorithm

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We present an algorithm that labels linear features with two matched toponyms describing the left and the right side of a line, respectively. Such a pairwise line labeling strategy is commonly used in manually produced maps to differentiate administrative or other geographic divisions. Our approach solves two basic tasks of the automated map labeling problem, namely candidate-position generation and position evaluation for a given scale. The quality of the name placement is evaluated by comparison to a set of established cartographic principles and guidelines for linear features. We give some results of our experiments based on real datasets. The implementation of our algorithm shows that it is simple and robust, and the resulting sample maps demonstrate its practical efficiency.

KEYWORDS: automated label placement; automated cartography; quality evaluation; computational geometry; GIS mapping

INTRODUCTION

Over the past few decades there have been many attempts to automate label placement in the field of cartography. Label placement algorithms have matured from being able to solve only the simplest problems (Yoeli 1972; Hirsch 1982; Basoglu 1982) into complex and sophisticated tools (see the excellent bibliography of papers on this topic produced by Wolff and Strijk [2009]). Examples used in map production include the *Maplex Label Engine* (ESRI 2009) and *Label-EZ* (**maptext.com/labelez**). The main goal of labeling algorithms is to relieve a human cartographer of two manual tasks, namely:

- The editing of the map, i.e. confirming the names are correct.
- The positioning of names on the map using pre-defined typefaces.

As a consequence, automated type placement reduces map production time and cost. Although commercial and open source labeling packages have been available for some time, there is still a great need to manually resolve conflicts and use non-automated labeling techniques in order to achieve a professional level of functionality and legibility on the final map. In addition, labeling packages are often difficult to parameterize to match production standards (Revell et al. 2011; Regnauld et al. 2013).

In cartography, all map objects to be labeled can be divided into three categories (Imhof 1962; Imhof 1975; Wood 2000; Brewer 2005): punctiform (e.g., settlements, mountain peaks), linear (e.g., roads, rivers, boundaries) and areal (e.g., countries, lakes, islands) designations. Each type of designation has its own requirements and involves its own challenges. Compelling attempts to automate map lettering were made by Yoeli (1972), Christensen et al. (1995), van Kreveld et al. (1999) for point features, by Barrault and Lecordix (1995), Edmondson et al. (1996), Chirié (2000), Wolff et al. (2001) for lines and by van Roessel (1989), Barrault (2001), Rylov and Reimer (2014b) for areas. In this article we propose a method for the pairwise labeling of a special type of linear feature: those that demarcate area boundaries. There are several situations in which a boundary needs to be labeled twice, differently on each side of the linear feature: e.g. international borders, municipal divisions, grid-zones or military zonings where different rules of engagement apply. In manual

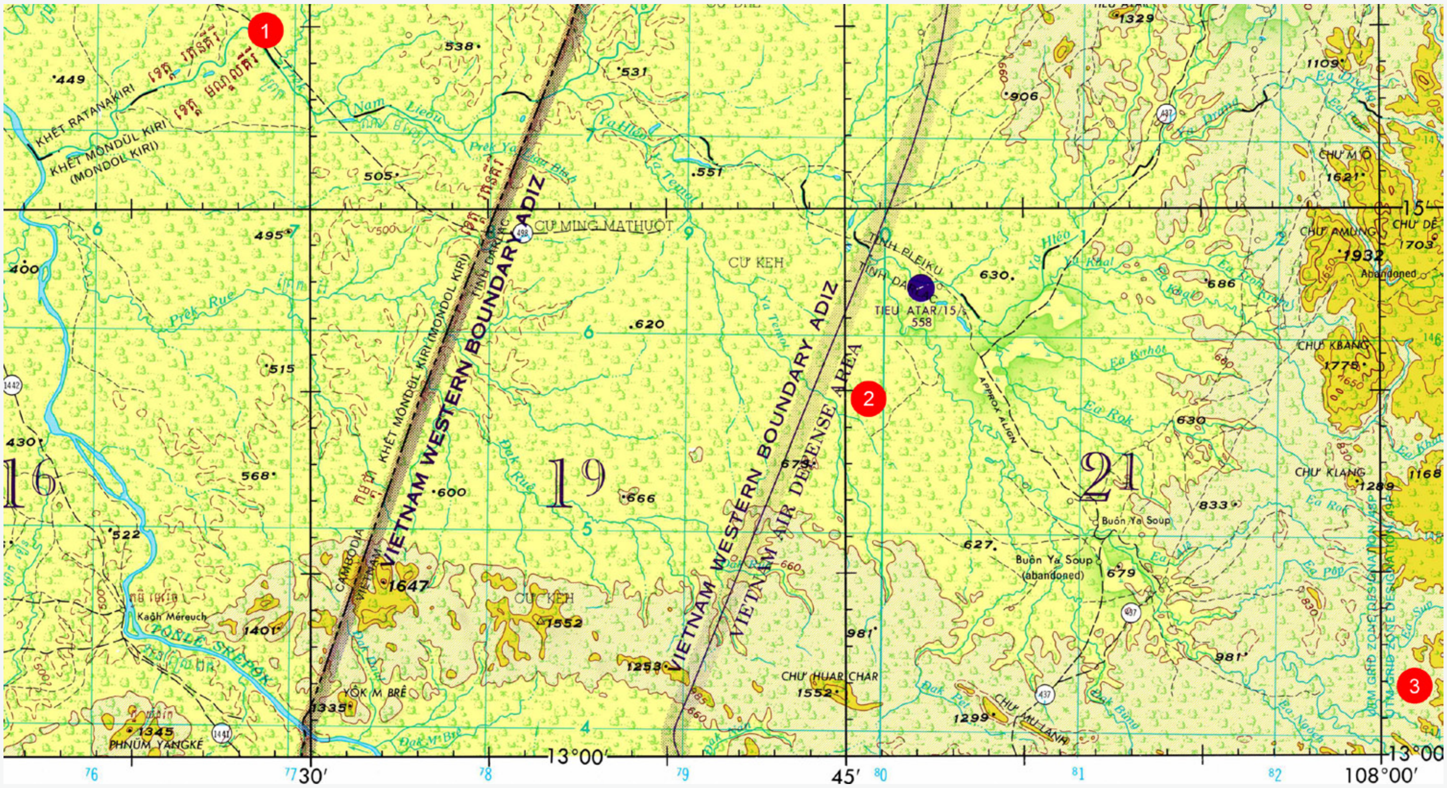


Figure 1. An example of manual pairwise line labeling: provincial boundaries (bilingual) [1], zones for changing rules of engagement [2] and UTM grid zone changes [3]. Source: Defense Mapping Agency (1973).

cartography two different techniques are used to letter a boundary line in pairwise manner: the boundary can be labeled either with text placed along a straight line (Figure 1) or curved following the direction of the polyline to be annotated (Figure 2). Curved lettering is often the preferred choice, aesthetics-wise. This paper presents an algorithm that is able to position labels in a way which is visually similar to the approach used in Figures 1 and 3b, when the label is not curved.

This method can be used on large-scale maps to label areas when the scale becomes too large to place the label inside the area. With pairwise line labeling, regions that lie on opposite sides of a boundary line can be identified without difficulty. The main visual advantage is that a map reader is informed about the exact nature of the line, not only its general type. This helps to easily distinguish boundaries from other linear objects and amplifies the precise graphic relation between the toponyms and the relevant map features. Another strong feature of such labeling is the consideration of two names as a unit or a single label. It means that the resulting map is free from partial designations, i.e. a label either on the left or on the right side of the object (Figure 3a).

To the best of our knowledge, there are no preceding published works regarding automated pairwise line labeling. However, it is worth noting that some existing commercial label engines have the ability to label administrative boundaries. For instance, the *Maplex Label Engine* produces labeling of administrative units for each side of a linear feature independently (Figure 3a). This kind of labeling can be performed using any line labeling algorithm (e.g., Barrault and Lecordix 1995; Edmondson et al. 1996; Chirié 2000; Wolff et al. 2001). Note that such

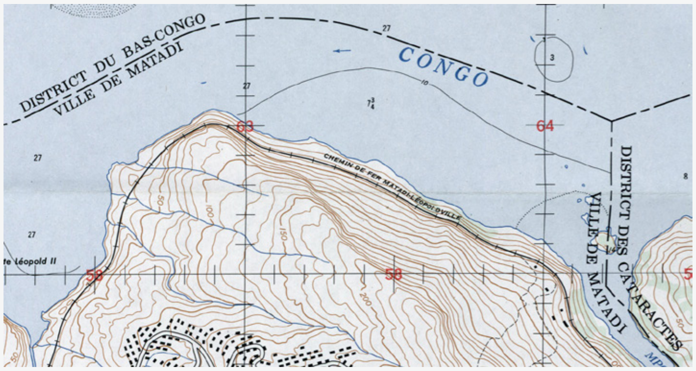
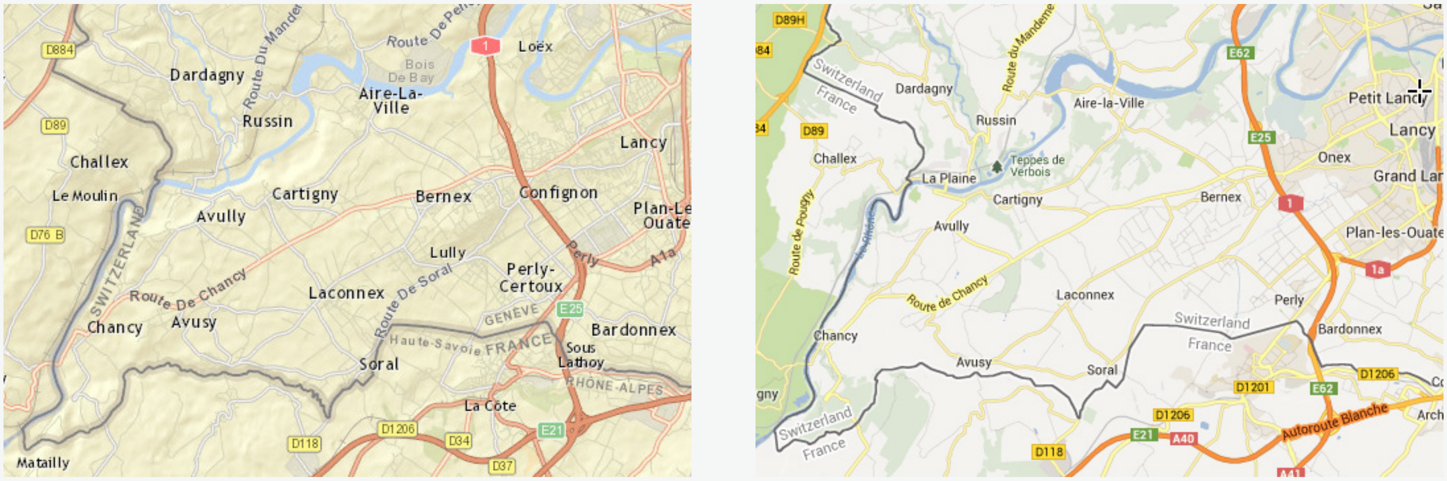


Figure 2. An example of curved labels annotating administrative boundaries. Source: National Imagery and Mapping Agency (1962).



(a) (b)

Figure 3. *Examples of different labeling of administrative boundaries. (a) Non-pairwise line labeling of boundaries with mixed hierarchies (© Esri). (b) Pairwise line labeling, closed source and unknown parameterization (© 2014 Google).*

label placement is not widely used in traditional cartography and violates cartographic labeling principles found in the literature and extant topographic maps. For example, this approach often creates ambiguities between the labels which annotate the boundaries of different subdivision levels (Figure 3a, "GENEVE" & "FRANCE"). The next example in Figure 3b illustrates map labeling on Google Maps, where the labels of national borders are coupled and positioned in regions with less curvature and where the text is less sloped. The two presented approaches follow different cartographic precepts, if at all. We interpret both approaches as arising from technical and theoretical limitations. The description and implementation of both algorithms is, of course, not known and closed source. Moreover, we have found no free/open source label engine or research publication aimed at pairwise label placement.

We start describing our method in the following section with a formalization of the criteria representing the cartographic guidelines for pairwise line labeling. Next, we introduce a general form of our scoring function (van Dijk et al. 2002). Then, we continue with a description of the first part of our model, which consists of an algorithm for generating of a set of potential label positions for each linear feature. Subsequently, we describe the components of the quality function in detail. The proposed quality measures take into account

- the curvature of the polyline,
- the offset of label from the polyline,
- the orientation of the lettering, and
- an even distribution of the labels along the polyline.

In general, a quality evaluation, or an objective function, can be employed by any *combinatorial optimization* algorithm (Christensen et al. 1995; Rabello et al. 2014) for finding a feasible near-optimal solution of the automated label placement problem. Note that the characteristics, like the position and the quality assessments, of the output label candidates can be used as input to a much more comprehensive and sophisticated general map labeling algorithm (Edmondson et al. 1996; Kakoulis and Tollis 1998). For example, such an algorithm could consider figure-ground relationship (Rylov and Reimer 2014c) or resolve any ambiguities between neighboring labels (Rylov and Reimer 2014a). In our results section, we show some significant map samples based on real-world datasets. These sample maps are labeled using our implementation of the proposed method. Finally, we conclude with a brief analysis of the present work and give some insights for possible improvements and future research.

CARTOGRAPHIC MODEL

The basic idea of our labeling model is depicted in Figure 4b. Succinctly, the necessary input of our algorithm is a polyline that describes a boundary, and two toponyms that define adjacent areal features. The output is a set of coupled labels that represent either side of the polyline to be annotated.

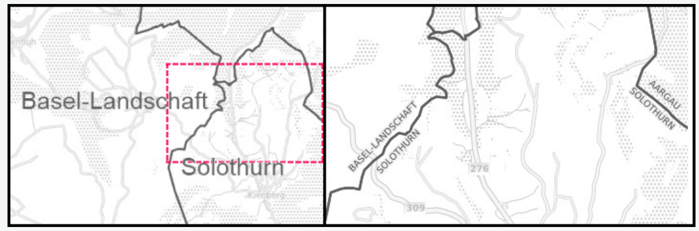
APPROACH METHODOLOGY

Automated text placement, or lettering, is one of the most difficult and complicated problems to be solved in automated cartography and geographic information systems. When it comes to solving a complex problem, usually the problem is decomposed into smaller and simpler sub-problems. In our approach we use the same technique. Thus, the map labeling problem in general can be divided into three substantially independent subtasks (Edmondson et al. 1996):

- *Candidate-position generation*: A method that generates a set of label candidates for each map feature, using its spatial characteristics and taking into account its type (e.g., point, line or area). The generated potential label positions are normally considered as the search space for the position selection procedure.

- *Position evaluation*: A process of computing a score for each label candidate. This score is calculated using a quality function, which measures how well a label is positioned with respect to the object it tags as well as to other labels and features on the map (van Dijk et al. 2002). In general, the quality function should take into account and reflect the formal cartographic precepts applied to each type of label (see Rylov and Reimer [2014a], for point features).

- *Position selection*: A process of choosing only one label position from each set of candidates, such that the total label quality measured with the quality evaluation function is globally maximized thereby achieving a superior level of cartographic quality in the resulting map (Christensen et al. 1995). Note that the *selection* is an *NP-hard* problem in general (Formann and Wagner 1991; Marks and Shieber 1991).



(a) (b)

Figure 4. *Labeling of administrative regions in Switzerland: (a) Placement of the names inside the areas. The dashed rectangle corresponds to map (b). (b) Positioning of the names along the boundary line.*

Our method deals with the two first subtasks of automated map lettering for the case of pairwise line labeling. Once these subtasks are solved, the position selection procedure can be applied. The position selection is canonically treated as a general optimization problem via strategies such as *exhaustive search methods* (Yoeli 1972; Hirsch 1982), *simulated annealing* (Edmondson et al. 1996), *genetic algorithms* (Verner et al. 1997), *gradient based optimization* (Christensen et al. 1995) or *tabu search* (Yamamoto et al. 2002). We provide the solution of these subtasks in the next three subsections. But first, we define and enumerate requirements for pairwise line labeling according to corresponding cartographic guidelines.

LINEAR FEATURE LABELING REQUIREMENTS

We have selected and operationalized the relevant rules for pairwise line labeling from the extant cartographic literature on positioning names on maps (Imhof 1962; Imhof 1975; Yoeli 1972; Wood 2000; Brewer 2005). The list of design guidelines adapted to our problem is as follows:

G1. A label must be placed along the linear feature it tags.

G2. A label should conform to the curvature of the polyline.

G3. Avoid complicated and extreme curvatures of the polyline. Straight or almost straight parts of the polyline should be preferred.

G4. A label must be placed close to the polyline, but not too close.

G5. The name must not be spread out, but may be repeated at specified intervals along the linear feature.

G6. Avoid placing names near end points of the polyline.

G7. Horizontally aligned labels are preferred to vertical ones.

G8. The two parts of a label should be centered relative to each other.

G9. The name should not cross the linear feature.

The term "label" in the list actually means a "pair of labels," in other words, one label to annotate the left side of the polyline and another label for the right side.

These guidelines are used as the criteria for *candidate-position generation* as well as for the *position evaluation* task in the following up subsections. Note G2 is a general guideline which refers to different methods of lettering depicted in Figures 1 and 2. Our approach deals only with text that is straight.

SCORING LABELING QUALITY

Once a potential position of a label is computed, it is numerically scored using a quality evaluation function. A quality function achieves two main goals: to evaluate the label positions according to the cartographic precepts and to compare various labeling algorithms. Normally, a quality function is defined as a weighted sum of single metrics (van Dijk et al. 2002; Zhang and Harrie 2006) and has the general form:

$$
\begin{aligned}
Q(L,F) = \sum_{l \in L} \Big(& w_1\, f_{\text{priority}}(l) + w_2\, f_{\text{aesthetics}}(l) \\
& + w_3\, f_{\text{association}}(l, L, F) + w_4\, f_{\text{label-visibility}}(l, L, F) \Big) \\
& + \sum_{f \in F} \big(w_5\, f_{\text{feat-visibility}}(f, L, F) \big)
\end{aligned}
\tag{1}
$$

where L is a set of labels, F is a set of non-textual features on the map, $w_1, \dots, w_5$ are the weights and $f_*(l)$ are the quality metrics, measuring how well the demands of cartographic guidelines are met in the positioning of labels. The value of a quality function such as Equation (1) is usually normalized to the range [0,1]. For a detailed description and the meaning of each partial metric $f_*(l)$ we refer to the work by van Dijk et al. (2002). In addition, a review paper by Kern and Brewer (2008) contains a comparison table that shows how the four criteria $f_{\text{aesthetics}}$, $f_{\text{association}}$, $f_{\text{label-visibility}}$, and $f_{\text{feat-visibility}}$ have been used in various proposed techniques and algorithms presented in the literature.

In Equation (1) the measure $f_{\text{aesthetics}}(l)$ evaluates the quality of the position and the shape of a label with respect to the geometry of the feature it annotates, and $f_{\text{association}}(l, L, F)$ describes the clarity of the association between a feature and its label. In our approach, we construct a quality evaluation function called $H(l)$, which substitutes $f_{\text{aesthetics}}(l)$ and partially substitutes $f_{\text{association}}(l, L, F)$. With this new function we will numerically score potential label positions that are output by the algorithm presented in the next section. The components of the measure are metrics designed to meet the requirements of some of the cartographic guidelines specified in the previous section. Let us define $H(l)$ for scoring l by analogy with Equation (1) as:

$$
\begin{aligned}
H(l) = {} & m_1\, g_{\text{PosDev}}(l) + m_2\, g_{\text{BaseOffset}}(l) \\
& + m_3\, g_{\text{GoodnessOfFit}}(l) + m_4\, g_{\text{HorizAlign}}(l)
\end{aligned}
\tag{2}
$$

where $m_1, \dots, m_4$ are the weight factors and $g_*(l)$ the functions are:

- $g_{\text{PosDev}}(l)$, measuring the deviation of a label position from an even distribution of labels along the polyline;
- $g_{\text{BaseOffset}}(l)$, evaluating how far a label's baseline is from the feature's centerline (Figure 5);
- $g_{\text{GoodnessOfFit}}(l)$, representing a measure for quantifying how well the centerline approximates the polyline in a given region; and
- $g_{\text{HorizAlign}}(l)$, evaluating the deviation of the orientation of the label from a horizontal alignment.

Note that the weights $m_1, \dots, m_4$ should sum to 1.0 and the return value of each partial metric should fall into the range [0,1]. We design our metrics to yield higher values for label positions that are closer to the ideal position. To examine other research attempts which deal with developing quality measures to quantify label positions for linear features, see Barrault and Lecordix (1995), Edmondson et al. (1996), and Chirié (2000).

ALGORITHM FOR CANDIDATE-POSITION GENERATION

IN THIS SECTION we introduce an algorithm that produces candidate positions along the input polyline (Figure 5). The algorithm produces a set of imaginary line segments (see *centerline* in Figure 5) which locally approximate the original polyline in a certain region. The width of the region (grey area) equals the maximum width of the two names. In addition to the centerline, an offset of the label (see d in Figure 5) from the polyline is computed. The centerline and the offset define two baselines. The *baseline* is the line upon (or under) which the characters of the name are drawn. Note that the candidate-position generation algorithm complies with the guidelines G1, G2, G4, G5, and G6.

Let us define some useful terms and measures before giving a detailed description of the algorithm. The input of our algorithm consists of a polyline $P = (p_1, \dots, p_n)$ specified by a sequence of points $p_i = (x_i, y_i)$, where $i = 1, \dots, n$ (Figure 6), and two names n_l and n_r that describe the left and the right side of the polyline P. We denote the total length of P by L. Let w_l and w_r be the widths (in map units) of n_l and n_r respectively. In order to satisfy requirement G5, we introduce a parameter S that defines the distance between names repeated along the polyline (Figure 6). We define the width of a label as $w_{max} = \max(w_l, w_r)$. The algorithm is composed of four phases that are detailed below.

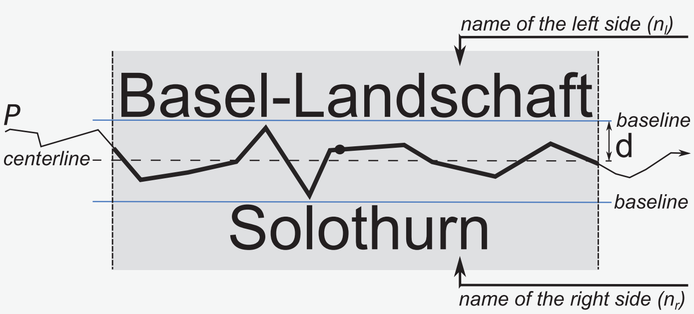


Figure 5. *The nomenclature used in describing the candidate-position generation algorithm.*

PHASE I

In the first phase, we generate a set of candidate locations along the polyline P (guideline G5). We denote a point that represents the anchor point of a candidate position by q_j, where $j = 1, \dots, m$ and $m = \lceil (L - S) / S \rceil$, the number of such points. The point q_j lies on P and its distance from the starting point of P is defined by $S'(j) = (1/2 + j)\, S$.

Let q_j, $j = 1, \dots, m$, be the points at which we will construct the centerline for placing a label. We consider q_j as preliminary locations, different from the resultant ones. The explanation of the difference between them is provided below. In order to increase the size of the search space, we move each point q_j along the polyline in both directions until the distance from q_j along P reaches a certain value, the maximum position deviation D_{max}. This approach gives us a set of positions (see blue areas in Figure 6), $\overline{q}_{jk}$ where $k \in [-N, N]$ with the center at q_j, $N \in \mathbb{Z}$. We denote this set by V_j. N is the half of the number of preliminary locations in V_j and defined as $N = \lceil D_{max} / D_{step} \rceil$, where D_{step} is the distance between two points $\overline{q}_{jk}$ and $\overline{q}_{jk+1}$. The total number of preliminary locations is calculated as $N_{total} = 2Nm = 2N\lceil (L - S) / S \rceil$. Assume that each point $\overline{q}_{jk}$ specifies a rough position for a label placement. Therefore, the maximum number of labels for one linear feature is equal to m, as only one label from each set V_j can be chosen. The adjustment of D_{max} and D_{step} should be done by the user, which controls the size of the search space. The parameters S, D_{max}, and D_{step} are measured in map units.

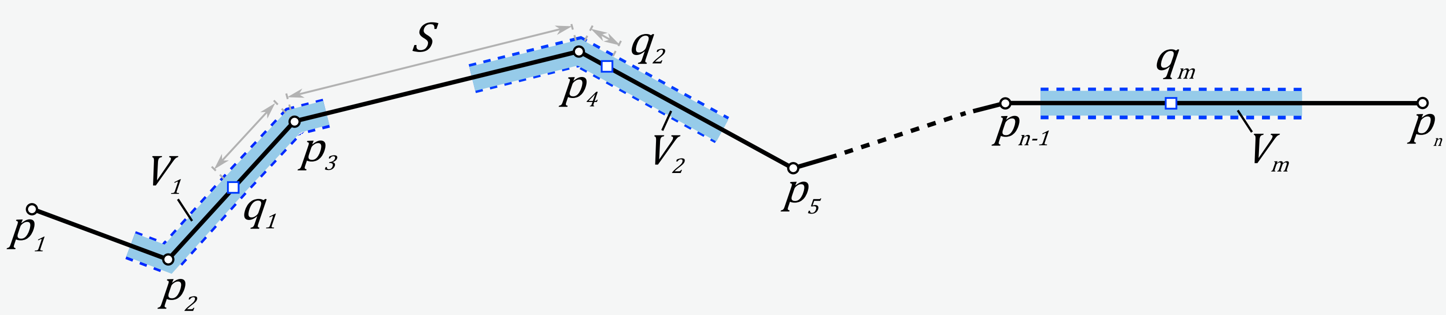


Figure 6. *The input polyline P (solid black line) with nodes p_i. Points q_j are the centers of sets of potential locations V_j. S is the interval between q_j and q_{j+1}.*

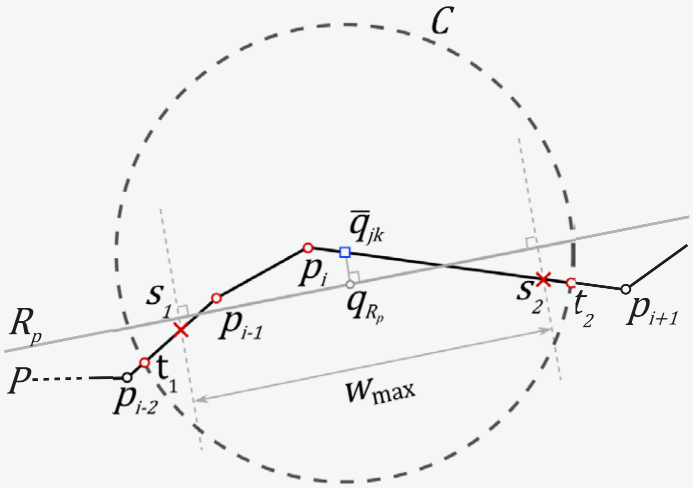


Figure 7. Best-fitting straight line R_p for a set of points of P with its center in $\overline{q}_{jk}$.

As the allowed position deviation D_{max} increases, the distribution of labels along P becomes less regular. It can be seen in Figure 6 that the method for candidate-position generation also complies with G6 (avoidance of end points) automatically.

PHASE II

In this phase, we try to find a centerline which approximates a part of P centered at $\overline{q}_{jk}$. Each part of this kind consists of points whose distance from $\overline{q}_{jk}$ along P is at most $w_{max}/2$. Such a centerline, or the best-fitting straight line denoted as R_p, can be found by employing the method of least squares (Chatterjee and Hadi 2006). This method requires a set of points as the input. An approach to finding this set of points on P and consequently the line R_p is described in the following steps.

1. Let C be a circle with the center at $\overline{q}_{jk}$ (Figure 7) and a radius equal to $r_c = Kw_{max}$, where K is a control parameter in the range [0.5,1]. As the actual shape of P is unknown, the circle radius is grown by increasing K until a satisfactory solution is found, i.e. step 3 has been passed and a centerline was found. Next, we want to find points of intersection between P and C. Due to the possible sinuosity of P, there could be many such points. Therefore, we consider only those two points of intersection whose distance from $\overline{q}_{jk}$ along P is the shortest. These two points we denote as t_1 and t_2. Note that there are two special cases when it is not possible to find these points: when P fully lies inside the circle C, and when $\overline{q}_{jk}$ is too close to one of the ends of P.

   The distance between t_1 and t_2 should be large enough to accommodate the label. Therefore, we check whether the distance between t_1 and t_2 is less than w_{max} before moving on to the next step. A refinement step can also be applied by trying several circles with different radii, as the curvature of a polyline can vary greatly from a straight line to a very bent curve.

2. Construct the best-fitting straight line R_p from a set of points. This set consists of all vertices of P that lie inside the circle C. In Figure 7 these points are: t_1, p_{i-1}, p_i, and t_2. R_p is a preliminary line.

3. We check whether P reverts too far back on itself for label placement, i.e. whether it represents a bulge in the segment under consideration. For this, we construct the perpendicular to R_p through the point $\overline{q}_{jk}$ and check whether the points t_1 and t_2 are on the same side of the perpendicular. If the points t_1 and t_2 happen to be on the same side of the perpendicular, we consider R_p to be invalid. In this case we skip $\overline{q}_{jk}$ and move to the next point $\overline{q}_{jk+1}$ and repeat steps 1–3.

PHASE III

Every time the circle C is grown beyond $K = 0.5$, the Euclidean distance between t_1 and t_2 can be greater than w_{max}. In this case we assume that R_p is not optimal and consider it as a first approximation. Therefore, we describe the procedure that refines the result of Phase II.

1. Construct a perpendicular from the point $\overline{q}_{jk}$ to R_p. Find a point q_{Rp} that is the intersection of the perpendicular and R_p.

2. Find two perpendiculars to R_p that are equidistant from the point q_{Rp}. The distance between q_{Rp} and each of them is $w_{max} / 2$.

3. Find the points of intersection between P and the perpendiculars from step 2. Denote these points as s_1 and s_2 respectively (Figure 7).

4. Find the best-fitting straight line R from a new set of points s_1, p_{i-1}, p_i, s_2 (Figure 8).

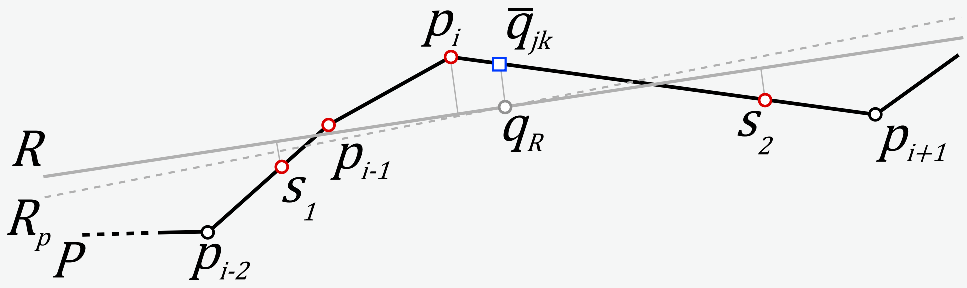


Figure 8. *Refinement of the preliminary centerline* R_p.

5. Construct a perpendicular from the point $\overline{q}_{jk}$ to R. We denote the point of intersection as q_R. This point defines the center of a label that will be placed along the centerline R.

Note that Phase III should be omitted if $K = 0.5$.

PHASE IV

The final phase computes the offsets for the baselines upon which, or under which, the labels will be placed (see Figure 5). This phase has three steps.

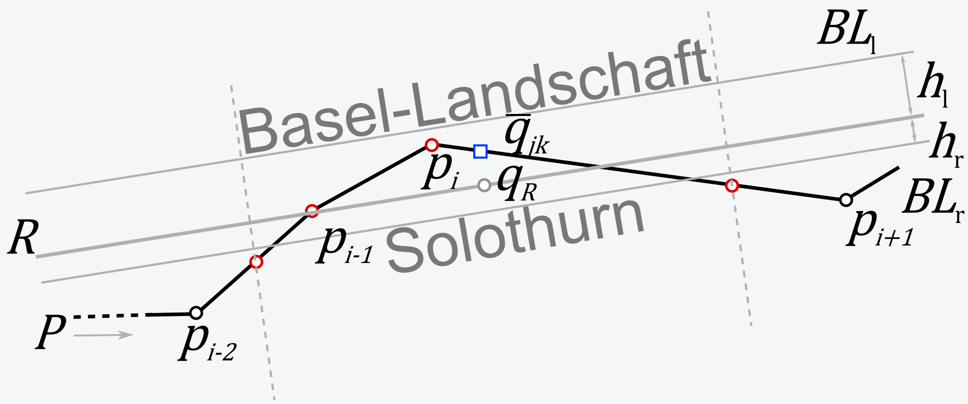


Figure 9. *Computation of baseline offsets* h_l, h_r *from the centerline* R.

1. Compute the Euclidean distance between R and each point in the set of points that we have employed for constructing R.
   Put the values of the distances into two separate lists. The first list contains the points that lie on the left side of R and the second list for the points on the right side.

2. Compute the maximum value of all entries in each list. These values denoted as h_l and h_r are the offsets of the baselines BL_l and BL_r from the centerline R (Figure 9). Each offset defines the Euclidean distance of the respective baseline to R.

3. Increase each offset from the centerline by adding a typeface-dependent value to each offset. This approach helps to avoid overlapping of the polyline with the descenders or the ascenders of the characters of the label, e.g. if $h_l = 0$ or $h_r = 0$.

To comply with the condition of G8, both names should be centered with respect to q_R.

OUTPUT OF PHASES I–IV

After applying the four phases to each point $\overline{q}_{jk}$, a candidate label position l can be defined with the following properties expressed as functions of l that will be used later in the quality measures:

- The center point, denoted as $q_R(l)$.
- Two offsets $h_l(l)$ and $h_r(l)$ from the centerline that represent the baselines for placing the characters.
- The tilt of the label, denoted as $\alpha(l)$.
- The deviation of a label from an even distribution, denoted as $\delta(l)$.
- The coefficient of determination (explained below), denoted as $\gamma(l)$. The value of this function is computed from the same set of points (see red points in Figure 9) that we used for computing the centerline R.

The output of the presented method meets the requirements of six cartographic guidelines listed above, namely guidelines G1, G2 in Phases II–III, partially G3 in Phase III (see Step 4), G4 in Phase IV. The requirements of guidelines G5 and G6 are met automatically in the approach for computing of q_j (Phase I). In the following sections we also use G4 and G5 for scoring label candidates.

In the following subsections we provide a more detailed description of each metric in Equation (2).

POSITION DEVIATION METRIC

In order to follow guidelines G5 and G6, the labels should be placed along P. We have already given the procedure that generates the candidate label positions with their centers near the points q_j. If an input polyline is more curved, as it is often the case when a border is following a natural feature (e.g. rivers, mountain ranges, etc.), it is not always possible to make a label placement at a certain position q_j. Therefore, our method allows increasing the number of candidate positions around q_j. These potential label placements are anchored at $\overline{q}_{jk}$. It might be that two labels specified by two locations $\overline{q}_{jk}$ and $\overline{q}_{jk+1}$, from two different sets V_j and V_{j+1}, are too close to each other (Figure 6). Thus, we need a metric to quantify the deviation of label candidate positions from an even distribution, i.e. the deviation of each point in V_j from the center point q_j. A function for this metric can have the following form:

$$g_{\text{PosDev}}(l) = 1 - \delta(l)/D_{\max} \tag{3}$$

where $\delta(l)$ returns the length of the part of the polyline that is bounded by the points q_j and $\overline{q}_{jk}$. Figure 10a depicts an example of the function for $g_{\text{PosDev}}(l)$. It is clear that the metric in Equation (3) gives the highest score when $\delta(l)$ returns 0.0; the worst case is when $\delta(l)$ returns $D_{\max}$.

BASELINE OFFSET METRIC

One of the output values of the candidate-position generation method are the offsets from the centerline R, which we call *baseline offsets*. Since the values of $h_l(l)$ and $h_r(l)$ represent the maximum distance between the centerline R and the points of P, it is clear that placing the labels on the lines BL_l and BL_r (Figure 9) respectively can lead to overlapping of P with descenders or ascenders of the label characters. To avoid this problem, we propose an additional offset to the values obtained from $h_l(l)$ and $h_r(l)$. The underlying idea is simple. We need to translate the baseline some distance in a direction perpendicular to the centerline. This additional offset we denote as ε. Note that the value of ε should be chosen by taking into account the font size of the label and the thickness (stroke width) of the boundary line.

Let us define a quality metric:

$$g_{\text{BaseOffset}}(l) = 0.5u(h_l(l) + \varepsilon) + 0.5u(h_r(l) + \varepsilon) \tag{4}$$

where function u has the form:

$$u(\beta) = \begin{cases} 0, \beta < B_{\min} \\ 1 - \dfrac{\beta - B_{\min}}{B_{\max} - B_{\min}}, \beta \in [B_{\min}, B_{\max}] \\ 0, \beta > B_{\max} \end{cases} \tag{5}$$

where $B_{\min}$, $B_{\max}$ are minimum and maximum allowed offset values. Function (5) (Figure 10b) yields a value of 0.0 when the distance β between the baseline of a label and the centerline is less than $B_{\min}$ or greater than $B_{\max}$, and a value of 1.0 when $\beta = B_{\min}$. It means that labels whose distance from the centerline is in the range $[B_{\min}, B_{\max}]$ are all acceptable. Note that the closer the label is to the centerline

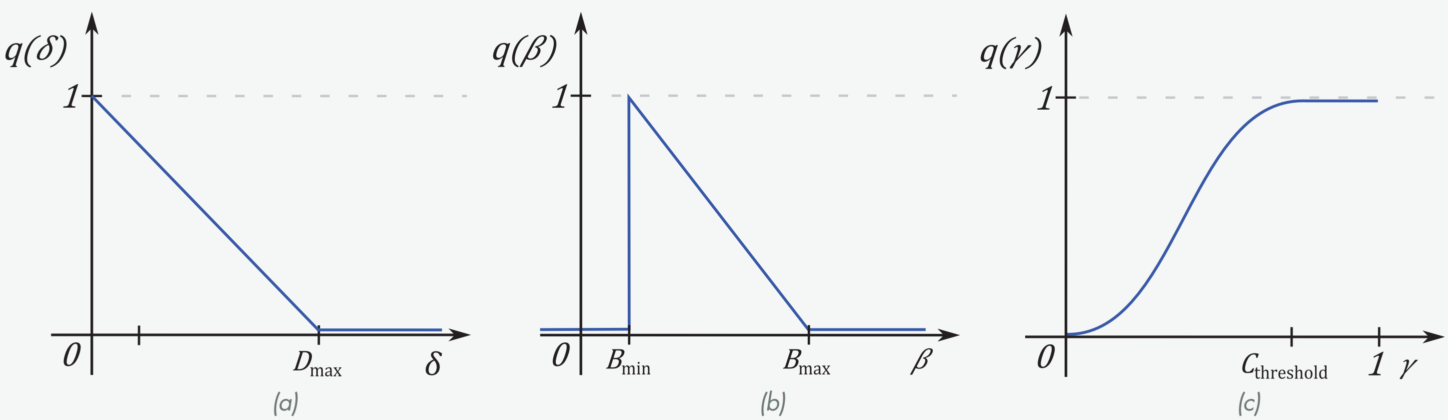


Figure 10. *Quality functions used in the metrics. (a) Position deviation metric. (b) Baseline offset metric. (c) Goodness of fit metric.*

the better. Parameter B_{max} defines the upper limit above which the label-feature association becomes unclear. The metric (4) scores how well the requirement of G4 is met.

GOODNESS OF FIT METRIC

We used the method of least squares for generating candidate-positions. Hence, we can calculate the coefficient of determination that equals the square of the correlation coefficient between the observed (polyline points) and modeled (centerline) data values for the case of a simple regression model. The coefficient of determination is a statistical characteristic that provides us with some information about the goodness of fit of a model. In our case it measures how well the centerline R locally approximates the polyline P (Figure 8). The coefficient of determination has values in the range [0, 1], where a value of 1.0 indicates that the centerline fits the polyline perfectly, for instance when all points used for the construction of R (see Phase II step 2 or Phase III step 4) lie on one line segment of P. Let us construct a metric that employs the coefficient of determination. For this purpose we use an appropriate fading function, and also define a threshold to the value of the coefficient of determination, denoted as $C_{threshold}$. Figure 10c depicts an example of such a fading function, in which the highest value is obtained if the goodness of fit is equal to the threshold value or higher. The quality of the fit to the polyline deteriorates as the goodness of fit metric approaches 0. As a fading function we chose the following:

$$g_{GoodnessOfFit}(l) = \begin{cases} 1, \gamma(l) > C_{threshold} \\ 1 - \left(\cos\left(\frac{\pi\gamma(l)}{C_{threshold}}\right) + 1\right)/2, \gamma(l) \leq C_{threshold} \end{cases} \quad (6)$$

where $\gamma(l)$ returns the coefficient of determination. Note that metric (6) corresponds to G2.

HORIZONTAL ALIGNMENT METRIC

This metric considers cartographic guideline G7, which says that "horizontally aligned labels are preferred to vertical ones." In other words, the text should be as near to "reader normal" as possible (Wood 2000). Therefore, we can determine the corresponding metric as follows:

$$g_{HorizAlign}(l) = 1 - \frac{\alpha(l)}{90} \quad (7)$$

where $\alpha(l)$ returns the angle between the horizontal axis and the centerline which defines the tilt of the label l. The return value is measured in degrees. Metric (7) is designed to yield a value of 1.0 when $\alpha(l)$ has a value of 0.0. This is the case when a label is horizontal.

PARAMETERIZATION

On first sight, our approach is dependent on ten input parameters. The main reason for this large number is that we present the method as it is actually implemented, to support our goal of reproducibility and adoption by others. Some of the parameters are simply pre-processing thresholds, which could be structurally left out. Others are adaptions of the *sliding model* (see van Kreveld et al. 1999; Strijk and van Kreveld 2002) to polylines, in order to generate more fine-grained candidate positions. The parameters and their functions are summarized in Table 1.

We can see that Q_T (see next section), D_{max}, and D_{step} are just variations dealing with the size of the search space for the solving algorithm (for which we generate the input; see Christensen et al. [1995]) and could structurally be omitted. The distance between label pairs can be best thought of as a scale-dependent function of the number of toponym repetitions the cartographer is aiming for, modified by the available drawing space in relation to the size of the objects to be labeled. Along with the allowed offsets from the polyline B_{min} and B_{max}, distance S could very conceivably be derived automatically for a given map series. As such, the only undefined parameters that require manual input are the four weights. We currently see no alternative to deriving them empirically or through trial and error. In the following experimental section, we provide two cartographically viable sets of weights.

Generally speaking, the number of parameters that are needed to be set by a user can be reduced in an implementation of the method in a GIS application.

Type	Role	Parameter	Meaning
geometric	scale dependent styling	S	distance between label pairs
	sliding model	D_{max}	maximum allowed deviation from label center
		D_{step}	interval between candidates
quality	pre-processing	Q_T	quality threshold
	scale dependent styling	B_{min}	minimum allowed offset from polyline
		B_{max}	maximum allowed offset from polyline
	general styling	m_1	position deviation weight
		m_2	baseline offset weight
		m_3	goodness of fit weight
		m_4	horizontal alignment weight

Table 1. *Overview of the parameters used in our approach.*

EXPERIMENTS

In this section we provide some results of the experiments that we carried out to test our method. We first describe our experimental methodology. Then we present performance results and labeling quality measurements. We finish this section with sample maps generated with our method.

DATASETS, IMPLEMENTATION, AND EXPERIMENTAL METHODOLOGY

We have implemented a version of the proposed algorithm on top of *MapSurfer.NET* (**mapsurfernet.com**), a platform for publishing spatial data to the Web, written in C#. The experiments were conducted on a computer equipped with an Intel® Core™ i5-2500 CPU @ 3.30 GHz and running *Windows 7 Professional* x64 with 8GB installed memory. The runtime execution environment of our test application was *.NET Framework 4.5* (x64).

We performed our experiments on a dataset from the *OpenStreetMap* project (OSM), one of the most promising crowd-sourced projects (Haklay and Weber 2008; Ramm et al. 2010). We chose Italy, a country with almost "complete" data for administrative divisions. The sample dataset was limited to a bounding box defined as: 41.836501°N to 41.948695°N, 12.436859°E to 12.626374°E. We extracted all municipal boundaries from the OSM dataset with tag value of "admin_level=9," which is used in the region of interest to define administrative subdivisions in Rome. Then, we added two additional attributes: *name_left* and *name_right*, which define the label content for the left and the right side of a polyline respectively.

The input parameters of our algorithm S, D_{max}, D_{step}, B_{min}, and B_{max} are measured in map units, which were pixels in our tests. Additionally, in our implementation, we used a quality threshold parameter Q_T. This parameter allowed us to control and eliminate candidate label positions that corresponded to poor and sloppy label placement. These potential label positions we considered unacceptable and omitted from the *position selection* procedure. Parameter Q_T takes values in the range [0,1], where a value of 1.0 corresponds to an ideal case. In the tests we used $D_{step} = 1$ and chose the value of the parameter K (see Phase II step 1) sequentially from the set [0.5, 0.55, 0.6, 0.65, 0.7, 0.75] until a label placement was found. Next, to evaluate each label position we used function (2) with two different sets of parameters, namely:

$$H_1(l) = 0.3\ g_{\text{PosDev}}(l)\ +\ 0.1\ g_{\text{BaseOffset}}(l)\ +\ 0.5\ g_{\text{GoodnessOfFit}}(l)\ +\ 0.1\ g_{\text{HorizAlign}}(l) \tag{8}$$

$$H_2(l) = 0.1\ g_{\text{PosDev}}(l)\ +\ 0.5\ g_{\text{BaseOffset}}(l)\ +\ 0.3\ g_{\text{GoodnessOfFit}}(l)\ +\ 0.1\ g_{\text{HorizAlign}}(l)$$

In function H_1 we give great weight to $g_{\text{GoodnessOfFit}}$ and nearly neglect the influence of $g_{\text{BaseOffset}}$ and $g_{\text{HorizAlign}}$. In function H_2 we give lowest priority to g_{PosDev} and $g_{\text{HorizAlign}}$, shift the importance of $g_{\text{GoodnessOfFit}}$ to second place, and give $g_{\text{BaseOffset}}$ the highest priority.

PERFORMANCE AND VISUALIZATION RESULTS

In the first set of experiments we used quality function H_1 and explored how the success rate (the number of potential label locations) decreases as the quality threshold Q_T and the position deviation D_{max} increase, as well as how much time the labeling took. We set the input parameters to $S = 400$, $B_{min} = 2$, $B_{max} = 8$. Then, taking into account the value of S and the length of each of the 46 polylines in the tested region, we calculated the maximum possible number of labels. This number was $m = 493$. It is worth noting that from each set V_j of the candidate positions $\overline{q}_{jk}$, we choose only one candidate. In Figure 11a we present the results of the experiment: the algorithm is able to place labels in 95% of the desired positions ($m = 493$) with $Q_T = 0.55$ and $D_{max} = 80$. When the quality threshold is higher, namely $Q_T = 0.75$ and $D_{max} = 1$, we observe 75% of the maximum possible number of labels. Therefore, we conclude that enlargement of the search space and a lowered quality threshold results in a higher rate of labeled positions. Furthermore, we also measured the algorithm's runtime, in order to determine the influence of the search space. Figure 11b illustrates a linear dependence. Our algorithm is able to find one label position in 7.602 milliseconds. Note that such performance makes the algorithm appropriate for usage in interactive and dynamic labeling (Been et al. 2006; Mote 2007).

In another test, we fixed the position deviation value $D_{max} = 25$ and ran our algorithm several times by varying B_{max}. The results of the tests are shown in Figure 12a, and illustrate the ability of the algorithm to increase the percentage of placements by increasing the maximum permissible distance between two coupled labels (n_l and n_r) on either side of the polyline. This possibility comes in handy in case of labeling extremely curved parts of a polyline.

Finally, we evaluated the dependence of the number of placed labels on the type of the quality function, running the same test for both functions H_1 and H_2. The results presented in Figure 12b show that the algorithm places more labels with function H_1 than with H_2. However, the number of labels is almost the same with higher values of D_{max}.

In order to demonstrate that our algorithm is able to generate legible and cartographically plausible label placements, we prepared two sample maps (Figures 13 and 14). We utilized function H_1 for type placement in both maps. Figure 13 depicts a map which was labeled using

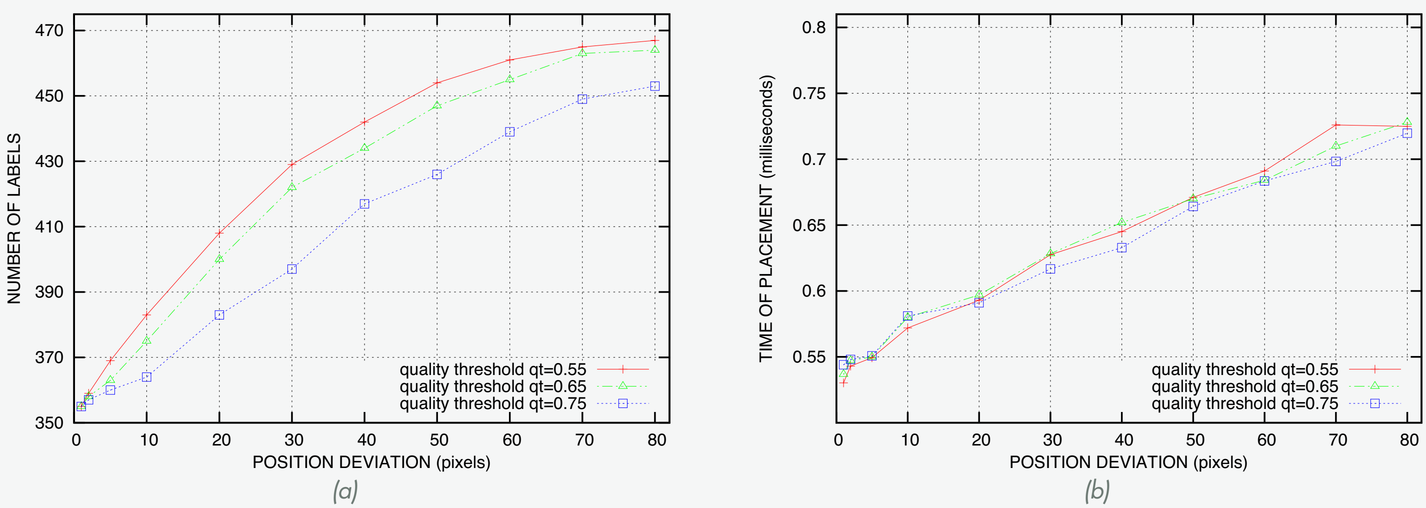


Figure 11. *Experimental results for different Q_T values. (a) Dependence of the number of label placements on D_{max}. (b) Dependence of the runtime on D_{max}; the Y-axis defines the time needed to find one label placement.*

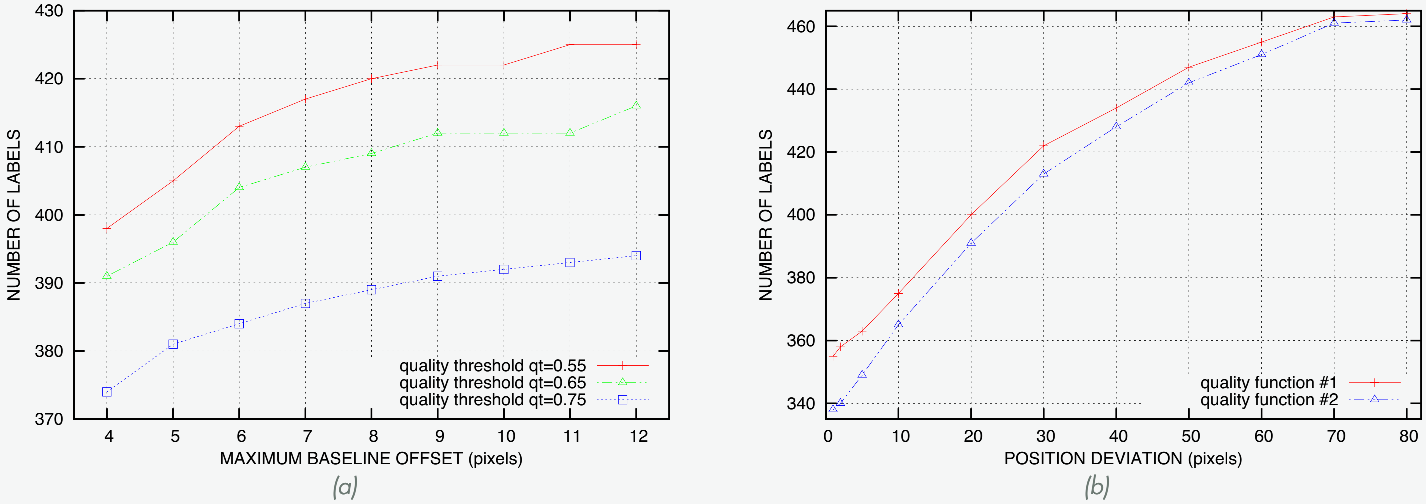


Figure 12. *Experimental results. (a) Dependence of the number of label placements on* B_{max} *when* $B_{min} = 2$*. Tested function is* H_1*. (b) Comparison of two quality functions* H_1 *and* H_2 *when* $B_{min} = 2$, $B_{max} = 8$.

Figure 13. *Labeling of municipal boundaries in Rome (7 labels). The input parameters are* $S = 400$, $D_{max} = 1$, $B_{min} = 2$, $B_{max} = 4$, $Q_T = 0.75$*. Data source: © OpenStreetMap contributors (2013, data licensed under ODbL).*

Figure 14. *Labeling of municipal boundaries in Rome (20 labels). The input parameters are* $S = 400$, $D_{max} = 100$, $B_{min} = 2$, $B_{max} = 10$, $Q_T = 0.55$*. Data © 2013 OpenStreetMap contributors (data licensed under ODbL).*

a small number of candidate positions and a high value of Q_T, while Figure 14 shows the same region with more candidate positions and a lower quality requirement. The algorithm placed 2.86 times more labels when using the second set of parameters.

The red marks in Figure 14 show that in some cases our algorithm places labels that overlap sinuous polylines, which contradicts guideline G9. This inability of the algorithm can be overcome by performing an additional post-processing step such as leaving out label pairs that intersect their polyline. To check whether a polyline and its labels intersect, we can utilize the algorithm by Bentley and Ottmann (1979) for reporting intersections between two sets of line segments in $O((n + k) \log n)$ time and $O(n)$ space, where n is the total number of line segments, and k is the number of itersections. Note that slightly faster but harder to implement algorithms for the same purpose exist, such as Mairson and Stolfi (1988) that requires $O(n \log n + k)$ time and $O(n)$ space. The polyline composes the first set of line segments, whereas eight line segments (eight for each pair of labels) bounding the label comprise the second set. For the sake of the performance this check should be done only once after all potential labels are generated. Note that our implementation currently does not take this extra step.

Figure 15 illustrates a part of a map generated by *MapSurfer.NET*, which contains labels for points (e.g., settlements, motorway shields and peaks), curved lines (e.g., streets, rivers, boundaries) and areas (e.g., parks, lakes). This map demonstrates the possibility of using our algorithm as a part of a more general labeling algorithm (Edmondson et al. 1996).

A set of maps involving pairwise line labeling of boundaries are available online through a web map tile service (García et al. 2012) on *OpenMapSurfer* (**korona.geog.uni-heidelberg.de**). On this page the layers "OSM Roads" and "OSM Admin Boundaries" demonstrate the output of the algorithm on the OSM dataset for the whole globe.

CONCLUSIONS AND FUTURE WORK

In this paper we have introduced a new, efficient, and easily configurable algorithm for performing visually plausible and functional pairwise labeling of lines representing geographic boundaries. Our algorithm achieves two goals: it generates candidate positions and evaluates their quality according to cartographic guidelines for line labeling.

Figure 15. A sample map containing administrative boundary labels together with other feature types such as roads, railways, districts, parks, etc. Data © 2013 OpenStreetMap contributors (data licensed under ODbL).

The results of our experiments on a real-world dataset show that our algorithm is able to find candidates in 95% of desired positions with a certain set of input parameters. The runtime measurements confirm the high performance of the algorithm. Another advantage of the algorithm is that the generated candidate positions and the quality function can be used in a general map labeling algorithm such as that of Edmondson et al. (1996) that labels all feature types (e.g., points, lines and polygons) simultaneously. More precisely, the quality function can potentially be used as a component for a comprehensive quality function (van Dijk et al. 2002; Rylov and Reimer 2014a) which is employed by a combinatorial optimization algorithm (Christensen et al. 1995) to find the globally best and optimal label placement. We also believe that our algorithm can be easily reproduced and embedded in commercial or open source GIS toolkits (Steiniger and Hunter 2013).

It remains an open problem how to perform pairwise labeling of boundary lines using curved text as depicted in Figure 2, which is often more preferable. This task can be accomplished by exploiting a curve fitting procedure. Note that it will require a new method for candidate positions generation and the construction of another quality function. Moreover, both parts of the algorithm should be based on an adopted list of cartographic guidelines that need to be determined through a study (like in Reimer et al. [2015]) of formal principles commonly used in manual lettering. We think that some parts of our algorithm can be borrowed as a baseline for the construction of a new method.

In conclusion, we sincerely hope that our approach advances the development of more robust and efficient algorithms for labeling geographic boundaries.

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The Mocking Mermaid: Maps And Mapping In Kenneth Slessor's Poetic Sequence *The Atlas*, Part Four

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Midway through composing his five-poem sequence The Atlas *(ca. 1930), the acclaimed Australian poet Kenneth Slessor suddenly wrote "Southerne Sea" in his poetry journal. He'd just chosen John Speed's famous double-hemisphere map,* A New and Accurat Map of the World *(1651/1676), as the epithet of his fourth poem "Mermaids." Unlike the cartographic epigraphs introducing the other poems, however, this map has little to do with "Mermaids," which is a riotous romp through seas of fantastic creatures, and a paean to the maps that gave such creatures immortality. The map features a vast "Southerne Unknowne Land," but no mythical beasts. And while it names "Southerne Sea" and "Mar del Zur," neither "Mermaids" nor* The Atlas *mentions Australia or the Southern Sea. Moreover, Slessor's sailors are "staring from maps in sweet and poisoned places," yet what the poem describes are "portulano maps," replete with compass roses and rhumb lines—features notably absent on* A New and Accurat Map of the World. *My paper, the fifth part of the first full-scale examination of Slessor's ambitious but poorly understood sequence, retraces his creative process to reveal why he chose the so-called Speed map. In the process, it extricates the poem from what Slessor originally called "Lost Lands Mermaids" in his journal, details his debt to the ephemeral map catalogue in which he discovered his epigraph, and, finally, offers alternative cartographic representations for "Mermaids." Among them, Norman Lindsay's delightful frontispiece for* Cuckooz Contrey *(1932), the collection in which* The Atlas *debuted as the opening sequence.*

KEYWORDS: Kenneth Slessor (1901–1971); *Cuckooz Contrey* (1932); *The Atlas* sequence (ca. 1930); "Mermaids"; poetry—twentieth-century; poetry—Australian; poetry and maps; cartography—seventeenth-century; John Speed (1552–1629); Norman Lindsay (1879–1969)

> Man … has been fascinated by the mermaid; by her eternal youth, her strange, unnatural beauty; her allure; and by the mysterious ocean wherein she dwells. Her delightful custom of combing her long tresses, mirror in hand, and the magic of her voice … these, too, have … often blinded him to her true nature. For the mermaid is the **femme fatale** of the sea; she lures man to his destruction, and usually he goes unresisting to his doom.
>
> —Gwen Benwell and Arthur Waugh, *Sea Enchantress: The Tale of the Mermaid and Her Kin* (1965)

> I have heard the mermaids singing, each to each.
> I do not think that they will sing to me.
>
> —T. S. Eliot, "The Love Song of J. Alfred Prufrock" (*Poetry*, June 1915)

Two decades ago, I discovered the Australian poet Kenneth Slessor while searching for "maps" in *Columbia Granger's World of Poetry* database. Among the hundreds of entries citing the word, one line leapt off the screen—"staring from maps in sweet and poisoned places." It came from "Mermaids," the exuberant fourth poem of Slessor's five-poem sequence *The Atlas* (ca. 1930). Reading the poem brought other delights. Seas filled with Mermaids, Anthropophagi and Harpies dancing on the shores, portolan charts with "compass-roses … wagg[ing] their petals over parchment skies," not to mention Slessor's obvious delight in conflating the imagery of early maps with what mariners actually experienced. I was hooked, especially after realizing that "Mermaids," like most of the sequence, begins with an introductory quote or epigraph from an important and beautifully illustrated seventeenth-century map.

And there lay the problem. Once I understood how map-obsessed Slessor was, it became impossible to treat "Mermaids" in isolation as if it were a self-contained poem like Earle Birney's "Mappemounde" (Haft 2002), Grevel Lindop's "Mappa Mundi: The Thirteenth-Century World-Map in Hereford Cathedral" (Haft 2003a), or Marianne Moore's "Sea Unicorns and Land Unicorns" (Haft 2003b), each of which also imagines fabulous sea-creatures through a cartographic lens. "Mermaids" had to be viewed in relationship to the poems around it, and to *The Atlas* as a whole.

In four earlier issues of *Cartographic Perspectives* I have begun that journey. My "Introduction" (Haft 2011) focused on Slessor's literary accomplishments, particularly *Cuckooz Contrey* (1932), his third solo collection which opened with the recently minted *Atlas* sequence. Since much of his early poetry was illustrated, at least two of the artists whom we encountered in the introduction reappear here. The first is Slessor's mentor, Norman Lindsay (1879–1969), the famously controversial bohemian artist/writer popularized, however inaccurately, in the 1993 film *Sirens*. According to Slessor, Lindsay's generous collaborations enabled the artist/writer to "exercise more influence … on numbers of this country's poets than any other single individual in Australia's history" (Slessor 1970, 111–112). Lindsay repeatedly alludes to "Mermaids" in the frontispiece he created for *Cuckooz Contrey*. The second prominent artist is poet/illustrator Hugh McCrae (1876–1958), who admired Slessor's and Lindsay's works as much as they admired his (Slessor 1970, 92–110; Lindsay and Bloomfield 1998, 40–41, 55–64). All three life-long friends contributed to the short-lived magazine *Vision: A Literary Quarterly* (Johnson, Lindsay, Slessor 1923–1924), which promised its youthful readers poetry and prose that "liberate the imagination by gaiety or fantasy" (*Vision* 1, May 1923, 2; see Lindsay 1960, 84; Dutton 1991, 58 and 71). Cavorting through the four issues of *Vision* were Norman's drawings of mermaids, fauns, nymphs, and centaurs—lustful creatures of Classical and Anglo-Saxon mythology that he and McCrae helped relocate in Australian literature. Then there's Captain Francis Joseph Bayldon (1872–1948), the maternal uncle of Slessor's first wife, Noela. As practical as the others were dreamers, Bayldon was a master mariner, accomplished hydrographer, and writer/lecturer specializing in Australian maritime history and exploration (Phillips 1979). Even so, he became "a major influence" on Slessor's "poetic career" (Dutton 1991, 142). For while composing *The Atlas*, Slessor discovered that weekly visits to Bayldon's home in Sydney gave him access not only to the old sea-captain's "astonishing knowledge of nautical things" (Kiernan 1977, 7; Slessor, Haskell, and Dutton 1994, 362), but also to the captain's "magnificent nautical library" (Slessor 1970, 192), now preserved in the Mitchell Library of the State Library of New South Wales. Slessor's biographer Geoffrey Dutton thought that "Slessor took his notebook along to Captain Bayldon's," because "it is full of jottings from old maps and books, lists of galleons, sloops, flying fish, sea monsters, battles and mermaids" (Dutton 1991, 144). More likely, Bayldon lent Slessor the work that inspired *The Atlas* and became its ultimate source—an illustrated and unusually lyrical catalogue titled *Old Maps of the World, or Ancient Geography; a Catalogue of Atlases & Maps of All Parts of the World from XV Century to Present Day* (Francis Edwards 1929). With its poetic advertisements of maps and cartographers as well as its attention to the period vocabulary of its items, *Old Maps of the World* proved irresistible to a word-smith and verbal image-maker like Slessor. What makes *The Atlas* unique is its poet's response not to the physical sensation of seeing or touching maps, but to a catalogue's impassioned *description* of their allure; *for without that piece of ephemera, "Mermaids"—like the other poems of the sequence—simply would not exist.* Yet the catalogue used by Slessor, like the creatures of his poem, is "GONE like the cracking of a bubble." No trace of it can be found in the Bayldon Collection, the Slessor

Papers at the National Library of Australia, the Slessor Collection at the University of Sydney, or any public library in Australia (Australia Trove, National Library of Australia).

As for *The Atlas* poems themselves, my article "Who's 'The King of Cuckooz'?" (Haft 2012a) dealt with the sequence's opening poem, the one most like "Mermaids" in tone, even though "The King of Cuckooz" focuses on a 1620 reconnaissance map of Algiers by the gunner/surveyor/cartographer Robert Norton. "John Ogilby, Post-Roads, and the 'Unmapped Savanna of Dumb Shades'" (Haft 2012b) examined Slessor's second poem, "Post-roads." If "Mermaids" envisions seas filled with mythical creatures, "Post-roads" recasts dancer/translator-turned-publisher/cartographer John Ogilby into a beatific Sisyphus mapping the roads of eternity. "Imagining Space and Time in Kenneth Slessor's 'Dutch Seacoast' and Joan Blaeu's Town Atlas of The Netherlands" (Haft 2013) explored one of Slessor's eight "least unsuccessful" poems. But if "Dutch Seacoast" became the central poem of *The Atlas*, that was not Slessor's original intention: he'd designed the sequence to showcase "Mermaids" as its centerpiece.

Why "Mermaids" came fourth occupies the beginning of this present paper, which reprints the poem and briefly discusses the poem's subject, artistry, and critical responses before turning to the difficulties that Slessor encountered when trying to conceptualize what he called "Lost Lands Mermaids." The poem's cast of characters then comes into focus, followed by an introduction to the maps in "Mermaids." After retracing Slessor's search for the right epigraph, the paper evaluates his choice—the famous world map associated with the English historian/cartographer John Speed—and investigates the complex relationship between *Old Maps of the World* and the drafts of "Mermaids" in Slessor's poetry journal. Next, it compares the published poem with the so-called Speed map, and then confronts the disparities between the two before concluding that the poem, despite its epigraph, has many cartographic inspirations. Finally, the paper shows how Slessor's artist friends, in contemporary illustrations of his work, combined maps and mermaids, though not necessarily in ways appropriate to the poem itself.

KENNETH SLESSOR'S "MERMAIDS"

Let's begin with the poem itself:[1]

> "*A new and Accurat Map of the World, in two Hemispheres, Western and Eastern, with the Heavens and Elements, a Figure of the Spheare, the Eclipse of the Sunne, the Eclipse of the Moon.*" — J. Speed, 1675[2]

Once Mermaids mocked your ships
With wet and scarlet lips
And fish-dark difficult hips, Conquistador;
Then Ondines danced with Sirens on the shore,
Then from his cloudy stall, you heard the Kraken call,
And, mad with twisting flame, the Firedrake roar.

Such old-established Ladies
No mariner eyed askance,
But, coming on deck, would swivel his neck
To watch the darlings dance,
Or in the gulping dark of nights
Would cast his tranquil eyes
On singular kinds of Hermaphrodites
Without the least surprise.

Then portulano maps were scrolled
With compass-roses, green and gold,
That fired the stiff old Needle with their dyes
And wagged their petals over parchment skies.

Then seas were full of Dolphins' fins,
Full of swept bones and flying Jinns,
Beaches were filled with Anthropophagi
And Antient Africa with Palanquins.

1. "Mermaids" is reprinted from the definitive *Kenneth Slessor: Collected Poems* (Slessor, Haskell, and Dutton 1994, 74–76), whose version, except for minor changes in punctuation and capitalization, is identical to the original version in *Cuckooz Contrey* (Slessor 1932, 16–17). Along with the rest of the sequence, "Mermaids" was reprinted in *One Hundred Poems* (Slessor 1944, 59–60), *Poems* (Slessor 1957, 51–52; Slessor 1972), and *Selected Poems* (Slessor 1975; Slessor 1993, 60–61). Like Haskell and Dutton, I quote the poem in its entirety. However, rather than employing notes to annotate Slessor's highly allusive and self-consciously baroque vocabulary (e.g., Slessor, Haskell, and Dutton 1994, 360–361), I explain the poet's word/phrase choices as they become germane to my paper's larger arguments.

2. The date 1675 is a misprint. (See below, note 19.) Unless otherwise noted, cartographic dates derive from Tooley et al. 1999–2004.

Then sailors, with a flaked and rice-pale flesh
Staring from maps in sweet and poisoned places,
Diced the old Skeleton afresh
In brigs no bigger than their moon-bunched faces.

Those well-known and respected Harpies
Dance no more on the shore to and fro;
All that has ended long ago;
Nor do they sing outside the captain's porthole,
A proceeding fiercely reprehended
By the governors of the P. & O.

Nor do they tumble in the sponges of the moon
For the benefit of tourists in the First Saloon,
Nor fork their foaming lily-fins below the side
On the ranges of the ale-clear tide.

And scientists now, with binocular-eyes,
Remark in a tone of complacent surprise:
"Those pisciform mammals—pure Spectres, I fear—
Must be Doctor Gerbrandus's *Mermaids*, my dear!"

But before they can cause the philosopher trouble,
They are GONE like the cracking of a bubble.

After the angst with which "Dutch Seacoast" ends, "Mermaids" delights us with its bouncy rhythms, varied rhymes, and gallery of mythic creatures that once entertained sailors and adorned their maps. A celebration of vitality and wonder, overlaid with "a new satiric nuance and dryness of tone" (Burns [1963] 1975, 24), the fourth poem of *The Atlas* pits new science against old science, only to find "scientists now" complacent, patronizing, pedantic, and utterly lacking in romance. For them, the seductive mermaid is merely one of "those pisciform mammals"—like the dugongs, who inhabit the shallow, tropical waters from East Africa through the Philippines; or the manatees, their West African and New World relatives whom the Conquistadors mistook for mermaids (Ellis 1994; see NLA MS 3020/19/1/137[3] for "1494"). Once classified as "Pisciformae" ("fish-shaped": Ellis 1994, 90), such homely and placid mammals held as much allure for Slessor as "Doctor Gerbrandus's *Mermaids*."[4] Throughout the poem, Slessor combines such light-hearted satire with a wistfulness for a more daring and imaginative era, when sailors braved unknown seas in "brigs no bigger than their moon-bunched faces." Yet Slessor hasn't entirely given up hope for a world that inspires awe rather than scientific skepticism or tourists' passive acceptance of whatever experts on their cruise ship happen to "remark."[5] In his *Vision* days, Slessor might have suggested that creatures like mermaids exist for those who believe in them (e.g., "Realities": Slessor, Haskell, and Dutton 1994, 58–59). He says as much in a draft of "Mermaids": "sailors undoubtedly saw them because they/ believed in them but as soon as they asked/ "Is that a mermaid"/ they vanished/ like a bubble snapping" (June 1, -s137). The final lines of "Mermaids," however, shift the perspective: mermaids are "pure Spectres" for those who haven't the imagination to believe.

Douglas Stewart recognized a shift in "Mermaids" and interpreted it as one of Slessor's "break-through[s] into the poetry of the twentieth century" (Stewart 1964, xxx):

> The difference between **Cuckooz Contrey** and the Australian poetry which had preceded it might be seen in … the change of outlook demonstrated in the subject of mermaids, where they are touched upon in "The Atlas." To Hugh McCrae—and rightly for his purposes—a mermaid would have been a serious matter; Slessor drily notes that such an apparition would have hardly been credible to the passengers of the P. & O.

3. "NLA" refers to the National Library of Australia, which holds the Papers of Kenneth Adolf Slessor (1901–1971) under the designation MS 3020. For brevity, subsequent references to items in the poetry journal that contains Slessor's drafts of *The Atlas*—NLA MS 3020/19/1—will be abbreviated "-s#". For example, "-s137" represents both "NLA MS 3020/19/1/137" (for the paper version) and **nla.gov.au/nla.ms-ms3020-19-1-s137-v** (for the online scan). As explained in my Introduction (2011), Slessor drafted *The Atlas* (ca. 1930) in a 1927 desk calendar: neither 1927 nor the date accompanying each entry has anything to do with the actual year or time in which the poet created the various parts of his sequence. Nevertheless, I've included the journal's "month" and "day" ("June 1") along with its "page" number (-s137) to aid identification.

4. Gerbrandus (d. 1504) was a Carmelite monk and Dutch chronicler who once offered a perfectly rational explanation for a creature who'd emerged, a century earlier, from a breach in a dike near Edam. Understood by no one, she spent the rest of her life spinning and adoring the cross. Although later writers insisted she was a mermaid, Gerbrandus put her down as a wild woman (*Encyclopedia Britannica* 1911, 18:172, s.v. "Mermaids and Mermen").

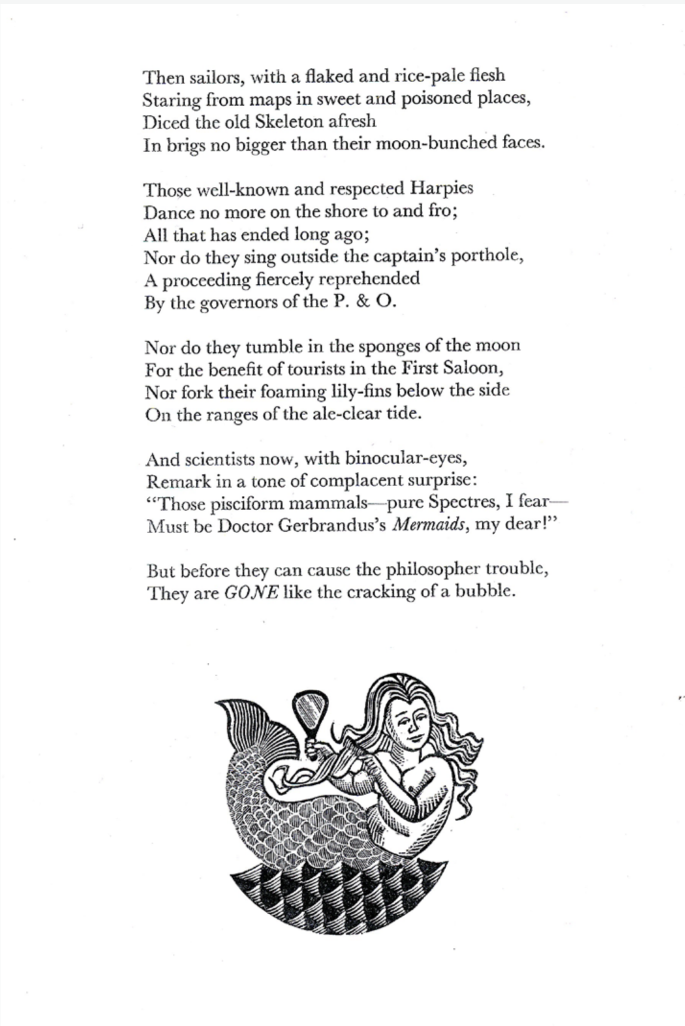
5. In her poem "A Traveller's Tale," Rosemary Dobson—a famous Australian poet whom Slessor mentored and clearly influenced—offers an equally light-hearted but cynical view of the same subject. While Slessor eschews the first-person in "Mermaids," Dobson imagines a seventeenth-century sailor conning drinks from a land-lubber by conflating the imagery of contemporary maps with what mariners actually experienced on the seas (Dobson 1948, 22):

> It *was* confusing, sir——
> All those damned cherubs hanging in the air
> Tangling their wings against the mizzen-mast;
> And then the mermaids …

Which is why Stewart began his influential anthology *Modern Australian Verse* with Slessor's poetry from 1930 on, and why he chose "Mermaids" in particular.

Like Stewart, Herbert Jaffa sensed the poem's significance within *Cuckooz Contrey*, but regarded "Mermaids" nostalgically. However "light" its spirit, however much its "high humor" resembles that of "The King of Cuckooz," Jaffa concluded (1971, 83):

> We leave the poem with some feeling of sadness and sense of loss. Once there was a time for imagining and dreaming; now it is no more: now we live with the facts, the literalness of things. We will discover this sadness and sense of loss with increasing frequency and depth in many poems of the middle period [1927–1932].



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Nor do they tumble in the sponges of the moon
For the benefit of tourists in the First Saloon,
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Remark in a tone of complacent surprise:
"Those pisciform mammals—pure Spectres, I fear—
Must be Doctor Gerbrandus's *Mermaids*, my dear!"

But before they can cause the philosopher trouble,
They are *GONE* like the cracking of a bubble.

Figure 1. *Mike Hudson's wood-engraving of "Mermaids" in* The Sea Poems of Kenneth Slessor*, edited by Dennis Haskell (Slessor et al., Canberra: Officina Brindabella, 1990, 21). With her long locks, comb, and mirror (symbol of beauty and vanity), Hudson's mermaid retains her medieval and early modern features. Reproduced from* The Sea Poems of Kenneth Slessor.

Dennis Haskell, on the other hand, approaches the poem more optimistically in *The Sea Poems of Kenneth Slessor* (Slessor et al. 1990, 7):

> 'The Atlas: Mermaids' establishes the sea as the site of the imagination, and of reality as it exists in full human awareness, uncontainable by the narrow vision of scientists or the mapmakers of 'The Atlas: Dutch Seacoast.'

In terms of technique, "Mermaids" showcases "Slessor's skill in utilizing the resources of rhyme and metre" (Thomson 1968, 39), particularly the "aaabbccb" rhyme scheme of the initial stanza (June 22, -s160). The sheer variety of stanza and line lengths, of meters and rhyming schemes, befits the variety of fabulous creatures dancing through "Mermaids." Ronald McCuaig praises the "*tempo di can-can*…where words dance" in lines like "Those well-known and respected Harpies… On the ranges of the ale-clear tide" (quoted in Thomson 1968, 55). And Stewart declares that Slessor contributed the "ub" sound to the music of English poetry (Stewart 1969, 152), especially in his use of "bubble" in "bubble-clear/ canals of Amsterdam" ("Dutch Seacoast") and "like the cracking of a bubble" ("Mermaids"). As for its broader appeal, "Mermaids" has appeared in more anthologies of Australian verse than the other *Atlas* poems. Besides Stewart's *Modern Australian Verse*, it graces Judith Wright's *New Land, New Language* (1957), though without its epigraph. And Haskell chose "Mermaids" for *Kenneth Slessor: Poetry, Essays, War Despatches* (Slessor and Haskell 1991) as well as for *The Sea Poems of Kenneth Slessor*, illustrated with Mike Hudson's delightful engraving of a mermaid holding a mirror while combing her locks (Slessor et al. 1990, 21) (Figure 1).

"LOST LANDS MERMAIDS"

Despite the poem's playfulness, Slessor found composing "Mermaids" to be the most difficult part of *The Atlas*. Several entries in his poetry journal reveal that he intended the poem to be the centerpiece of his sequence (March 18, -s76; March 28–29, -s83–84; April 3, -s88; April 23, -s101; April 29, -s105). Yet he couldn't decide on a title. On the fifth page of his *Atlas* drafts, for instance, a question mark follows his first attempt (March 2, -s62): "Ballade of Vanished Countries?" His second attempt, "lost countries," suggests the name of a list rather than the title of a poem (March 6, -s65). His hybrid title "Lost Lands Mermaids" (March 18, -s76) hints at two potentially competing ideas: one focused upon the land and its inhabitants; the other, on the sea and its denizens. Although "Lost Lands" quickly rose to the fore (March 28, -s83; April 3, -s88), and although Slessor was busy sketching out its stanzas (April 23–29, -s101 to -s105; insert before May 3, -s108; insert after July 11, -s177; May 31, -s136), "Lost Lands" ultimately joined "Seafight" as the two *Atlas* poems that remained unfinished by December 6, 1930 (see "August 9," -s206). Once he'd completed the latter (August 10–30, -s207 to -s230), Slessor crossed out "Seafight" in that entry. But "Lost Lands" never resurfaced in the journal, let alone in *The Atlas*. The stanzas Slessor was sketching (see Stewart 1977, 99–100) eventually morphed into "Lesbia's Daughter," which premiered in *Five Bells* several years later (1939: Slessor, Haskell, Dutton 1994, 128, 358, 398). The change of title says it all: only two lines of Slessor's "Lost Lands" remain in "Lesbia's Daughter"—"Where's the fine music that the fossil men/ Of lost Lemuria brandished on a pen?" As for our poem, Slessor did not return to it until long after he'd abandoned "Lost Lands," and only after having completed more than half of what we now recognize as "Mermaids." By then, he had not only written the first three parts of *The Atlas*, but had quietly shifted the "central" poem into fourth place (May 25, -s132; May 29, -s134).

Without "Lost Lands," however, neither "Mermaids" nor *The Atlas* would exist. On the seminal opening pages of *The Atlas* drafts (February 22 to March 4, -s58 to -s63), Slessor highlights three items with triple XXXs. The second and third relate to "The King of Cuckooz" ("Atlas 5": March 2, -s62). But the initial item reads: "note vanished empires, lost kingdoms, forgotten lands & provinces, crumbled boundaries" ("Atlas 4": February 28, -s61). Slessor would later include "The King of Cuckooz Contrey" as one of his lost kingdoms (March 6, -s65). Besides that, what these items have in common is their debt to the 1929 Francis Edwards catalogue *Old Maps of the World*. Nowhere is this more obvious than in the expanding and overlapping lists of toponyms labeled "lost countries" or "lost lands" that Slessor periodically compiled to jump-start his composition.[6] The first list includes "Antient Africa" (March 6, -s65), the only place-name in "Mermaids" (stanza 4). Slessor found its archaic spelling in E. Wells' *A New Map of the North Part of Antient Africa* (1700). Although no citation appears in his poetry journal, the catalogue's item 491 not only features a map with this title but also closely follows the Robert Norton entry used by Slessor for "The King of Cuckooz" (item 487: Francis Edwards 1929, 106; see Haft 2012a). Since Slessor first mentions "Antient Africa" in his journal immediately after his discovery of Norton's map ("Atlas 6": March 4, -s63), it's clear that the earliest pages of his *Atlas* drafts reflect his engagement with the catalogue from beginning to end, or at least to "Poli Arctici" in item 636 of 852 total (Francis Edwards 1929, 123; March 4, -s63).

While "Mermaids" would ultimately favor sea-creatures over the monstrous races cluttering lands called "unknown" (see Friedman 1981; Haft 1995), the poem does revel in "singular kinds of Hermaphrodites" (stanza 2), and "beaches…filled with Anthropophagi" (stanza 4). Human races endowed with both male and female sexual organs were common enough on medieval manuscript maps (Westrem 2001, 378–379; Van Duzer 2013a, 397–398), although none of the items in *Old Maps of the World* actually mentions hermaphrodites or *androgini* (Friedman 1981, 10). As for anthropophagi, people who "eat people" remained popular on maps, especially once this monstrous race was transposed to the New World and renamed "cannibals" (Reinhartz 2012, 110, 132, 147–148). The third and fourth pages of the *Atlas* drafts reveal how quickly Slessor discovered references to man-eaters in the catalogue (February 26, -s60; February 28, -s61). "Figures of anthropophagi" comes from item 106—a Mercator atlas containing a map of Brasil by Hondius "adorned with figures of anthropophagi, ships, animals, &c." (Francis Edwards 1929, 49; detail in Reinhartz 2012, 147), while "anthropophagi in Brasil" comes from item 133—a Ptolemaic atlas with 50 maps, including "*Tabulae Terrae Novae*, with … anthropophagi in Brasil, &c." (Francis Edwards 1929, 58; see also 116, item 565).

"Anthropophagi in Brasil" reappears with a check beside it in Slessor's pivotal "May 29" entry (-s134). Although titled "Lost Lands" (see also August 9, -s206), that entry and the following two pages mark the transition to "Mermaids," whose outlines are evident by "June 1" (-s137). Slessor's "May 29" entry includes many other names and phrases

6. "Lost countries" (March 6, -s65: fourteen place-names) and "lost lands" (March 28, -s83: nineteen place-names; May 25, -s132: thirty-three place-names; May 29, -s134: over forty place-names).

recognizable from “Mermaids”: “mermaids,” “dolphins,” “palanquins,” “portolanos” or “portolan maps,” “the Eclipse of the Sunne,” and “compass roses (spreading their green & yellow petals).” Like “anthropophagi,” each of these first surfaced in the opening pages of his *Atlas* drafts, and each was highlighted with a check.[7] The only words not initially checked are “dolphins” and “palanquins” (March 2,-s62), though, like almost everything else in the poem, they are hybrids—at least in name. For unlike fish, the dolphin (Gk *delphis*) has a womb (Gk *delphus*), while “palanquin”—one of the exotic words that Slessor found irresistible—is the Portuguese pronunciation of the East Asian word for an enclosed litter that rests on poles, thus allowing an individual to be conveyed on other men’s shoulders. At the center of his “May 29” entry, these two words appear with “mermaids” in phrases heavily bracketed to indicate their importance (-s134). Once Slessor began to abandon “Lost Lands,” in other words, “Mermaids” quickly revealed itself from the fragments of his earliest musings.

7. Mermaids (“Atlas 3”: February 26, -s60); portolanos (“Atlas 5”: March 2, -s62); compass roses (“Atlas 6”: March 4, -s63).

MERMAIDS AND OTHER FABULOUS CREATURES

Mermaids were nothing new to Slessor. In fact, they were part of his program “to help heal the hurt of Gallipoli” (Jaffa 1971, 15):

> Published shortly after World War I, Slessor’s first poems, adorned with bare-breasted mermaids and nudes astride gamboling centaurs, “were read with a quickening delight as symbols of youth resurgent from the mire and the wreckage” (15 n.3, quoting Charles Higham).

Slessor showcased mermaids in “Adventure Bay” and “Thieves’ Kitchen,” published in his first collection, *Thief of the Moon* (Slessor and Lindsay 1924). “Adventure Bay” had premiered a year previously: in the third issue of *Vision*, the mermaid was the iconographic theme, and the poem itself was accompanied by Norman Lindsay’s seductive engraving of mermaids hailing a lone vessel (Figure 2). There was even a quarterly called *The Mermaid* that attracted writers and artists like Slessor, Lindsay, and McCrae (NLA MS 3020, 2/1/8). And Slessor’s semi-fictitious character John Benbow sports a mermaid tattoo in “Metempsychosis,” a poem completed just before *The Atlas* (Slessor, Haskell, Dutton 1994, 102 and 384). So it’s no surprise that the mermaids’ “wet and scarlet lips” are the first of the poem’s words that Slessor composed, although he originally penned them for “Dutch Seacoast” (May 6, -s111; May 8, -s113; undated typed insert, -s178).[8]

Dolphins are also associated with eroticism, fantasy, and exploration in Slessor’s early poems “The Buccaneers” (1919), “The Embarkation for Cythera” (1924), and “Realities” (1924).[9] In his journal, Slessor imagined that a sailor, spying a mermaid at night, “might … think no more of it than seeing a dolphin leap” (June 1, -s137). As for Ondines—French for “undines,” sea nymphs named for the “waves” (Latin *undae*) they supposedly inhabited—Slessor emphasized their wealth and sexuality in his poem “Undine” (Slessor, Haskell, Dutton 1994, 6), published in *Thief of the Moon* (Slessor and Lindsay 1924), and later anthologized with “Mermaids” in *The Sea Poems of Kenneth Slessor* (Slessor et al. 1990, 9). And he’d compared the laughter of undines to “bells in water” in his “The Embarkation for Cythera,” also in *Thief of the Moon* (Slessor and Lindsay 1924, 29). The *Atlas* drafts show Slessor giving Ondines the same “wet and scarlet lips” that his mermaids would have in the published version (-s150, insert between June 15 and 16; see also June 7, -s143).

Other characters seem new to Slessor’s work. Sirens were originally bird-women in Classical art (Neils 1995). But they had long since transformed into mermaids called “Syrens” who, like their Homeric counterparts (*Odyssey* 12.39–54, 165–200), lured sailors to destruction with

8. Nor is it surprising that Slessor’s reference to mermaids’ “fish-dark difficult hips” was dubbed “unforgettable” (Stewart 1969, 158; Stewart 1977, 74). Fellow poet and bon vivant Richard Aldington praised the expression in his enigmatic way (Aldington 1958, 13):

> “Difficult hip[s]” … everyone must at some time have pondered that problem but I know no other writer who has managed to suggest it in less than a line. The difficulty seems insoluble, for the solution put forward by Rubens, and after him Böcklin, presents grave inconveniences.

To which Dutton responded, “Aldington is dead, and extensive researches have failed to explain Rubens’ solution” (Dutton 1991, 309). Whatever it may have been, Lindsay’s etchings certainly reveal the problem. They appeal because they show mermaids in thigh-high fish-net stockings: with their girlish pudenda and bare buttocks, Lindsay’s mermaids seem to offer tantalizing legs rather than a single “chaste” fish-tail.

9. See Slessor, Haskell, Dutton 1994, 257–258 and 441; 29–30 and 344–346; 58–59 and 353–354, respectively.

Adventure Bay.

SOPHIE'S my world—my arm must soon or later
Like Francis Drake turn circumnavigator,
Stem the dark tides, take by the throat strange gales
And toss their spume to stars unknown, as kings
Rain diamonds to the mob—then arch my sails
By water-spouts of lace and bubbling rings
Gulfed in deep satin, conquer those warmer waves
Where none but mermaids ride, and the still caves
Untrod by sailors—aye, and with needle set,
Rounding Cape Turnagain, take up my way,
And so to the Ivory Coast—and farther yet,
Port of all drownéd lovers, Adventure Bay!
—*Kenneth Slessor.*

Figure 2. *Kenneth Slessor's "Adventure Bay" in* Vision: A Literary Quarterly *(November 1923, 6). For its debut publication, "Adventure Bay" was illustrated with Norman Lindsay's enticing mermaids. Although Slessor's lover/narrator desires to "conquer those warmer waves/ where none but mermaids ride" (lines 7–8), Lindsay also alludes to Odysseus's temptation by the Sirens in* Odyssey *12. Reproduced from* Vision: A Literary Quarterly.

their seductive songs (Benwell and Waugh 1965, 228; Ellis 1994, 41, 46-47; Leclercq-Marx 1997; Ciobanu 2006, 11). Columbus—who reported that the New World contained no monstrous races only savages (Friedman 1981, 198–207, 257–258)—named the manatees of the Caribbean "sirens," and scientists still classify these herbivores and their relatives as "Sirenia" (Ellis 1994, 88). Slessor's "well-known and respected Harpies" were originally wind spirits called "Snatchers" (Gk *Harpuiai*: *Odyssey* 20.77), though they devolved into predatory women with wings and talons who left their stench behind after carrying off food or people (Apollonius of Rhodes, *Argonautica* 2.187–300; Vergil, *Aeneid* 3.210ff.). In stanzas six and seven, Slessor conflates the repellant Harpies with Sirens, who by tradition were able not only to fly but also, unlike the Harpies, to "sing" and "fork their foaming lily-fins below the side." Finally, Slessor drew from sources other than Classical myth. His "seas … full of … flying Jinns" (stanza 4) refers to "genies" or "jinni," Islamic spirits—familiar from *The Arabian Nights*—who assume human or animal form to aid, or harm, men. Germanic myths inform his lines: "Then from his cloudy stall, you heard the Kraken call,/ And, mad with twisting flame, the Firedrake roar" (stanza 1; see June 4, -s140, and June 19, -s157, respectively). The "Firedrake" or "fire-dragon" entered English literature in the Anglo-Saxon epic *Beowulf*, while "Kraken," a Norwegian name, can refer to a sea-serpent sporting a horse's head and a body spiraling over a mile-and-a-half (Ellis 1994, 45, 125).[10] Memorialized in a sonnet by Tennyson[11] and identified by "scientists now" as a giant squid *Architeuthis* (Ellis 1994, 113–164, 365), its undulations were said to resemble islands, and its coils to crush ships (ibid., 125, 143*; Encyclopedia Britannica* 1911, 15:923, s.v. "Kraken"). Slessor's "murky stall" is the perfect home for a horse-headed creature, though the Kraken's "call" may derive from Jules Verne's description in *Twenty-Thousand Leagues under the Sea* (1870) of the giant squid's beak-like mouth (Ellis 1994, 115, 118).

In Slessor's poetry journal, the Kraken first surfaces in a list of sea creatures: "Mermaids, Dolphins, Krakens, Dragons, Chilons, Balena, Hippocampus, [?], Monk fish, Bishop-fish/ Calamary, Cetacean" (June 4, -s140). Slessor must have consulted the landmark 11th edition of the *Encyclopedia Britannica* for "Doctor Gerbrandus's *Mermaids*," since his "July 9" entry (-s175) cites "D'Arras/ John Gerbrandus a Leydis [Leiden]"—two names found in that encyclopedia's entry "Mermaids and Mermen."[12]

10. The Kraken is also associated with the *lyngbakr*—an island-size whale that lured, and then devoured schools of fish in one gulp after belching partially digested morsels from its maw (Van Duzer 2013b, 108–110; see also Nigg 2013, 142–147).

11. Alfred Lord Tennyson published "The Mermaid," "The Merman," and "The Kraken" in *Poems, Chiefly Lyrical* (1830: see Tennyson and Ryals [1830] 1966, 33–34, 31–32, and 101, respectively); while his "Sonnet to JMK" speaks of scaring "church-harpies from the master's feast" (117). In a 1962 interview, Slessor confessed: "Tennyson has always been my master. Tennyson was a teacher and master of metrical genius" (quoted in Kiernan 1977, 3–4). Ondines and Sirens are equally well represented in nineteenth-century and early twentieth-century poetry/romance, while "Mermaids" and another *Cuckooz Contrey* poem "Captain Dobbin" (see below) recall T. S. Eliot's "The Love Song of J. Alfred Prufrock" (*Poetry*, June 1915: see Dutton 1991, 147–148).

12. The French poet Jean d'Arras completed his *Roman de Mélusine* in 1393, after asserting in his prologue the divine truth of his story (Delogu 2007). His romance about a mermaid who lived as the wife of a mortal until being

***Figure 3.** "Inventio Maris Magallanici" (Discovery of the Sea of Magallanica), plate 15 in* America, *part 4 of Theodor de Bry's* Les Grands Voyages *(Bry and Benzoni 1594). If neither title or caption, nor the text of chapter 15 (pp. 66–67) refers to the mythical characters in this copper-engraving, that's because De Bry took the image, drawn by Jean Stradan and engraved by Jean Galle, from a 1522 work celebrating the return of Magellan's flagship Victoria after the first circumnavigation of the globe (Bucher 1981, 25–26). Like this famous illustration, Slessor's poem features mermaids, sea-monsters, exotic savages, and a nonchalant "mariner" aboard his "brig." There is also a "flying" spirit (a Jinn rather than Apollo) as well as "flames" (for the Firedrake rather than Tierra del Fuego), peculiar natives, and a predatory bird-like creature (a Harpy, rather than a Roc, who isn't carrying off an elephant—an animal found in "Antient Africa" rather than in Patagonia). While no direct evidence exists of Slessor's having seen this triumphal image in Balydon's library or elsewhere, the Captain's* Remarks on Navigators of the Pacific, from Magellan to Cook *came out the same year as* Cuckooz Contrey *(Bayldon 1932). Reproduced from Philip Alexander's* The Earliest Voyages Round the World, 1519–1617 *(1916, 25).*

And Slessor certainly had access to Captain Bayldon's library, which specialized in books on discovery and exploration, like Philip Alexander's *The Earliest Voyages Round the World, 1519–1617* (1916), with its Theodor de Bry illustration of Magellan sailing through the Strait that bears his name and into an ocean filled with mermaids and sea-monsters (Figure 3). Bayldon also collected books on the romance of the sea, including *Legends and Superstitions of the Sea and of Sailors*, with its chapters on mermaids, water-sprites, and sea-monsters (Bassett [1885] 1971); and *Monsters of the Sea: Legendary and Authentic* (Gibson 1890), which dealt with the legendary Kraken. In fact, both the Kraken and the Firedrake make their appearance in *Cuckooz Contrey* in poems closely associated with *The Atlas* and completed only a short time before; namely, "Captain Dobbin" and "Five Visions of Captain Cook."

betrayed by him "became one of the most popular folk-books of Europe" (*Encyclopedia Britannica* 1911, 18:171–172).

The eponymous hero of "Captain Dobbin" watches "the lights, like a great fiery snake, of the *Comorin/* Going to sea" (Slessor, Haskell, Dutton 1994, 77, 362), while "Five Visions of Captain Cook" opens with "Cook was a captain of the Admiralty/ When sea-captains had the evil eye,/ Or should have, what with beating krakens off" (87, 366). The lines from "Five Visions" stand out because Slessor originally experimented with "Evil Eye" in the fifth stanza of "Mermaids" before settling on "the old Skeleton"—presumably the sea "full of swept bones": "Then mariners …/ Dicing against the Evil Eye afresh/ In caravels no bigger than their faces" (June 24, -s162). If Slessor exchanged lines within *The Atlas* poems, the sea-obsessed sequences of *Cuckooz Contrey* reveal their own interminglings.

PORING OVER *OLD MAPS OF THE WORLD*

"Mermaids" may celebrate fanciful creatures, but maps are equally its subject. Besides the epigraph, two of the poem's nine stanzas call attention to them. In stanza five "sailors … star[e] from maps in sweet and poisoned places." And stanza three, added belatedly after Slessor had worked his way through the original five (June 30, -s168; July 3–4, -s170–171; July 6,-s173), focuses entirely on a type of map named only this once in *The Atlas*:

> Then portulano maps were scrolled
> With compass-roses, green and gold,
> That fired the stiff old Needle with their dyes
> And wagged their petals over parchment skies.

Variously called "portolanos" or "portolan/portulan" maps or charts, Slessor's "portulano maps" refer to sea charts dating from around 1200 through the seventeenth century (see Francis Edwards 1929, 6, 91; Philip Lee Phillips Society 2010). Portolanos were originally designed as navigational tools rather than for contemplation (like medieval Christian *mappaemundi*, "world maps") or for arm-chair exploration (like multi-volume atlases). Focused initially on the Mediterranean and Black Sea, portolan charts display compass roses intersecting networks of rhumb lines (see Figure 13, below), which when plotted with a compass, aided navigators in determining the direction and distance from harbor to harbor. Whether on vellum or another type of parchment, portolan charts are immediately recognizable by the accuracy of their coastlines, the proliferation of towns and place-names along the water, the paucity of geographical detail in the interior, and the absence of *terrae incognitae*. *Old Maps of the World* lists and describes in detail three portolanos, each an expensive seventeenth-century manuscript map on vellum (Francis Edwards 1929, 91, item 313; 108–109, item 515; 114–115, item 556). Slessor was clearly impressed. On the fifth page of his *Atlas* drafts, he put an "X" beside "portolanos/—portolan maps/ with/ compasses/ direction stars/ towns, trees and animals/ by Franciscus Oliva" (March 2, -s62). These words come directly from item 313, the "highly decorated" 1613 "Portolan Map of the Mediterranean with the adjacent coasts of Europe, Asia and Africa" (Francis Edwards 1929, 91). Some of the words he copied into his journal—"portolan maps (portolanos)/ compasses"—would reappear in his pivotal entry of "May 29" (-s134). But Slessor's "compass-roses, green and gold" comes from item 556: Joël Gascoÿne's "brilliant portolan or navigation chart in gold and colours with elaborate compass roses and other decorations, the whole most delicately drawn and coloured in reds, greens and yellows" (Francis Edwards 1929, 114). The sixth page of Slessor's *Atlas* drafts records this discovery in his slightly embroidered "compass roses (spreading their green & yellow petals)" ("Atlas 6": March 4, -s63). And he repeats the phrase in his "May 29" entry (-s134).

The epigraph of "Mermaids" does not come from a portolan chart, however. What the Francis Edwards catalogue emphasizes about the portolans is their historical importance as well as their accuracy and reliability, qualities more attractive to a mariner than to Slessor. Nevertheless, if he was looking for more imaginative items in *Old Maps of the World*, no poem in *The Atlas* offered him more hope for finding a suitable opening quote, even if we exclude the titles Slessor had contemplated as epigraphs for "Lost Lands" and then listed along with their item numbers (March 27–28, -s82 to -s83).[13] For instance, on the third

13. (1) "Les Révolutions de l'Univers" by Michel Picaud, N°.126 [1763]

(2) "Claudii Ptolemaei Alexandrini Geographicae Enarrationis Libri Octo," N°.133 [1541]

(3) "Atlas Maritimus et Commercialis…," N°.11 [1728]

(4) "Europae totius orbis terrarum partis praestantissimae universalis et particularis descriptio" – Jani Bussemechers (with Franconia), N°.30" [1592]

(Bracketed dates are mine and derive from Francis Edwards 1929, pp. 55, 58, 18–19, and 26, respectively). Note that these maps date to the sixteenth or eighteenth centuries, not to the seventeenth as do his other epigraphs.

page of the *Atlas* drafts, he'd placed a large "X" beside "Italian Map with / galleons, caravels, sloops,/ flying fish, sea monsters/ battles and mermaids" ("Atlas 3": February 26, -s60; see Dutton 1991, 146). The first mention of mermaids in Slessor's journal, the quote belongs to a beautifully ornamented atlas of Italy by Giovanni Antonio Magini (1555–1617) (item 100: Francis Edwards 1929, 46). In Magini's 1620 work, Slessor seemed to have all that he wanted: colorful sea-creatures to accompany his mermaids, a seventeenth-century date (unlike the maps listed for "Lost Lands"), and an Italian title to complement the English and Dutch titles he'd chosen for his other epigraphs[14] (Figure 4).

Figure 4. *Giovanni Antonio Magini's* Regno di Napoli, *pl. 48 in his atlas* Italia, *engraved by Benjamin Wright and published posthumously by Magini's son Fabio (Bologna, 1620: 38 × 44 cm, 15 × 17 ¼ inches). Of the maps in Magini's atlas that feature mermaids, this is the most ornate, displaying not only a mermaid and a piping merman in the sea, but also ships, sea-monsters, and a cupid merman on the cartouche.* Regno di Napoli *is not among the Magini maps listed separately for six shillings in* Old Maps of the World *(Francis Edwards 1929, 89, entry 301). Reproduced from* Enciclopedia Bompiani, *vol. 6 (*Storia*), Gruppo Editoriale Fabbri, Bompiani, Sonzogno, etas; Milan 1988. Posted on Wikimedia Commons and accessed March 26, 2015:* **commons.wikimedia.org/wiki/File:Kingdom_of_Naples.png**.

14. Several of Magini's atlas maps feature merfolk on cartouches or sea-monsters in the water, but these creatures appear together only on three: "Isola di Sardegna"; "Liguria o stato della Republica di Genoua," which also shows ships riding on the sea; and Figure 4, below. Although Magini began his work by 1595, it took until 1608 before all the maps were engraved (Magini, Magini, and Almagià 1974, xiv and xx).

Slessor's allusion to the Magini atlas so early in *The Atlas* drafts suggests that its catalogue description inspired not only the title "Mermaids," but perhaps even Slessor's decision to imitate in verse those early maps that populate exotic geographies with mythical hybrids and monsters. For immediately below this "Italian map" quote,[15] Slessor copied details from three more items in the Francis Edwards catalogue ("Atlas 3": February 26, -s60; bracketed details from *Old Maps of the World* are my own):

> giants with puffed cheeks symbolising winds [Ptolemy's atlas: item 534, p. 110]
>
> Virginia & Florida map with/ ships, seamonsters [*sic*], natives & animals/ gilded ships gleaming in water [Mercator-Hondius atlas: item 105, p. 47]
>
> X figures of anthropophagi [Mercator atlas, map of Brasil by Hondius: 1633, item 106, p. 49]

With "Anthropophagi (in Brasil)" checked again below them, the first two items would resurface in Slessor's pivotal "May 29" entry, where "Lost Lands" transitions into "Mermaids." There they merge with a list of words from his "Atlas 5" entry (March 2, -s62: opposite "portolanos"). The heavy bracket enclosing them in his "May 29" entry emphasizes their importance to Slessor (-s134; below, internal brackets from *Old Maps of the World* are my own):

> galleons, caravels, sloops, flying-fish, sea-monsters, mermaids [Magini map, 1620: item 100, p. 46],
>
> giants as winds with puffed cheeks [Ptolemy's atlas, 1542: item 534, p. 110],
>
> buccaneers [Sanson *Archipelague du Mexique*, 1692: item 657, p. 125],
>
> elephants [G. Blaeu, *Aethiopia Superior vel Interior*, 1662: item 442, p. 102],
>
> gilded ships, in water, natives of Virginia & Florida [Mercator-Hondius atlas, 1613: item 105, p. 47],
>
> ostriches, monkeys [G. Blaeu, *Aethiopia Superior vel Interior*, 1662: item 442, p. 102],
>
> dolphins [P.J. Sauermann's map, 1699: item 606, p. 121],
>
> palanquins [no map identified],

15. Both *Old Maps of the World* and Slessor imply that Magini's 1620 work is a "map" of Italy, though it is an atlas comprising many regional maps. Magini's actual map of Italy contains no mermaids (Patrick Morris, email to author: July 29, 2014).

Negroes [G. Blaeu, *Aethopia* (*sic*) *Inferior, vel Exterior*, 1640: item 494, p. 107].

Again, Slessor used none of these titles. He already had a Blaeu epigraph, even though the epigraph for "Dutch Seacoast" came from an atlas by Joan Blaeu rather than his father Willem Janszoon Blaeu ("G. Blaeu" representing the Latin form "Guilelmus Blaeu"). And Slessor had a map of Africa in Robert Norton's "Platt of Argier." Perhaps "Virginia and Florida" didn't sound exotic enough, a problem the Mercator-Hondius map shared with Magini's "Italia"; and both were limited geographically. The Italian atlas had a more insurmountable problem: its single-word title. (Ultimately, despite his depictions of sea battles, Magini also lost out to the "Sanson" epigraph in the final poem of *The Atlas*, "The Seafight" [August 11, -s208].) In his "July 2" entry with its header "O Mermaids" (-s169), Slessor subsequently played with the title of the Mercator-Hondius atlas containing the map of Virginia and Florida: "*L'Atlas ou Méditations Cosmographique de la Fabrique du Monde, et figure di celuy, de nouveau revenue et augmenté*, Amsterdam, J. Hondius, 1613." But he later crossed out the name of this very important atlas, leaving an equally evocative title below it (July 2, -s169):

> *A New and Accurat Map of the World, in two Hemispheres, Western and Eastern, with the Heavens and Elements, a Figure of the Spheare, the Eclipse of the Sunne, the Eclipse of the Moon*."—J. Speed, 1676.

Slessor had finally chosen his epigraph.

But why *this* one? By his "July 2" entry, it is clear that Slessor wanted to introduce "Mermaids" with the title of a seventeenth-century world map ornamented with ships and sea-creatures. The Mercator-Hondius atlas had "La Fabrique du Monde" in its title, and a world map among its offerings. Unfortunately, the Francis Edwards catalogue offers too early a date for the map and says absolutely nothing about its ornaments: "THE WORLD according to Mercator 1587, consisting of two spheres within a very fine arabesque border" is all that there is (Francis Edwards 1929, 47). Nevertheless, when Slessor eliminated the Mercator-Hondius atlas, he replaced it with something he'd been considering nearly as long.

JOHN SPEED

Speed's map was already known to Slessor, even though he didn't record the name "J. Speed" until he'd almost finished "Mermaids" (July 2, -s169; NLA MS 3020/19/7). On the sixth page of his *Atlas* drafts, Slessor had checked "the Eclipse of the Sunne" (March 4, -s63), then transferred the phrase to his pivotal "May 29" entry, where it appears immediately after "portolan maps (portolans)/ compasses" (-s134). Later, while choosing his epigraph for "Mermaids," he would have been reassured of Speed's credentials: the cartographic-landmarks section of the Francis Edwards catalogue entitled "Data" highlights the year 1611 when "John Speed published the second [English] county atlas" following Christopher Saxton's *The Counties of England and Wales* in 1579 (Francis Edwards 1929, 7, 61–63). Nearly twenty items advertised in the catalogue bear Speed's name.[16] And nearly sixty of his county maps of Great Britain and Ireland are listed in item 173, which also informs us that "John Speed, 1552–1629, was born at Farndon in Cheshire" (ibid., p. 75). Further research reveals that Speed, the son of a Merchant Taylor, began his working-life as a tailor. Freed by patrimony from the Company (1580: Bendall 2004, 51:771), he began pursuing his interests in theology, history and cartography. By 1595, he'd produced a wall map of Canaan, his first cartographic endeavor; and three years later, presented maps to Queen Elizabeth. Under the patronage of Sir Fulke Greville, Speed secured an allowance and a sinecure appointment with the Customs Service (1598), thus releasing him "from the daily imploiments of a manuall trade" (quoted in Pollard 1898, 53:318; Skelton 1966, vii; Tooley 1977, 4; Barber 2007, 1636). In 1600, Speed donated three maps to the Merchant Taylor's Company, who extolled his "very rare and ingenious capacitie in drawing and setting forth of mappes and genealogies and other very excellent inventions" (quoted in Baynton Williams 1991, vi). Speed made the acquaintance of the greatest intellects of his time, including Sir Robert Cotton, famous for his collection

16. Speed's name appears in *Old Maps of the World* in items 173 (p. 75), 307 (p. 90), 330 (p. 93), 373 (p. 97), 409 (p. 99), 416 (p. 100), 434 (p. 102), 538 (p. 111), 577 (p. 118), 588 (p. 119), 598 (p. 120), 612 (p. 122), 680–681 (p. 127), 703 (p. 129); see also 19 (p. 22), 146 (p.63), and 171 (p. 74). It's worth noting that Speed's was "the first atlas of the *British Isles*, and…the first attempt by an Englishman at atlas production on a scale comparable with the great continental publishing houses" (Baynton Williams 1991, vii).

Figure 5. *Portrait of John Speed, copperplate engraving by Solomon Savery (ca. 1631–1632: 30.6 × 19.6 cm, 12 in. × 7 3/4 in.). This portrait, published by George Humble soon after Speed's death in 1629 at the age of seventy-seven, was the frontispiece for the 1631–1632 edition of* A Prospect of the Most Famous Parts of the World … Together with All the Prouinces, Counties, and Shires, Contained in That Large Theator of Great Brittaines Empire *(Speed, Goos, and Gryp, 1631[–1632]). Image from Early English Books Online: Text Creation Partnership (EEBO-TCP) and accessed at the NYPL-Research Library, July 9, 2014.*

of manuscripts and maps.[17] Speed is best known for *The Theatre of the Empire of Great Britaine* (Speed et al. [1611] 1612), "a highly individual work" containing his much-collected county maps and "clearly evok[ing his] personality as a scholar and writer" (Skelton 1966, vii). His name is also associated with the 1627 *Prospect of the Most Famous Parts of the World* (Figure 5)—"the earliest world atlas to bear the name of an Englishman" (ibid., v).[18] Its opening map is *A New and Accurat Map of the World*—dated 1626, a year earlier than *The Prospect*. The 1626 map is essentially identical to the 1676 map, whose date Slessor copied from the Francis Edwards catalogue (Francis Edwards 1929, 111) into his own "July 2" journal entry (-s169: see above). Only the map's imprint and title date distinguish the 1626 state from the 1676 state. Which means that although every published version of "Mermaids" contains "1675" in its epigraph, the date is clearly a misprint.[19] The important year was 1676, for not only was *The Prospect* part of a combined edition, but *The Theatre … with the Prospect* (Speed 1676a, Speed and Baynton-Williams [1676] 1991) has been called "the best printed edition of the two works" (Skelton 1966, xii). By then, Speed had been dead for nearly half a century, and his *New and Accurat Map of the World* had been re-engraved "1651." Through its final state in 1676, "1651" remained on the map hailed as "one of the best known and most important of English world maps" (Jonathan Potter Ltd. n.d.; see Shirley 2001, 341).

No matter what date appears on the world map, however, its title is always the same:

> *A New and Accurat Map of the World Drawne according to ye* [the] *truest Descriptions latest Discoveries & best Observations yt* [sic] *have beene made by English or Strangers.*

Comparing this title to the epigraph of "Mermaids," we notice that Slessor uses only its opening words before proceeding to describe the map itself:

> "*A new and Accurat Map of the World, in two Hemispheres, Western and Eastern, with the Heavens*

17. Just as Slessor acknowledged Captain Bayldon and his library, Speed commends Sir Robert Cotton, "whose Cabinets were unlocked, and Library continually put open to my free accesse: & from where the cheifest garnishments of this work have been enlarged and brought" (quoted in Baynton-Williams 1991, viii; Skelton 1966, viii). Speed's biography would have been available to Slessor through sources like Pollard (1898).

18. In their otherwise definitive edition *Kenneth Slessor: Collected Poems*, Dennis Haskell and Geoffrey Dutton identified the wrong John Speed: "*Epigraph*: John Speed (1628–1711) was an author, and mayor of Southampton who gathered a manuscript collection there" (1994, 360; for John Speed's son and great-grandson, both named John Speed, see Bendall 2004, 51:773).

Haskell and Dutton also maintained that Doctor Gerbrandus is "a fictional name" and that compass-roses are "illustrations on Speed's map" rather than on portolanos (1994, 361).

19. Although the final octavo, or pocket, edition of *The Prospect* alone came out in 1675 (Skelton 1966, xiii), *Old Maps of the World* indicates that its own copy of the world map is the size of the folio edition. The octavo world map is far simpler than the one in the folio edition, and lacks its decorative elements (see Speed 1675; Speed 1676b).

***Figure 6.** John Speed,* A New and Accurat Map of the World Drawne according to ye truest Descriptions latest Discoveries & best Observations yt have beene made by English or Strangers *(1651/1676). This hand-colored engraving measures 15 × 20 ½ inches (38 × 51 cm), according to* Old Maps of the World *(Francis Edwards 1929, 111); and appears on a sheet 17 × 22 inches (43 × 56 cm), with each hemisphere 9 ¾ inches (25 cm) in diameter. Accompanying text entitled "The General Description of the World" appears on the verso. That the map was published for the 1676 folio edition of* The Theatre … with the Prospect *is apparent from the imprint "Are to be sold by Tho: Basset in Fleet Street and Ric: Chiswell in St. Pauls Churchyard" (at the feet of the map's allegorical figure "Aire": bottom, right of middle). This beautiful baroque map, perhaps originally engraved by Abraham Goos (Skelton 1966, vii), attempts to be up-to-date and scientific even as it symbolizes the transition between pre-modern and early-modern views, and between mythical and scientific conceptions of space. Courtesy of the State Library of New South Wales (SAFE/ M2 100/1651/1), Sydney, Australia.*

> *and Elements, a Figure of the Spheare, the Eclipse of the Sunne, the Eclipse of the Moon*."

This description certainly corresponds to the map's content (Figure 6). With the double-hemisphere design so popular in the seventeenth century, it displays "two hemispheres, Western and Eastern," although no text on the map identifies them as such. "The Heavens and Elements" is a phrase found on an inset at the top-left corner of the map. Furthermore, tucked between the earthly hemispheres, are two smaller celestial ones representing "The Heavens," with "The Northern Hemisphaere" above "The South Hemisphaere." The Elements, symbolized by naked gods, bracket these star charts. To the left of the northern celestial hemisphere, personified Water pours liquid into a stream; to the right, Earth holds her cornucopia. To the left of the southern celestial hemisphere, Fire tramples a fiery lizard; to the right, birds surround Aire. "A Figure of the Spheare" refers to the top-right inset and the words "A Figure to prove the spherical roundnes of the sea" [*sic*]. The bottom-left inset is labeled "The Eclipse of the Sunne," while the bottom-right inset features "The Eclipse of the Moone."

Why, given the map's many details, did Slessor pick these for his epigraph? For the same reason he chose all of his epigraphs: he copied each directly from *Old Maps of the World* rather than from the map itself. As usual, Slessor is selective about what he takes. For instance, Slessor refers to "ships at sea" and "sea monsters" in his Author's Notes to *Cuckooz Contrey* (Slessor 1932, 77), yet for his poem he preferred to craft word-pictures like "brigs no bigger than their moon-bunched faces" rather than to copy the catalogue's words "numerous ships and sea monsters" into his own epigraph. (He omitted "sea monsters" and crossed off "numerous ships" in his July 2, -s169 entry.) Below, I've inserted brackets around details in item 538 that Slessor chose not to incorporate into his epigraph or the body of his poem (Figure 7):

> 538 SPEED (J.)
> A New and Accurat Map of the World, in two Hemispheres, Western and Eastern, [numerous ships and sea monsters; in the corners are] with the Heavens and Elements, a Figure of the Spheare, the Eclipse of the Sunne, the Eclipse of the Moon [with portraits of Drake, Magellan, Van de Noort and Candish, 20 ½ by 15 ins.], 1676 [£4].
>
> [A hypothetical coast-line is given for the N.E. coast of Australia, "*These Coasts were first discovered by a Spainsh Ship separated from her fleet, and driven heere along in ye Southerne Sea*." California is shown as an island, and the coast northwards stretches abruptly away westwards into the Pacific.]

Slessor names none of the four circumnavigators whose portraits flank the terrestrial hemispheres; namely, the Englishmen celebrated elsewhere on the map—Sir Fra[u]ncis Drake (1577–1580, top left) and Thomas Cavendish ("Mr. Thomas Candish": 1586–1588, top right)[20]

20. Three of the circumnavigators are mentioned on the map near the southern tip of the western hemisphere. In the Pacificke Sea a cartouche above Magallanica reads: "Twice in our age hath these straightes beene passed by

—as well as the Portuguese nobleman Ferdinand[us] Magellan[us] (1519–1522, lower left), who died in 1521 after "discovering" the Magellan Strait; and the Dutchman Oliver[us] van der Noort (1598–1601, lower right) (see Alexander 1916, xii–xxiii). Yet in the first stanza alone, "Firedrake" plays off Drake's name,[21] while "Conquistador," alludes not only to Magellan, who sailed for Spain, but also to Magellan's Spanish contemporaries, Cortez (1519) and Pizarro (1531), "conquerors" of Mexico and Peru, respectively.[22] In his poem, Slessor appears equally unconcerned about the map's geographical eccentricities, although map dealers and cartographic historians repeatedly advertise its depictions of California as an island and North America's bulging West Coast. Yet immediately after choosing the Speed map for his epigraph, Slessor added two words to his poetry journal—"Southerne Sea"—clear evidence that the name was crucial to his final choice (July 2, -s169).

Because of Slessor's reliance on the Francis Edwards catalogue, the same question inevitably arises for each of his *Atlas* poems: could his choice have resulted from perusing the Speed map itself, rather than relying solely on the catalogue's description of the map? Probably not. To begin with, *The Prospect* and its maps are relatively rare outside of Britain (Shirley 2001, 341, entry 317). Unless Slessor had access to a private copy of the atlas or to a rare facsimile of the world map, therefore, chances are that he never saw the map while composing "Mermaids." Then there's the fact that half of item 538 is devoted to the Southerne Sea and the "hypothetical coast-line … for the N.E. coast of Australia." The map, by contrast, refers only obliquely to "Southerne Sea." Readers must first locate the cartouche just above the enormous landmass called "Magallanica" at the southern tip of the western hemisphere. Only then, to the left of that cartouche, does the legend quoted in the Francis Edwards catalogue come into view: "these Coasts were first discovered by a Spainsh [*sic*] Ship separated from her fleet, and driven heere along in ye Southerne Sea."[23]

English men, the first was by that valiant Sea Captaine Sir Francis Drake Ano 1578 in the Pelican and ye second by that famous Gentellman master Thomas Candish in the Desire 1586." Just below the cartouche is a description of Magallanica itself: "Ferdinand Magellanus gave his name to this vast unknowne tract, from whome it is called."

FRANCIS EDWARDS LIMITED · *America and the World*

535 ROBERTS (Lieut.)
A General Chart Exhibiting the Discoveries made by Captain James Cook, with the Tracks of the Ships under his command, *long folding sheet, coloured,* [N.D.] £3

536 SANSON (LE SIEUR)
Map of the World, [East and Western Hemispheres], *large folding sheet, Paris, Jaillot,* 1691. £2 10s

California as an island, with Terra de Iesso stretching between its northern point and Siberia. The southern point of Tasmania is shown and a small part of New Zealand.

537 SENEX (J.)
Map of the World [*outer margins defective not affecting the bemispheres*], *fine large folding sheet, coloured,* 1725. £1 10s

Showing California as an island, Australia joined to New Guinea and part of New Zealand (from C. Cipige to C. Mary and King's I.). With a note on N.-W. Coast of America, "*'tis not certain whether America joins to the North Eastern part of Tartary,*" &c.

538 SPEED (J.)
A New and Accurat Map of the World, in two Hemispheres, Western and Eastern, numerous ships and sea monsters; in the corners are the Heavens and Elements, a Figure of the Spheare, the Eclipse of the Sunne, the Eclipse of the Moon, with portraits of Drake, Magellan, Van de Noort and Candish, 20½ by 15 ins, 1676. £4

A hypothetical coast-line is given for the N.E. coast of Australia, "*These Coasts were first discovered by a Spainsh Ship separated from her fleet, and driven heere along in ye Southerne Sea.*" California is shown as an island, and the coast northwards stretches abruptly away westwards into the Pacific.

539 TEESDALE (H.)
A New Chart of the World on Mercator's Projection, with the Tracks of the most celebrated and recent Navigators. *Engraved by J. Dewar, 2 large folding sheets, mounted on linen, coloured,* 4to, *morocco,* 1844. £1 10s

540 THOMSON
Hydrographical Chart of the World on Wright or Mercator's Projection, with the tracts of the last circumnavigators, *folding sheet, coloured,* [1817]. 10s

111

Figure 7. *Description of John Speed's* A New and Accurat Map of the World, *item 538 in the Francis Edwards catalogue* Old Maps of the World, or Ancient Geography; a Catalogue of Atlases & Maps of All Parts of the World from XV Century to Present Day *(London: F. Edwards Ltd., 1929, 111). The map's description appears on the last of the four pages comprising "American and General Maps of the World" (108–111), which is contained in Part II, "Single Sheet Maps or Maps of One or More Sheets on Particular Districts" (71–138)—the longest of the catalogue's three parts and the one advertising Speed's maps. The third of four catalogues in the short-lived "new series" of 1929,* Old Maps of the World *and its companion booklets were larger and far better illustrated than the more than 500 Francis Edwards catalogues preceding it. Courtesy of the New York Public Library (Map Div. [Edwards, F. Ancient geography]) and of Francis Edwards Ltd.*

21. "The tracks of Francis Drake" in Slessor's journal (May 29, -s132) comes from a G. De Lisle map of 1708 (Francis Edwards 1929, item 159, p. 69) or ca. 1778 (item 552, p. 114).

22. "Conquistador" is prominent in the catalogue's preface, specifically, in its praise of "old maps" and "ancient atlas[es]" (Francis Edwards 1929, 4):

> To wander farther afield it is impossible to see unmoved, Jamaica under Spanish rule…, or following in the wake of the conquistadors to read the sonorous names of Spanish piety (5).

23. It is tempting to read this statement as a rumor of Luis Vaez de Torres's separation, in June 1606, from the flagship under the command of Pedro Fernandez de Quiros during the Spanish expedition to discover the great southern continent and claim it for Spain (see Heawood [1912] 1965, 69–75). In October 1606, while navigating the Strait (later named for him) between New Guinea and Australia, Torres may have sighted Australia. (See Hilder 1980, 87–101, and esp. 141–147, for how Torres's carefully guarded information may have found its way to the Dutch cartographer Hessel Gerritsz, perhaps as early as 1618 or 1622; Pearson 2005, 35; and Martin Woods, in National Library of Australia 2013, 112). On the other hand, the statement

It's true that "Mar del Zur"—Spanish for "Sea of the South"—looms large on the map's western hemisphere, the words extending along the west coast of the Americas from present-day California to Peru. Yet despite its prominence on the map, the name "Mar del Zur" appears nowhere in *The Atlas* drafts. And this, even though Slessor's journal attests to his faithful copying of the Francis Edwards catalogue, including many Spanish toponyms (e.g., February 22, -s58, from item 38, p. 28; February 28, -s61; and March 6, s65, -s132, from item 133, p. 58, and item 135, p. 59). But what if Slessor *had* a copy or facsimile of the Speed map? If Magallanica's interior is not colored in, the catalogue's connections between "these Coasts" and "the N.E. coast of Australia"—or, for that matter, between either of those coasts and the "Southerne Sea"—are anything but clear (Figure 8). The "hypothetical coastline" is almost impossible to make out; and not only does the legend lie significantly east of modern-day Australia, but also just west of the name "The Pacificke Sea" on the map. Even when that coastline is outlined in color and its boundaries filled in, as in Figure 6, the double-hemisphere design still separates Magallanica, in the western hemisphere, from The Southerne Unknowne Land, located at the southern tip of the eastern hemisphere and also below "The Indian Sea." Even if the viewer assumes that Magallanica and the Southerne Unknowne Land are two regions of a single land, rather than two different lands,[24] the northwest coast of Magallanica plunges seven degrees below the northeastern coast of the Southerne Unknowne Land at the map's margins. Is this a draftsman's error? Or another uncertain certainty reflecting the millennia-old philosophical mindset—championed even by the great Mercator (National Library of Australia 2013, 90)—that the hypothetical super-continent Terra Australis Incognita had to exist in order to balance the earth's other lands? Or a hint, as the catalogue suggests, at the "strong northern projection" of northeastern Australia (see Tooley 1979, viii)? Even with an aid like Figure 6, in other words, the relationship between "Southerne Sea" and northeastern Australia doesn't leap off the map. For Slessor, *Old Maps of the World* remains the most likely source for the entire content of the Speed map.

Like the other poems of *The Atlas*, "Mermaids" mentions neither the Southerne Sea nor Australia. But it does name the Peninsular and Oriental Steam Navigation Company, otherwise known as "the P. & O." (stanza 6; see June 12, -s147ff.). London-based to this day, the P&O markets itself as the first cruise line (Howarth, Howarth, Rabson 1994, 47, 107). What is significant for the fourth poem of *The Atlas*, however, is that the P&O began opening routes to Australia in the mid-nineteenth century, and continued its passenger service throughout Slessor's lifetime (ibid., 83–85, 155; Rabson and O'Donoghue 1988, 17, 358). To publicize its routes the company produced illustrated brochures, including one advertising the SS *Moldavia* and the SS *Mongolia*, two P&O steamships built after World War I for passengers and cargo en route between England and Australia. A copy of this 1928 brochure, distributed by the Australia Travel Service in Sydney, found its way into Captain Bayldon's nautical library, where it remains to this day (Figure 9). And presumably into Slessor's hands, for the brochure features a photograph of the SS *Moldavia*'s First Saloon (Figure 10). This image may have inspired his lines about the Harpies—"Nor do they tumble in the sponges of the moon/ For the benefit of tourists in the First Saloon" (see also June 29, -s167). If so, the P&O

also appears as legend 5 on Petrus Plancius's rare world map *Nova et Exacta Terrarum Orbis Tabula Geographica ac Hydrographica* (Shirley 2001, 199–202, entry 183, pl. 148). F. C. Wieder dates Plancius's map to 1592 and, after lamenting the vagueness of the legend, suggests that the ship's separation from its fleet occurred sometime between 1569 and 1592 (1925–1933, 2:33, 53).

While others must take up the legend's mystery, it is notable that Captain Bayldon, a fellow of the Royal Australian Historical Society, wrote a controversial article on the Torres Strait (1925) that was attacked in print by the Hakluyt Society in 1929. No doubt the catalogue's reference to "coasts…first discovered by a Spainsh [*sic*] ship separated from her fleet" caught Slessor's attention, since Bayldon "was incensed [by the criticism of the Hakluyt Society] and took every opportunity to counteract what he considered were 'most misleading deductions'" (Phillips 1979). One way he did so was to publish another article in 1930 (Hilder 1980, 178–179, 181), the year that Slessor was completing "Mermaids."

24. On the back of the world map, the two-page "General Description of the World" dispels any confusion (see Speed and Skelton [1627] 1966, 2; Speed and Baynton-Williams [1676] 1991). Drawn heavily from Peter Heylyn's *Microcosmus* (1621, 1625, 1627: Skelton 1966, ix), it lists "Terra Australis Magellanica" as one of the earth's six parts (paragraph 23: "Magellanica" being the way the "Description" spells "Magallanica," the name on the world map). This part is also known as:

Terra Incognita in "the Southerne course" (paragraph 20):

> Now of all the Southern course is most unknown and yet Art hath not been idle, nor altogether lost it self [*sic*] in the search: it hath discovered Countries about the 52 degree toward the Pole, but so uncertainly, that it may well yet keep her name of Terra Incognita.

And *Terra Magellanica,* in the "full South" (paragraph 23):

> a continent … thought to be greater than the whole earth besides … and some few Provinces have rather descried [*sic*] than known (paragraph 22)

That *Terra Magellanica* embraces all parts of the southern course is clear from its "Provinces," some of which appear in the map's western hemisphere (e.g., "Tierra del Fuego"); others, in the eastern (e.g., "Nova Guinea … Psittacorum regio … Beach and Maletur") (paragraphs 22, 24).

Figure 8. John Speed, A New and Accurat Map of the World Drawne according to ye truest Descriptions latest Discoveries & best Observations yt have beene made by English or Strangers *(1651/1676). Unlike Figure 6, this hand-colored original shows only the vague outlines of* Terra Australis Incognita, *portrayed as Magallanica and the Southerne Unknowne Land. Courtesy of the Lionel Pincus and Princess Firyal Map Division, The New York Public Library, Astor, Lenox, and Tilden Foundations (Map Division 02-321).*

advertisement is the second piece of inspirational ephemera that Slessor could have found at Captain Bayldon's.

"The P. & O." and its "First Saloon," however oblique they may be, are Slessor's only allusions in the entire Atlas *to his native Australia*. Its virtual absence ultimately derailed his ambitions for the sequence in favor of other gems in *Cuckooz Contrey*, like "Captain Dobbin" (April 1929) and "Five Visions of Captain Cook" (May 1929), both composed shortly before *The Atlas* (Slessor, Dutton, Haskell 1994, 362, 366). So much so that in his influential *One Hundred Poems* (1944) and *Poems* (1957), "Captain Dobbin"—whose mariner hero is modeled on Captain Bayldon (Kiernan 1977, 7)—abruptly replaced *The Atlas* as the opening work of Slessor's middle period, and monopolized that position until the publication of the definitive *Kenneth Slessor: Collected Poems*, distributed under the HarperCollins imprint more than twenty years after Slessor's death (Slessor, Haskell, Dutton 1994; see Haft 2011, 25, 33).

But what is most peculiar about Slessor's choice of the Speed world map is the disparity between what the map actually depicts and what readers of "Mermaids" *assume* it depicts. Consider mermaids themselves. Nowhere are they to be found in the catalogue's description of item 538. Nor do they appear *anywhere* on the map, not even decorating

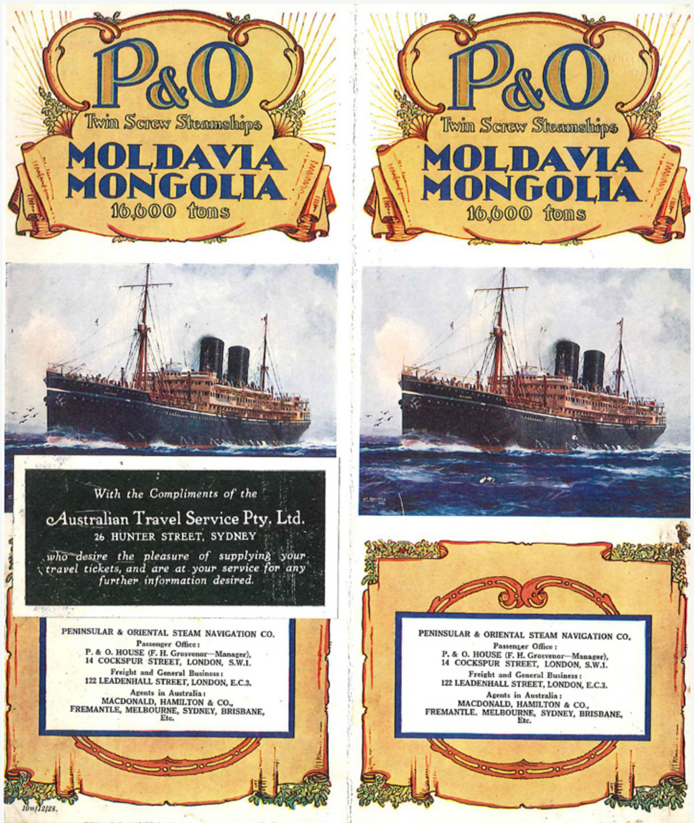

Figure 9. *P&O Brochure advertising "Twin Crew Steamships Moldavia Mongolia 16,600 tons." First of twelve pages, to which is stapled a card with the address and compliments of the Australian Travel Service Pty. Ltd. The brochure in the Babylon Nautical Collection is in an uncatalogued folder, supposedly containing items from the 1930s and 1940s. The brochure and its illustrations itself can be dated more precisely, however, for "10M/12/28" appears on the cover's lower left. In the Australian/British dating standard, that's December 10, 1928, the "M" probably being "Monday," the day on which the 10th of December fell that year (Wendy Holz, email to author, August 14, 2014). What this means is that the brochure was available to Slessor while he was composing "Mermaids." As for the vessels themselves, the* Moldavia *and* Mongolia *were constructed in 1922 and 1923, respectively, the ships after which they were named having been sunk in World War I (Swiggum and Kohli 2008). P&O Twin Screw Steamships: Moldavia Mongolia, brochure in Francis J. Bayldon papers, MLMSS 160/Box 12, Mitchell Library, State Library of New South Wales.*

its cartouches or floating with other mythical creatures in its celestial hemispheres. Yet while sketching his "Notes" for *The Atlas* into the final "Mermaids" entry of his poetry journal, Slessor wrote: "Mermaids—Speed: map is filled with numerous ships at sea, *mermaids* and sea-monsters" (July 22, -s191: emphasis mine).[25] And he said nearly the

Figure 10. *"S.S. Moldavia, First Smoking Saloon," photographed by Messrs. H. H. Martyn & Co., Ltd. From a 1928 P & O brochure advertising "Twin Screw Steamships: Moldavia and Mongolia" and distributed "with the compliments of the Australian Travel Service Pty. Ltd., 26 Hunter Street, Sydney." The ships accommodated around 230 1st class patrons (Rabson and O'Donoghue 1988, 172, 189–190), who paid "£100 Single, £175 Double" for a return ticket between Australia and London, according to* The Sydney Morning Herald, *December 6, 1930 ("Advertising" 1930). As the 1926 "P&O Pocket Book" boasted (Rabson and O'Donoghue 1988, 172):*

> *"Everyone…likes to journey in luxury when luxury is possible. And all men like the company of the 'people who matter'… so it comes that there is nothing in the life of the average man half so full of interest or so much enjoyed as the six weeks of the longest P&O voyage—the run to Australia. Such a journey is the cream of human experience."*

P&O Twin Screw Steamships: Moldavia Mongolia, brochure in Francis J. Bayldon papers, MLMSS 160/Box 12, Mitchell Library, State Library of New South Wales.

25. A typed page with four lines of "Mermaids" was inserted randomly between "October 23" and "October 24" (NLA MS 3020/19/15, -s277), but

same thing in his Author's Notes for *Cuckooz Contrey*: "'MERMAIDS.'—'Speed's map is filled with pictures of ships at sea, *mermaids* and sea-monsters'" (Slessor 1932, 77: emphasis mine). However, in the published notes, quotation marks have been inserted around "Speed's map is filled with … mermaids …" as if the assertion came from the same Francis Edwards catalogue that Slessor had just acknowledged as the source "for much of the information concerning the subjects of these poems" (ibid., note for *The Atlas*). Quotations also appear around the entire passage that constitutes Slessor's note for "Dutch Seacoast." But while "to see a Dutch town by Blaeu…" *is* a direct quote from *Old Maps of the World* (Francis Edwards 1929, 4–5), "Speed's map is filled with … mermaids …" is not.

Was Slessor lying? Short of the quotes being a publisher's addition (and one that the usually fastidious poet failed to correct), the answer is "absolutely." Ships and sea-monsters commonly ornament Speed's maps, including ours; two others—Asia and Jamaica—are also advertised as such in *Old Maps of the World* (item 330, p. 93; item 703, p. 129). Mermaids, however, are far more elusive. *The Prospect of the Most Famous Parts of the World* reveals not a single one, even though its maps sport birds and animals as well as ships and sea monsters. Speed's *Theatre of the Empire of Great Britain* is another story. As early as 1604 or 1605, the famous Flemish engraver/mapmaker Jodocus Hondius Senior (1563–1612)—the same Hondius of the Mercator-Hondius atlas (1606)—began engraving maps for Speed's *Theatre* (Skelton 1966, v, vii–viii; Baynton-Williams 1991, v–vi, viii), and these maps were incorporated into the combined 1676 edition of *The Theatre of the Empire of Great Britain, with The Prospect*. At least two mermaids can be glimpsed there along with the occasional unicorn, merman, bearded Triton, or Neptune riding a sea monster (Speed 1676a; Speed and Baynton-Williams [1676] 1991). One appears in the Irish Sea on *The Countie Pallatine of Lancaster* (between pages 75 and 76; see Speed and Hondius 1610), while another graces *Merionethshire Described 1610* (Figure 11). Given that in the 1920s Francis Edwards was advertising *The Theatre …, with The Prospect* for between £5.50 (Tooley 1977, 8) and £60 (Francis Edwards 1926, 2, item 8), a copy may have been accessible to Slessor in Sydney. On the other hand, the Bayldon Collection doesn't contain *The Theatre* (or *The Prospect*, or, for that matter, an independent copy of *A New and Accurat Map of the World*). And it is extremely unlikely that Slessor would have searched these maps out. For one thing, the Francis Edwards catalogue makes no mention of *The Countie Pallatine of Lancaster*; and although it does list a Lancashire map and the Merionethshire map, it details none of their decorations (Francis Edwards 1929, 75–76: item 173). Furthermore, Slessor himself was composing *The Atlas* while working full-time as a journalist for *Smith's Weekly*. Had he seen these county maps, he could have easily written "Speed's *maps* are filled with pictures of … mermaids" to keep his Author's Notes as "accurate" as the title in his epigraph.

Nor are Speed's mermaids the iconic preening-in-mirror type depicted on maps from the Middle Ages through the Renaissance (Benwell and Waugh 1965, 227 and pl. 11b). That's one reason why Penny Maxwell turned to Abraham Ortelius (1527–1598), author of the "first modern atlas" (Francis Edwards 1929, 6; see 53), when designing the cover for the Angus&Robertson/HarperCollins edition *Kenneth Slessor: Collected Poems* (Figure 12). After Dennis Haskell requested that a map grace the cover of the collection,[26] Maxwell chose *Indiae Orientalis Insularumque Adiacientium Typus*, originally plate 48 in Ortelius's pioneering atlas, *Theatrum Orbis Terrarum* (Antverpiae: Coppenium Diesth, 1570), four editions of which were advertised in *Old Maps of the World* (Francis Edwards 1929, 52–53, items 119–122, £15 to £120). Housed in the National Library of Australia, Ortelius's map of southeast Asia and the islands adjacent features sea-monsters, as large as Japan, attacking a ship, while in the Pacific below the Tropic of Cancer, two voluptuous mermaids brandish their mirrors.[27] Maxwell's charming cover goes a long way

would be better placed somewhere around the mid-"June" entries (-s154 to -s156) since "Mermaids" essentially ends at "July 22" (-s191). To put this in context, *The Atlas* sequence begins on the page marked "February 22" (-s58) and ends with two pages marked "September 13" and "September 14" (-s242 to -s243).

26. Dennis Haskell, email to author, February 10, 2015.

27. Ortelius's *Indiae Orientalis Insularumque Adiacientium Typus* is mistakenly called a "world" map on the copyright page of the Haskell and Dutton edition. The Ortelian world map, entitled *Typus Orbis Terrarum*, depicts an enormous continent—*Terra Australis Nondum Cognita*—straddling the south. (The 1570 Ortelian world map in the Library of Congress is online at **commons.wikimedia.org/wiki/File:OrteliusWorldMap1570.jpg** and accessible on March 28, 2015.) At the continent's northern tip is a name familiar from Marco Polo *and the Speed map*—"Beach, part of the continent of Australia" (*Beach, pars continentis Australis*), although Beach lies "hundreds of kilometers to the south of Polo's route through Thailand and Cambodia" (Martin Woods, in National Library of Australia 2013, 96). Ortelius's *Indiae Orientalis Insularumque Adiacientium Typus*, on the other hand, displays Beach as if it were the tip of an iceberg below Java. As Martin Woods attests: "The misplacement of Beach…on Ortelius's highly popular maps contributed greatly to the persistent belief in the existence of a great southern landmass, depicted on world maps well into the 1600s" (ibid.).

Perhaps in keeping with the virtual absence of Australia in Slessor's sequence, Maxwell's cover crops out Beach, and thus any physical presence of *Terra*

Figure 11. *A mermaid combing her locks on an inset map of Harlech Castle. Detail from John Speed's* Merionethshire Described 1610 *(38.5 × 51cm, 15 × 20 inches), one of the Welsh county maps that appeared in his* Theatre of the Empire of Great Britain *from its earliest publication. This image comes from the rare 1616 Latin edition (Speed, Holland, and Camden, 1616); the 1676 edition of* The Theatre … with the Prospect *displays the map between pages 117 and 118 (Speed 1676a, Speed and Baynton-Williams [1676] 1991). Engraved by Jodocus Hondius Senior, who resided in England from 1583–1593, the full* Merionethshire *map also features compass roses as well as ships and sea monsters in the Irish Sea. Courtesy of Richard Nicholson,* **antiquemaps.com**.

toward rectifying the absence of maps in Slessor's poetry collections after 1932. For it to allude so directly to "Mermaids" means that *The Atlas* and its cartographic delights are highlighted as well in the definitive edition of Slessor's poetry. Furthermore, Maxwell may have rejected, for reasons beyond their lack of accessibility, the maps whose titles constitute the epigraphs of the sequence. Like poems, maps are representations of "reality" infused with their own subjectivities and limitations: not one of the maps named in Slessor's epigraphs manages to speak to the feeling, sensuality, or exotic nature of *The Atlas* sequence *as a whole* in the way that the Ortelius map does. Nor do they suggest the variety of strange lands and bygone eras that animate Slessor's collected poetry. Nonetheless, because Ortelius's map represents an earlier stage in the history of the atlas, it is no more "right" for "Mermaids" than the

Australis. (Nevertheless, the great southern landmass is named. The legend on New Guinea, partially obscured by the word "Poems" in the title, questions whether New Guinea is an island or part of the great Southern Continent: *Nova Guinea…an insula sit an pars continentis Australis incertum est*.)

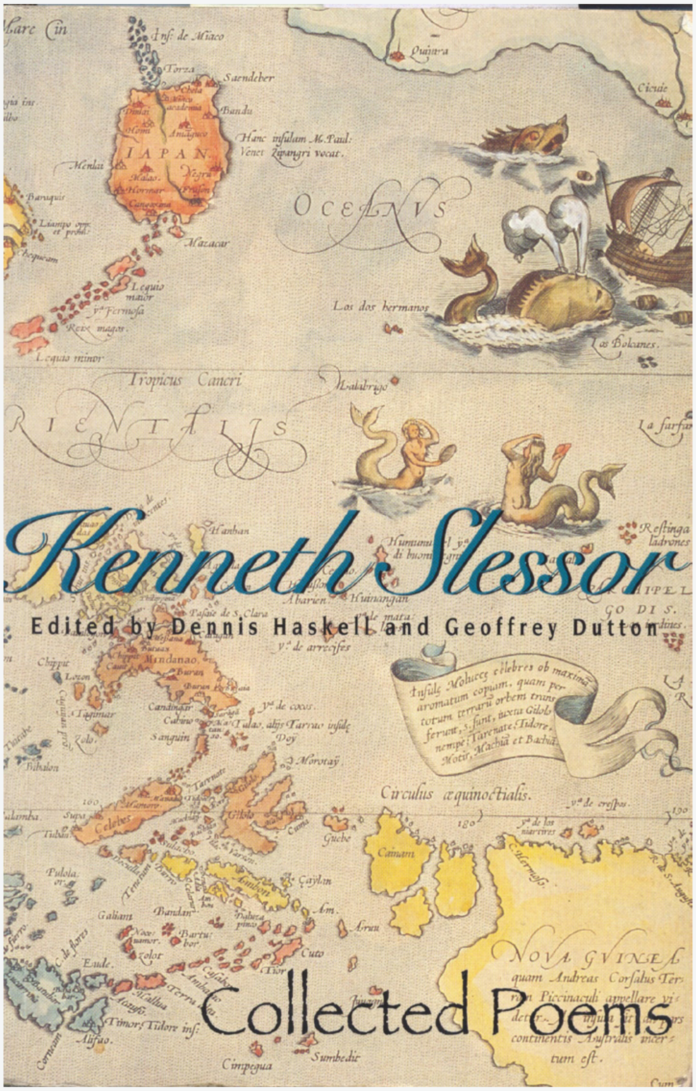

Figure 12. Penny Maxwell's cover design of the definitive Kenneth Slessor: Collected Poems*, edited by Dennis Haskell and Geoffrey Dutton (Pymble, Sydney: Angus&Robertson, 1994). Maxwell chose the right side of Abraham Ortelius's double-page* Indiae Orientalis Insularumque Adiacientium Typus *(1570 or 1571), a double-page map of Southeast Asia and the adjacent islands (32.5 × 47.5 cm, 12 ¾ × 18 ¾ inches). Framing the Tropic of Cancer (just above the collection's title) are the temptations and threats that beset sailors: two mermaids and enormous sea-monsters attacking a ship. Their appearance in the* Oceanus Orientalis *accords with cartographic practice: since at least the 12th century, such creatures were thought to inhabit poorly explored waters of the "East," particularly the Indian Ocean (Van Duzer 2013b, 19, 43–45, 47–48, 55–56, 68–69, 80–81) and, later, the Pacific (ibid., 96, 100, 105). The map that Maxwell used is housed in the National Library of Australia (MAP NK 5318). Her cover design is reproduced with permission of HarperCollins Publishers Australia Pty Limited.*

world map attributed to John Speed.[28] In fact, Ortelius's work was completely supplanted by the Mercator-Hondius atlas to which Slessor's journal repeatedly refers (Feb 26, -s60; May 29, -s134; July 2, -s169; see Francis Edwards 1929, 47, item 105; Skelton and Humphreys [1926] 1952, 58). The *only* seventeenth-century cartographic work described in the Francis Edwards catalogue as featuring mermaids is the Magini atlas of Italy. And Slessor discarded Magini early in his composition.

By now you've realized that the Speed map displays neither Sirens nor Ondines, neither Harpies nor Jinns, neither Kraken nor Firedrake, neither Hermaphrodites nor Anthropophagi.[29] Although Pliny's influential *Natural History*—with its account of such mythic creatures—had been translated into English by Philemon Holland in 1601 (Ellis 1994, 51), Speed, like most intellectuals of his day, was no believer in them (Lowes [1927] 1964, 447 n. 34; Friedman 1981, 198). Centaurs and other hybrids might appear in his celestial hemispheres, but not in his terres-

28. Slessor may have encountered Ortelius's map of south-east Asia, since it was donated to the State Library of New South Wales in 1907 by David Scott Mitchell (Martin Woods, in National Library of Australia 2013, 96). The poet certainly saw Ortelius's *Tartariae Sive Magni Chami Regni Typus*, as that map from *Theatrum Orbis Terrarum*—one of the atlases named in Slessor's journal (February 26, -s60) —is among the few illustrations in *Old Maps of the World* (1929, 49).

Another suggestive map is *Americae Sive Quartae Orbis Partis Nova et Exactissima Descriptio* ("A New and Very Exact Description of America, or the Fourth Part of the World"), based on the charts of the Spanish cartographer Diego Gutiérrez, and engraved by Hieronymus Cock of Antwerp (Reinhartz 2012, 55). The famous 1562 map not only features Brazilian cannibals, monstrous sea creatures, and South Pacific mermaids/sirens, but also privileges the claims of the Conquistadors over those of the Portuguese (Ciobanu 2006, 11–13). Gutiérrez's map is not listed in the Francis Edwards catalogue, however; and, even if it were, it is too early.

29. Similarly, the Francis Edwards catalogue mentions only the Anthropophagi. "Mermaids" appears once, but "Sirens" never does. "Water-nymphs" is the closest the catalogue comes to "Ondines" (Francis Edwards 1929, 135, item 783: the Blaeu/Ogilby 1671 map of Venezuela); and one would be hard-pressed to find "Harpies" or "Jinns" on any map. (On the other hand, a sea-monster thought to be the Kraken appears in the Olaus Magnus 1539 map of Scandinavia as well as on Ortelius's map of Iceland: see Van Duzer [2013b, 108–110]).

The vast Southerne Sea and Continent became the locus of marvels on maps as early as the mid-fifteenth century. Dragons, if not the Firedrake itself, are famously featured in the legend *HC SVNT DRACONES* [*sic*] ("Here there are Dragons") on the south-east coast of Asia just below the equator on the Hunt-Lenox globe of ca. 1510 (ibid., 60–61; Reinhartz 2012, 77), and are also found in the southern ocean on Andrea Bianco's 1436 *mappamundi* (Van Duzer 2013b, 52–53). And while another sea dragon graces the 1570 Ortelian map *The Barbarie et Bildedvlgerid* (Reinhartz 2012, 77), a terrestrial dragon is one of many monsters populating the great southern continent on Giacomo Gastaldi's world map of ca. 1561 (Van Duzer 2013b, 103).

Incidentally, realistic images of dolphins began surfacing in the sixteenth century (ibid., 104, 134, 137, 139), and manatees, rather than mermaids, appear in the Atlantic on a 1541 Mercator globe (ibid., 87–89).

trial landscapes, no matter how unknown or unexplored. The "General Description of the World" on the map's verso offers an enlightened interpretation of geographical advances: "Our God in these latter times hath enlarged our possessions, that his Gospel might be propagated, and hath discovered to us inhabitants, almost in every corner of the earth" (paragraph 20, in Speed and Skelton [1627] 1966, 2; and Speed and Baynton-Williams [1676] 1991, 139). Of those living in Magellanica [*sic*], the conjectural outlines of which extend below the tip of South America, the "General Description of the World" records that, however "little can be reported," its inhabitants are merely "barbarous" and "goe naked"—a far cry from monstrous (paragraph 24). And in "The Southern Unknowne Land" stretching beneath the Indian Sea, the map's cartouche simply states: "This South part of the world, containnyng almost the third part of the Globe, is yet unknowne certaine sea-coasts excepted, which rather shewe there is a land then discrye either Land, people, or Comodities." All of which is to say that *A New and Accurat Map of the World* attempts to be scientific and up-to-date in its emphasis on global exploration, its profusion of ships plying the seas, and its plethora of names identifying far-off places.

Yet for us, the map is refreshingly old-fashioned, symbolizing the transition from pre-modern to early-modern views, and from mythical to scientific conceptions of space. Its diagram of the outmoded Ptolemaic universe centered on the earth, its picture of God's arm holding an armillary sphere to demonstrate the "roundnes of the sea," its distended boundaries of North America and enormous "Southerne Unknowne Land," its accompanying "General Description of the World"—all seem like quaint attempts to reconcile contemporary discoveries with Biblical and Classical notions of geography.

Another problem remains, however: Speed's name appears nowhere on the world map. Copyright issues might have led to reluctance on his part (Baynton-Williams 1991, viii), for there is no question that *A New and Accurat Map of the World* is indebted to a rare and identically named double-hemisphere map by his countryman William Grent (1625).[30] That Speed was blind by the mid-1620s could have prevented him from being involved with the world map, which was one of only three maps *not* attributed to him in *The Prospect*. The inevitable conclusion is that the ascription of Speed's name to the world map "must be considered spurious" (Skelton 1966, ix). Nor may Speed have had much to do with *The Prospect*, the 1627 premiere edition of which was the last one published in Speed's lifetime. "Primarily a commercial venture," the world atlas was not "original in conception or execution" even at its release (ibid., viii and xiii). By 1676, the date recorded in the Francis Edwards catalogue, *The Prospect* was so obviously outdated that there was no further publication, and most of its plates—including the world map—were never reprinted (ibid.; Shirley 2004, 1:971). Yet because of the atlas's relative scarcity except in Britain, original copies of the world map alone have gone for over $20,000 (Barry Lawrence Ruderman, email to author, July 18, 2014) rather than the £4 that Francis Edwards was asking in 1929.

A New and Accurat Map of the World epitomizes the baroque cartography that so enchanted Slessor: "If only world cd be like world of old mapmakers neatly parcelled into known and unknown" [*sic*], he declared on the seventh page of his *Atlas* drafts (March 5, -s64). Speed's map continues to fascinate us today. Blame it on the map's epic scope, its celebration of heroic adventurers, its ability to transport us—at a glance—across space and time. As Peter Whitfield says about a similar work copied from a 1629 world map, then printed in 1665 and republished in 1683 (Whitfield 1994, 92–93; see 96 for the "Pseudo-Blaeu World"):

> It was from the 1580s onwards, the years also when the great Flemish mapmakers began to issue their newly-conceived world atlases, that the world map regained its encyclopedic, celebratory form. To this age heroic, classical imagery was a natural idiom for the new world map. But by the final quarter of the seventeenth century, the realities of trade and international rivalry, and the spirit of science, had made that idiom inauthentic and dated, and its appearance in this map is purely rhetorical.

Then too, whoever crafted the Speed world map lived in an age that still believed in mermaids. Henry Hudson

30. Almost nothing is known about William Grent, and the name of his map's "accomplished" engraver has disappeared without a trace (Shirley 2001, 337; see entry 313, pl. 238). Nevertheless, the influence of the Grent map is evident in the nearly identical English legends, including the discovery of the coasts of Magellanica by a Spanish ship "severed" from her fleet; the division of the southern continent into Magellanica (left hemisphere) and Terra Australis Incognita (right hemisphere); as well as the portraits of the same four circumnavigators, the similar diagrams of eclipses in the lower corners, the retrogressive representation of California as an island, and the map's publication in London a year before the Speed world map (Skelton 1966, xi; Baynton-Williams 1991, viii).

sighted mermaids in 1608, as did Captain Sir Richard Whitbourne off Newfoundland; while Captain John Smith found them in the East Indies in 1614, and two men briefly captured a merman in 1619 after attending a Diet in Norway (Ellis 1996, 79–80; Benwell and Waugh 1965, 95–97). As the authors of *Sea Enchantress: The Tale of the Mermaid and her Kin* explain (Benwell and Waugh 1965, 86-87):

> When renowned explorers and sailors such as Sir Walter Raleigh and Henry Hudson returned with reports of monsters and mermaids, who could doubt them? … What chance had intellectual doubts and skepticism against the stories of personal encounters with mermen and mermaid—some of them sworn to by persons of unimpeachable integrity?

Slessor understood the relationship between mermaids and baroque maps. A. K. Thomson was right when he wrote about Slessor's composition of *The Atlas*: "As always, when he writes an historical poem, or a poem touching history in any way, he masters the period" (1968, 39). Had Slessor had access to original maps and atlases or to the gorgeous facsimile editions so common today, he might have discovered the exquisite portolan chart of the Atlantic by Pierre de Vaulx (1613). With its central compass rose flanked by mermaids and its ships traversing rhumb lines between continents decorated with native scenes (Putnam 1983, 90–91; Portinaro and Knirsch 1987, 144; Ciobanu 2006, 14), this seventeenth-century portolano comes close to representing what Slessor describes in the fourth poem of *The Atlas* (Figure 13). But once again, the Pierre de Vaulx chart wasn't one of the three portolanos described in *Old Maps of the World.* And while "Mer du Su" [*sic*] appears off the west coast of Peru, the map omits the other characters that animate "Mermaids." Not to mention the half of the world that Slessor called home. And that is a vital consideration, given two related facts: first, the maps in the other *Atlas* epigraphs focus on places far from Australia; and, second, "except for crude regional maps in various collections of [Ptolemy's] *Geographia*, and occasional travel books…, the only maps relevant to the discovery of Australia were world maps" (Clancy 1995, 61).[31]

31. Among the portolanos in *Old Maps of the World* is a 1616 world map (item 515, pp. 108–109). But the catalogue focuses on its historical importance and accuracy, and Slessor would have had to obtain a photograph in order to describe other features. Like the Pierre de Vaulx chart, these seventeenth-century manuscript maps appear to have been made not for sea captains to use for navigation, but for important clients; hence, their price. *Old Maps of the World* lists two of the portolanos for £350 each (item 515, pp. 108–109; and item 556, pp.114–115), making them the fourth most expensive purchases, after a two-volume *Atlantic Neptune* dating 1780–1781 (Francis Edwards 1929, 12–17, item 10, £1300), a 1649 dedication copy of Joan Blaeu's *Townbook of the United Netherlands* (21, item 18, £600; see Haft 2013), and the 1641–1644 J. Janson series of city views in nine volumes (138, item 818B, £475).

"GONE LIKE THE CRACKING OF A BUBBLE"?

Slessor's poem, despite its epigraph, is an imaginative recreation of a number of very different maps. No other poem in *The Atlas* inspired him to pore over so many items in *Old Maps of the World*. Again and again, what caught his eye was the catalogue's lyrical description of a hand-colored sixteenth- or seventeenth-century map or atlas featuring names of "lost countries" and ornamented with ships and exotic creatures. Like the wealthy clients for whom such maps were made, Slessor was an arm-chair explorer who delighted in sumptuous embellishments. The voluminous notes in his poetry journal demonstrate his fascination with the artistry and playfulness of decorative maps; their gift for conveying not only the thrill and danger of navigation, but also the diversity of creatures world-wide, along with "the myths and realities that contribute to the cultural heritage of a place or a region" as well as to stereotypes about such locales (Reinhartz 2012, 89). Most of all, Slessor obviously relished the paradox that "the development of modern cartography unexpectedly produced a Counter-Enlightenment result: to make monsters real" (Warner 2013, 61). Unlike traditional collectors, however, Slessor didn't acquire these expensive maps, but transformed them "into something rich and strange"—his own poetic analogue.

No single illustration or map can hope to do "Mermaids" justice. For one thing, the seventeenth century was a bit late. Chet Van Duzer, in his recent book *Sea Monsters on Medieval and Renaissance Maps*, focuses on maps from the eighth century through the end of the sixteenth century because by the early seventeenth century "the most florid development and widest use of sea monsters on maps had

Figure 13. *Pierre de Vaulx,* [Carte de l'Océan Atlantique] Ceste carte A Este faiste Au havre de Grace Par Pierre Devaulx, Pilote Geographe Pour le Roy, l'an 1613. *Royal pilot and geographer, Pierre de Vaulx created this exquisite portolan chart of French claims in the Americas for "an important client" (Portinaro and Knirsch 1987, 144). Although Pierre's map is not among the manuscripts advertised in the Francis Edwards catalogue, its iconography matches Slessor's poem far better than* A New and Accurat Map of the World *does. On parchment made of calf's skin (vellum), it is a "portulano map" featuring mermaids and several varieties of "compass-roses," including four whose dyes are "green and gold," and one (top center) "wagg[ing its] petals over parchment skies." (The* fleur-de-lis *incorporated into compass roses may have inspired Slessor's description of mermaids' "foaming lily-fins.") The map also displays Africa and "Anthropophagi," though the single individual above "Les caniballes" (in Brazil) looks as benign as the other naked natives. The chart measures 68.5 × 96 cm (27 × 38 inches) and resides in the Bibliothèque Nationale, Paris (Cartes et Plans, S.H. Archives N° 6; and see gallica.bnf.fr/ark:/12148/btv1b8001881m, accessed March 28, 2015).*

come to an end" (2013b, 116; see 8). As one reviewer explains (Rameswaram 2013, 27):

> Early medieval period mapmakers, Van Duzer says, actually believed in the dangers they depicted. Their illustrations were warnings. In the 16th century cartographic creatures were made increasingly whimsical in order to lure map buyers—the more marvelous the monster, the better. By the 17th century sea monsters were singing their swan song. Increasing confidence on the high seas led cartographers to make maps teeming with triumphant ships, with far fewer sirens in sight.

If the Author's Note in *Cuckooz Contrey* weren't such a blatant lie, one could argue that Slessor chose the Speed world map precisely to lament the waning of mermaids on maps prior to their demise in the eighteenth century (Reinhartz 2012, 89).[32] Despite his epigraphs in *The Atlas*,

32. According to Van Duzer, "in Joan Blaeu's famous *Atlas Major* of 1665, which consists of 594 maps in 11 volumes and was the most complete and

however, Slessor would later protest that poems and illustrations are essentially antithetical: "It is a contradiction that a poem in which time is fluid should be fixed to an instant by the illustration of a few of its lines" (Slessor 1970, 114). And his suggestion that poetry exists in "the mapless country of the human mind" (ibid., 96) implies that maps are equally poor illustrations of poems. Slessor's very insistence on "this freedom to imagine might account for his 'lying' about the Speed map."[33] Nevertheless, when he was establishing himself as a poet, illustrations certainly helped to sell his verse. And so he compromised on the artistic interpretations of friends.

While composing *The Atlas*, for instance, Slessor worked with Norman Lindsay's son Raymond on the drawing that would illustrate "Five Visions of Captain Cook" in *Trio: A Book of Poems* (Slessor et al. 1931). That sequence says nothing about sea beasts or mermaids. In fact, it describes Cook's crew spearing "sea-cows" or dugongs in Australian waters (Slessor, Haskell, Dutton 1994, 90, line 108). Nevertheless, Raymond Lindsay depicted the Captain with one leg over a sea monster and, beside him, a mermaid astride a globe (Haft 2011, fig. 2).

The mermaid reappears again in Norman Lindsay's whimsical frontispiece for *Cuckooz Contrey*, one of at least eleven images he provided for Slessor's "serious" poetry (Thomson 1968, 2; Jaffa 1971, 51 and n.42) (Figure 14). Norman's etchings attracted book collectors to the beautifully crafted limited editions in which Slessor published his finest poems prior to *One Hundred Poems* (1944). So much so that Slessor had to admit: "drawings by Norman Lindsay, even a tailpiece or a mere decoration, could often mean the difference between publication and oblivion" (Slessor 1970, 9). As the collection's only illustration, Lindsay's "Cuckooz Contrey" alludes to other poems besides *The Atlas*. But it focuses almost exclusively on the sequence, and on "Mermaids" in particular. And it's not just that the frontispiece's seas are filled with ships and "dolphin fins," or that its lands are covered with mythical creatures. Or that these figures are standing *on an old chart*:

Figure 14. *Norman Lindsay's frontispiece and the sole illustration in Kenneth Slessor's* Cuckooz Contrey *(Sydney: Frank C. Johnson, 1932). Lindsay's "Cuckooz Contrey" is a reproduction of his etching* Strange Lands *(1932: 25.5 × 20.3 cm, 10 × 8 inches). Details demonstrate that Lindsay focused primarily on Slessor's opening sequence,* The Atlas, *and on "Mermaids" in particular. © Lin Bloomfield, Odana Editions, Bungendore, NSW, Australia.*

and this despite the fact that of the more than 370 plates etched by Lindsay during his life (Lindsay and Bloomfield 1998, 18), "Cuckooz Contrey" remains his only map-like image (Haft 2011, 20). Or that, no matter how toponymically challenged "Mermaids" may be, the chart contains *none* of the place-names—let alone the political divisions and scales of distances—common to most maps. Nor is it simply that Lindsay's compass rose shines like the sun, or that giants with puffed cheeks are blowing winds across the waters; or that his brigs, minus their sails, are "no bigger than [the sailors'] moon-bunched faces." Nor is it just that when Lindsay went to sell his etching, he named his work *Strange Lands*, a title reminiscent of Slessor's "Lost Lands" (Lindsay and Bloomfield 1998, 335, pl. 323). It's that Lindsay has centered his etching on the lines "Then

trusted atlas for 100 years, ships far outnumber sea monsters…but even ships became obsolescent on maps in the 18th century" (2013b, 119, and nn. 296, 298). As for the mermaid, in the admittedly abridged facsimile *Atlas Maior of 1665: "the Greatest and Finest Atlas Ever Published,"* she is relegated to the occasional cartouche (see Blaeu and van der Krogt 2005, 333, 379–380, 413, 415–416, 465, 490). For why European intellectuals of the eighteenth century "came to distain both wonder and wonders," see Daston and Park 1998 (329 and passim).

33. I owe this idea to one of this paper's anonymous reviewers.

Figure 15. *Mermaid astride a sea-monster and reaching for a flying fish. Above her hangs the title cartouche; below her lie The Antilles. Detail from the upper register of James Emery's* Carte de l'Archipelague du Mexique *(Sydney: Sunnybrook Press, 1932), a map celebrating the publication of Slessor's* Cuckooz Contrey. *The map is housed in the Mitchell Library Map Collection (MT3 701.2/1692/1) in the State Library of New South Wales.*

sailors with a flaked and rice-pale flesh/ Staring from maps in sweet and poisoned places." For there in the middle of Lindsay's foreground, stand sailors and a merchant listening "without the least surprise" to one of "those well-known and respected Harpies." And at their feet, like a youngster listening to the yarns of his elders, sits a mermaid gawking *at the men*. With each flourish, in other words, Lindsay has captured the seductive charm, inverted perspectives, and dry humor of Slessor's "Mermaids." To this day, Norman Lindsay's frontispiece remains the poem's finest visual counterpart and eulogy.

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Despite our skepticism, the mermaid has endured for thousands of years (Ellis 1994, 79), splashing her way through fantasy fiction, films, and video-games into the twenty-first century. Less than a decade before Slessor died, Benwell and Waugh could attest that "in peasant belief, she survives to this day in areas as far apart as the isles of Greece and Java" (1965, 275). For the poet himself, however, there was perhaps no greater testament to her longevity than the illustration that his cartographer friend James Emery created for "The Seafight," the final poem in *The Atlas*. Although none of Slessor's poems differs more from "Mermaids" in tone or theme—or in the complete absence of creatures like the mermaid—Emery couldn't resist placing her on his map celebrating the 1932 publication of *Cuckooz Contrey* (Figure 15).[34]

Even Slessor couldn't escape the mocking mermaid.

34. Stay tuned for Part Five of my study. While Slessor kept the fourth poem light, shying away from the mermaid's reputation as "the *femme fatale* of the sea," "The Seafight" places death center stage as men slay men, the sea drowns others, and "existence" exacts its own "bitter" toll.

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Birmingham's Cartographic Treasure

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The Birmingham Public Library's cartographic collection consists of historical maps and atlases dating from the 1500s, including materials purchased by the library and from the private collections of Rucker Agee, James Woodward, and Charles Ochs. These private materials represent the lifetime collecting of their donors and emphasize the Age of Discovery, Alabama and Native Americans, and the exploration of the Caribbean area. Combined, they provide a comprehensive picture of European exploration, white settlement of the New World, and the history of Alabama. This article is a description of one library's attempt to make its treasures more accessible.

HISTORY OF THE COLLECTION

Maps, primarily dealing with Alabama or the Birmingham area, have been added to the collection regularly since 1927. In that year, a new central library opened and a special collection of Southern History and Literature was organized.

The first large addition of maps and atlases came in 1964, when Rucker Agee gave a large portion of his private collection to the library. Mr. Agee was a founder of the Alabama Historical Association and a trustee of the Alabama Department of Archives and History, and was thoroughly familiar with the state and its development. In addition, he had a lifelong avocation of map collection and studying cartography. His mind painted with a broad brush, collecting both the most common service station map (now almost impossible to obtain) and the most beautiful examples of early modern cartography. The "showpiece" atlas of the collection is the Royal Edition of the *Atlas Maior* published in 1622 by Joan Blaeu. This 11-volume set is the crowning achievement of the great cartographical publishing house of Blaeu in Amsterdam. Sheet maps in the collection begin with the Age of Discovery. Benedetto Bordon's 1528 *Oval Map of the World* is an example.

As plans were made for the 1964 gift, the library undertook the preparation of space to house, organize, and maintain the collection. A separate area was constructed with its own temperature, humidity, and security provisions. Although the collection had been arranged so that Mr. Agee could find anything, there was no systematic organization whereby library staff could search or locate. Thus, the library came face to face with the problem which still evades many map collections today—how to catalog the collection and make it accessible.

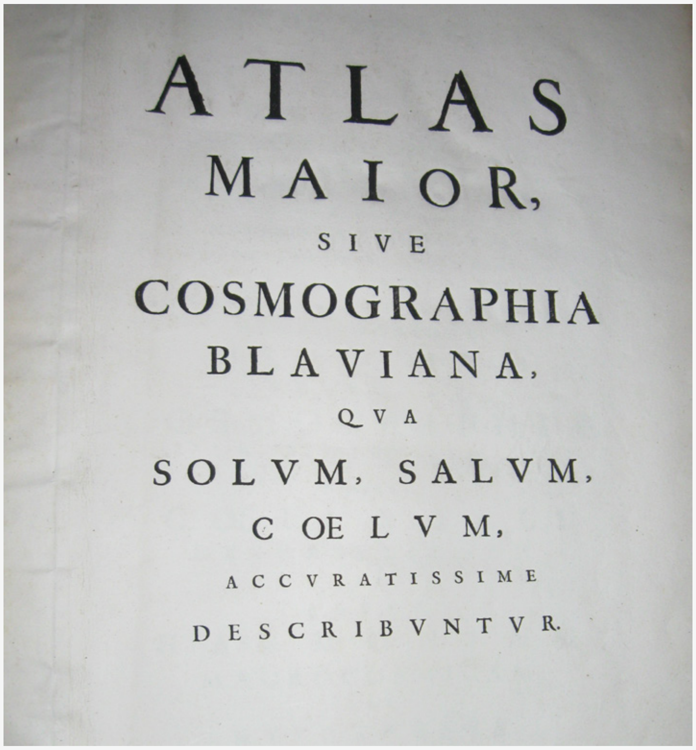

Figure 1. *First title page from Blaeu's 1622* Atlas Maior.

In the late 1960s, Sara Elizabeth Mason retired as head of the library's catalog department. She agreed to continue, on a part-time basis, to organize the cartographic material. Her work resulted in a collection that was organized by subject and, as time passed, with a card catalog. In 1973, the library published her very thorough listing and union list: *A List of Nineteenth Century Maps of the State of Alabama*. The chronological limitations of such a listing excluded any maps published before 1819, the year of Alabama's statehood, or the comprehensive maps of the southeast, in which present day Alabama is presented as a portion of Louisiana, Georgia, etc. But there are such maps in the collection: Geronimo Chaves' 1591 *La Florida* illustrates the geographical knowledge and cartographic skills of that period, while Henri Chatelain's 1719 *Carte contenant le royaume du Méxique et la Floride* shows considerable detail of the region that would become the state of Alabama a century later.

The second major private collection was received from James Woodward. Mr. Woodward was president of a local iron company and had written a comprehensive guide to Alabama's early blast furnaces and iron industry. In addition to industrial history, Woodward was interested in Alabama history and Native Americans. His

Figure 2. *Illustration from* Atlas Maior.

Figure 3. *Benedetto Bordon's 1528* [Oval Map of the World].

__Figure 4.__ Geronimo Chaves's 1591 La Florida.

__Figure 5.__ Henri Chatelain's 1719 Carte contenant le royaume du Méxique et la Floride.

collecting included many important maps of the state and region as Native American lands were taken and the people removed. David Burr's 1838 *Map illustrating the plan of the defenses of the Western Frontier* presents a picture of how the US was planning its western growth. The location of Native American tribes, forts, and trails is provided for the area from the Mississippi Valley to the, then, western border.

The third major component of the collection was provided by Dr. Charles Ochs. He was a career navy officer whose travels had taken him to many lands and had introduced him to many of the questions of sea travel and navigation. In particular, Dr. Ochs was interested in the exploration and settlement of the Caribbean area which washes the shores of Alabama and other southeastern states. His maps provide vivid pictures of what Europeans knew, and did not know, as well as what they wanted to share with others.

CATALOGING

These various components combine to provide a comprehensive picture of how modern cartography developed, how the world was presented, and how the New World was settled by Europeans. Since many of the maps had been added after Mason's cataloging, it was decided to inventory and re-catalog the entire collection. That process was begun in 2008 and continues today. The overall project involves several components: inventory, assessment of condition, appropriate conservation and cleaning, encapsulation, digitization, cataloging, and classification.

The inventory database includes: cartographer, title, date, OCLC number if available, size, collection (Agee, etc.), whether digitized (if yes, the image location is included), whether encapsulated, notes regarding condition and information from the existing catalog. A temporary digital image was made with a hand-held camera. Finally, a temporary location code was added to enable staff to find individual maps before they were cataloged. No effort was made to group maps by subject or date at this stage.

After inventory, several decisions were made. All cataloging would be done through OCLC and full records would be prepared for each entry. The collection would be organized using the LC classification system. No map would be cataloged until any necessary (and possible) conservation was undertaken, encapsulation was completed, and a high quality digital image was available.

Conservation and encapsulation are done in-house by a part-time conservator. It might be worthwhile (and perhaps encouraging) to mention that this entire process has been conducted by part-time personnel. The desirability of making the map collection more accessible has long been recognized, but the cataloging tasks for Birmingham's central library, its many branches, and the many municipal libraries that are system members means that maps are never a top priority. Many libraries may find themselves in the position of waiting until the ideal time arrives to catalog their map collections. Such times seldom materialize.

Many of the maps had been digitized previously for various exhibits and projects. How to digitize the remainder proved to be a daunting piece of the puzzle. Staff considered buying scanning equipment. However, the cost of the equipment capable of producing consistently high quality images and accommodating large material was beyond the

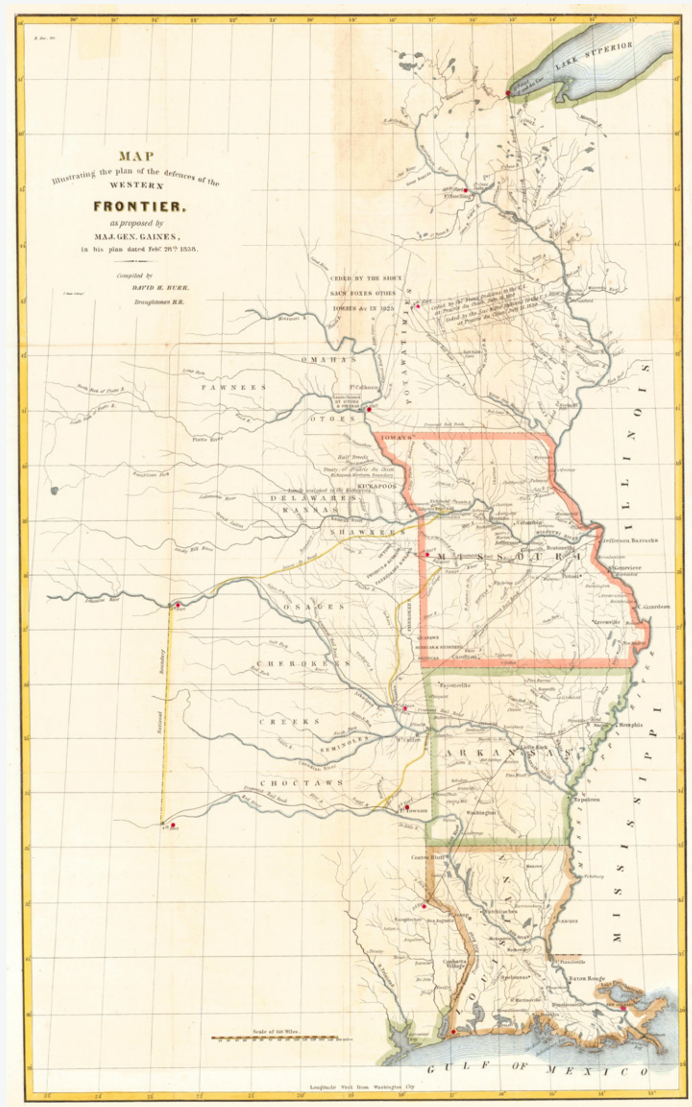

Figure 6. *David Burr's 1838* Map illustrating the plan of the defenses of the Western Frontier.

budget. Investigation made it clear that such equipment was not "point and shoot." Each document needed to be individually evaluated and its digitization tailored to fit the prospective use and its key features. Intricate maps with fine detail require a higher resolution at the expense of color depth. Documents with fine color detail and hued shading (e.g. topographical maps) are often better served with higher color depth and less resolution. Trained staff would be required. Consideration was given to contracting with a private agency, but that was also beyond the budget.

The solution came from the University of Alabama's Cartographic Research Laboratory. Its supervisor, Craig Remington, agreed to scan the maps in batches. The maps are taken to the lab in Tuscaloosa; the maps and files of the digital images are returned to the library. Copies of the images are also added to the lab's excellent web site **alabamamaps.ua.edu**.

The opportunity to finally catalog the collection was tempered by the realization that no one involved knew the intricacies of that task. Funded by a grand from LYRASIS, Paige Andrew, Map Cataloging Librarian at The Pennsylvania State University, came and provided two days training for staff from several local libraries.

HIGHLIGHTS OF THE COLLECTION

It is wonderful for a local collection to hold classic works of cartography, or to own a title whose only other "locatable" copy is at the Library of Congress or the New York Public Library. But it is meaningful that they also hold unique or very specialized items of local significance. This section highlights some items of regional interest in the Birmingham Public Library's collection.

Figure 7. The War Department's General Jackson's campaign against the Creek Indians, 1813 & 1814.

Much of Alabama was settled on lands previously occupied by Native Americans. A key part of that relocation process was Andrew Jackson's destruction of their military power. The War Department's *General Jackson's campaign against the Creek Indians, 1813 & 1814* covers the overall campaign, while John Reid's *The Battle of the Horse Shoe, 27th March 1814* details a major event in that effort.

To encourage white settlement, land was given to many groups. One of the most unique was a group of French immigrants who wanted to establish an agricultural community to grow grapes and olives, the "Vine and Olive Colony." The General Land Office's manuscript *Map of four townships in Marengo County, Alabama: granted to the french [sic] immigrants by act of Congress 3rd March 1817* is the only known map of that gift. John La Tourette's 1833 *Map of the Creek territory in Alabama from the United States surveys: shewing [sic] each section & fractional section* details the lands taken in the Creek's final removal.

Settlement of the newly available land enabled Alabama to move rapidly from being a part of the Mississippi Territory, to its own Alabama Territory, and finally to statehood in

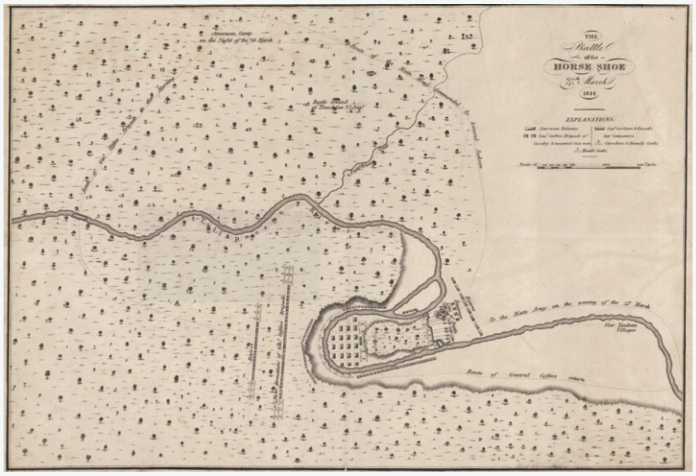

Figure 8. John Reid's The Battle of the Horse Shoe, 27th March 1814.

Figure 9. General Land Office's Map of four townships in Marengo County, Alabama: granted to the french [sic] immigrants by act of Congress 3rd March 1817.

1819. The favorable climate and rich soil brought large plantations and slavery. Michael Tuomey, professor of geology at the University of Alabama in the 1840s, had attempted to lead Alabama's economy away from slavery-based agriculture. In 1849, he produced the first survey of the state's mineral wealth. His map *Geological map of Alabama* showed exactly where the state's natural riches were located. The efforts of Tuomey and others were rejected, as were similar efforts in other southern states.

After the Civil War, Birmingham was established as an iron and steel making district. The city and adjacent communities were created because of the natural locations of raw materials, as shown on Tuomey's map, and the placement of railroads. The Elyton Land Company, which created and owned the new city, planned it with railroad lines as its "compass points." *Map of the City of Birmingham, Alabama and the Adjacent Property*, drawn by William P. Barker in the early 1870s, shows great detail of the city's planning around the "railroad reservation," but is very

Figure 10. John La Tourette's 1833 Map of the Creek territory in Alabama from the United States surveys: shewing [sic] each section & fractional section.

dark. Herman Schoel's 1888 *Map of the City of Birmingham and Suburbs* shows how much the city had grown in about fifteen years. All this development was recorded and publicized on maps. *Birmingham-Bessemer, Ala. Map showing tracks and facilities of various railroads within Birmingham-Bessemer terminal area / November 5, 1935* is a treasure trove for local historians. Although the image is too large to reproduce here, it can be seen on the library's catalog. The map names, and locates, virtually every company, mine, community, and rail connection in the industrial area of Jefferson County. Much of this information is now lost in suburbia. Similarly, early neighborhood plats and plans provide valuable information. Birmingham's civil rights history is also presented. A large zoning map, dated July 13, 1926, shows the city's established system of segregated schools. *Birmingham's Civil Rights Churches* locates all of

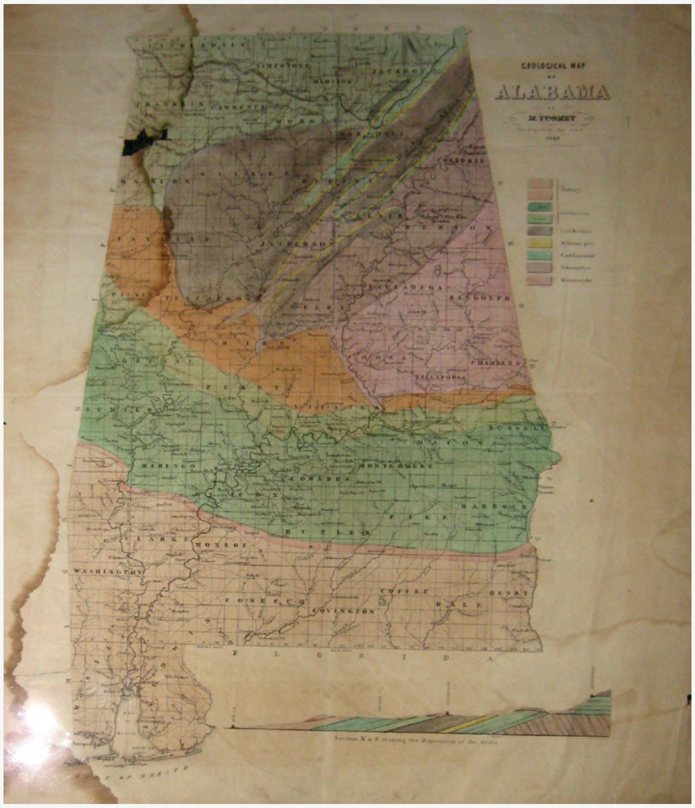

Figure 11. Michael Tuomey's Geological map of Alabama.

Figure 12. William P. Barker's Map of the City of Birmingham, Alabama and the Adjacent Property.

Figure 13. Herman Schoel's 1888 Map of the City of Birmingham and Suburbs.

the churches involved in the efforts to end segregation in the early 1960s.

The Birmingham Public Library's project to make its treasures more accessible is a work in progress. A great deal has been learned about how, and how not, to do the various steps. Hopefully, this article will encourage other institutions to pursue partnerships to make their holdings, particularly regarding local history, more accessible.

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3D-Printed Landform Models

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INTRODUCTION

Many clever techniques to represent the undulations of the surface of the Earth have been documented in the pages of *Cartographic Perspectives* (Tait 2002; Jenny and Patterson 2007; Abplanalp 2013) and elsewhere (Imhof 1965; DiBiase et al. 1994). But at the end of the day, contour lines and other two-dimensional representations are abstractions that map viewers can interpret with varying degrees of success. Three-dimensional representations of landforms, on the other hand, are easy to understand, since we experience them as we experience the world around us. The following recipe is based on a workflow I developed to print landform models that can quickly and easily convey the shape of the land in educational settings, namely at wine-tasting sessions.

A WORD ABOUT SUITABLE 3D PRINTERS AND SOFTWARE

The only full-color printer available in 2011 was the ZCorporation 650, which deposited a thin layer of gypsum plaster (also known as plaster of Paris) that was then sealed with a liquid binder. The model has since been rebranded as the ProJet 660 Pro from US-based 3D Systems.

At present I am working on another, smaller model to be printed on an Mcor IRIS printer from Ireland. These printers use reams of photocopier paper as the medium, work with inks in the CMYK color space, and coat the print so that it resembles plywood in look and feel. Their main marketing pitch is the fact that the paper is inexpensive compared to the media used by other brands.

Figure 1. *A model printed by vW Maps. More photographs are available at tinyurl.com/3dterrain. Photo by Bonnie Savage.*

The following workflow uses Manifold System 8.0 with the Surface Tools extension for data compilation and DTM export, Adobe CS5 for creating and rasterising the map to be draped over the top of the model, and AccuTrans 3D from MicroMouse Productions for creating the 3D printer-ready file. Where I've capitalized ordinary words such as Drawing and Image, I'm referring to the meaning of the term within the software.

Much has been written, especially on CartoTalk (**cartotalk.com**), about Manifold software and how it hasn't been updated in many years. What's described here can surely be replicated in any other GIS software. But Manifold allows a user to easily merge and trim raster data and move quickly between raster data and imagery—two important traits in this exercise, as you'll see. Also, Manifold handles different projections and coordinate systems applied to different data sets particularly gracefully.

AccuTrans 3D excels at transformations between different 3D file formats. It's inexpensive, is updated regularly, and its developer is very responsive to requests and comments. Over the course of writing this paper the software has been upgraded quite a few times; the screenshots show how the user interface has changed. The functionality—at least of the small set of features I've needed and explored—has, however, not changed so as to make the older images in this article outdated.

STANDARD 2D MAPMAKER'S WORKFLOW

As you would for any mapping project, begin by compiling data and projecting linework and a suitable DTM to your final map projection in Manifold. Meanwhile contact a 3D-printing service bureau to find out what printer is available and fits your needs and budget and then find out the final build size.

In Manifold, draw a blob around your area of interest as a new Drawing in order to define the final map area. If you want your model's edges to be aligned with north and south, then use Insert Box to draw a rectangle that covers the blob and then delete the blob from your drawing so only the rectangle remains. But if north doesn't have to be up, select the blob and use the Transform: Enclosing Rectangle option. Tweak the area so that the aspect ratio is roughly correct for the 3D printer's build area either by eye or by measuring the lengths of the rectangle. Keep this bounding rectangle in a safe place and don't change the map projection again.

Export the linework, including your bounding rectangle, and make a map draft in Illustrator or similar. Exporting a Layout Image onto 11" × 17" will give you a canvas that shows a little more than the map area. If you're happy with the result, you'll be able, in Photoshop, to easily crop the tabloid map to the ProJet 660 Pro's 10" × 15" build area, or that of the smaller IRIS. Note your final map scale.

Later you'll rasterize the AI file in Photoshop to create a JPG to be draped on the map. The manufacturer of the ProJet gives the printer's capabilities as 600 × 540dpi but this is based on the printheads and not the medium which, to my eye, doesn't produce crisp detail much over 150dpi.

CLEAN YOUR DTM

If your DTM is assembled from multiple data sources, Manifold makes it very easy to compile these into the same layer through a simple copy and paste. Make sure, however, that you're adding pixels to the highest-resolution Surface so that you're never throwing away data.

Should your data have missing or incorrect height values, you can hunt these down and make up values using the Transformation "Threshold Lower." Zoom in tight to the erroneous cells, read the values of the neighboring cells, and type in a realistic value in the Transformation bar (permission to make up these data is granted under your *cartistic license*). Make sure that your View doesn't show relief shading, which Manifold does by default, because this will obscure which cells actually have the erroneous values.

DO YOU WANT A CARTOUCHE?

At this point I like to indulge my passion for postmodernism by dragging a renaissance-era convention into the present, and what better way than by writing "Martin fecit" under the map title on a 3D print? But whether you write this on the model in Trajan Pro or in Comic Sans, the cartouche will look funny if it's draped over steep terrain. A large water body might suit if you're not showing bathymetry or if the bathymetry is shallow, but if it has to be over hilly terrain you'll want a flat surface on the model.

So draw a rectangle in your Illustrator map in a suitable area. Using the map scale, calculate the size of the bounding rectangle if it were on the ground. For example, if you decide you can allocate 3 × 2 centimeters on your terrain model, you'll draw it as a Drawing in Manifold at 3 × 2 kilometers for a 1:100,000 map. Use a combination of Transform: Rotate, Transform: Move Horizontally, and Transform: Move Vertically to put the rectangle in the Drawing in about the right position relative to the terrain and bounding rectangle.

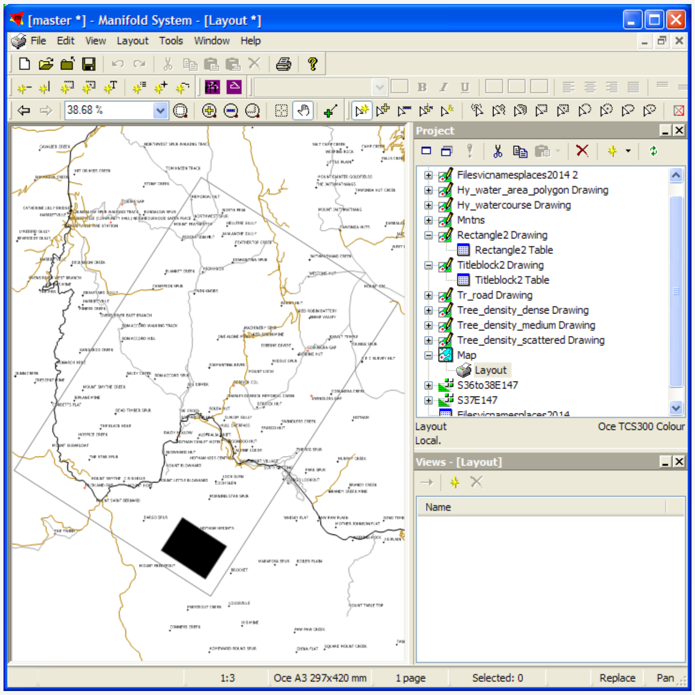


Figure 2. The black rectangle indicates the location of the title block.

Select the rectangle, make the Surface active, and select Surface > Transfer Selection, Modifying your DTM Using the vector Drawing. Turn off the vector layer to confirm you've selected the pixels of the DTM that the title block will rest upon and make the DTM Surface layer active. Assign an appropriate z value once you've considered whether you want the title block to sit high like a plateau (as in Figure 1, above), whether it should be of an intermediate height among the hills, or whether it should sit in a depression in the land. Use Transformation: Threshold Lower and Transformation: Threshold Upper to type in the right height value, making sure you're only applying it to the "Selection in" your DTM layer.

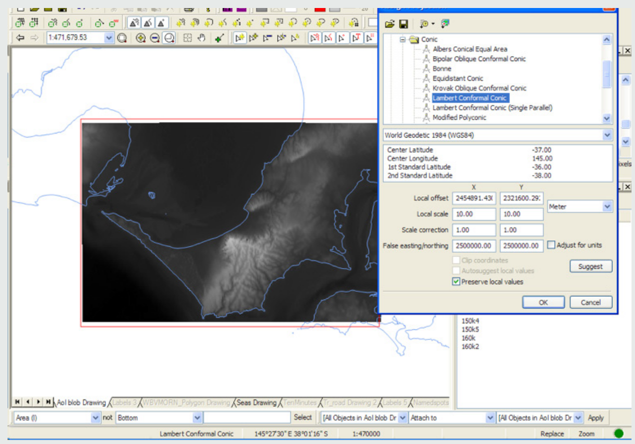
Once the holes in the DTM have been patched and you've prepared an area for the title, then it's time to trim the DTM to your area of interest. First save your Manifold .map file so that you don't lose the master DTM. Make a new Map with your area of interest polygon and your DTM, making sure it's in your projection of choice. Select the rectangle and, as above, use Surface > Transfer Selection. Now make the Surface active and Select Inverse so that the heights outside of your subject area are selected. Delete, and now your 3D data set is ready.[1] Export the

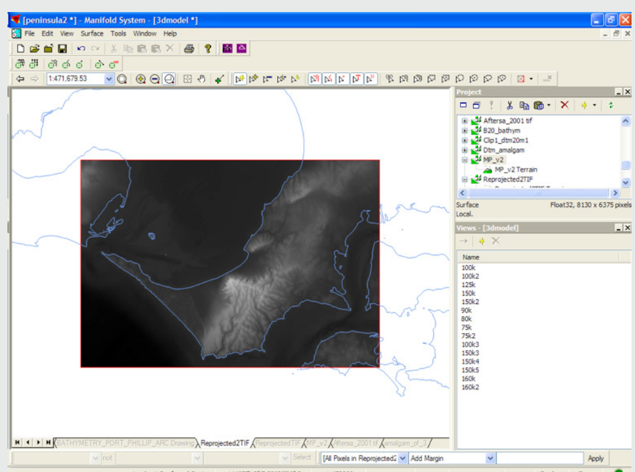
1. The Surface probably still has pixels outside your area of interest that will come through in AccuTrans 3D. My 3D operator has confirmed that these are easy to identify and trim.

MIND YOUR PROJECTION

Twenty years ago our GIS software could be a bit ham-fisted in its handling of data in different projections and coordinate systems. Things have changed since then and Manifold, in particular, handles data from various sources quite gracefully. The other side of the coin, however, is that the Manifold operator can get a little sloppy and careless, potentially resulting in output that's not necessarily in the right projection. Be careful to check the projection parameters as you proceed.

The first image below is the result of trimming the image, reprocessing it, and then exporting and re-importing a derivative. Note that the DTM data don't meet the outline of the area of interest, in red, because the projection of the DTM is wrong! The second is the result of reprocessing the DTM and *then* trimming it.





Surface as an ArcInfo ASCII Grid file, again making sure it has the right coordinate system and projection. To test that the projection is truly correct, export the trimmed DTM also as an image, either JPG or TIF. Bring that into your Illustrator file and if it's in the right projection, you'll be able to scale the image to fit the bounding box (see Mind your Projection, previous page).

Now turn off the Surface but keep the title block rectangle visible and export your Layout as another Image. Open this in Illustrator in order to make sure you put the elements that go inside the block in the right place on the Illustrator version of your map. Based on how this export lines up with your finished map, you may want to adjust the placement of your cartouche in Illustrator. You don't need to use this Manifold export in the finished map; after all, you don't want a neatline around your title block since it'll be quite apparent if your neatline doesn't perfectly line up with your tableland.

FROM GIS TO REAL 3D

Now in the Explorer window, change the file suffix of your ASCII Grid from .grd to .asc. Launch AccuTrans 3D and accept the default settings so that you're not throwing away any information.

After you've examined your 3D surface, exaggerate the elevation by clicking on the Change tab at upper right (Figure 4). At the bottom of the panel, change the Scale value from 1.0 to, for example, 2.5 and click Scale to see the resultant exaggerated z dimension. I've used 2, 2.5, and 5 for landscapes that were relatively flat and needed a little "lifting" (make sure your cartistic license hasn't expired). But watch out, because the effect is cumulative, so if you try 10.0, decide it's too much, and try to halve it by using 5.0, then your result will be an exaggeration of 50! No matter, just bring it back to where you started with 0.02, the inverse of 50. Note that AccuTrans 3D has no Undo function.

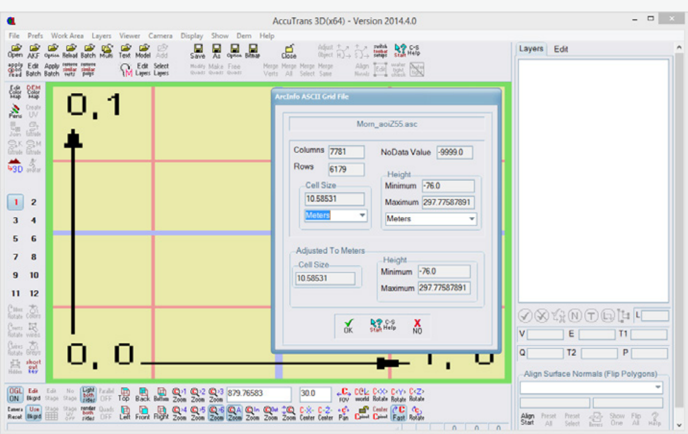


Figure 3. The amount of data, 48 million points, is acceptable and the heights above and below sea level, in meters, are plausible.

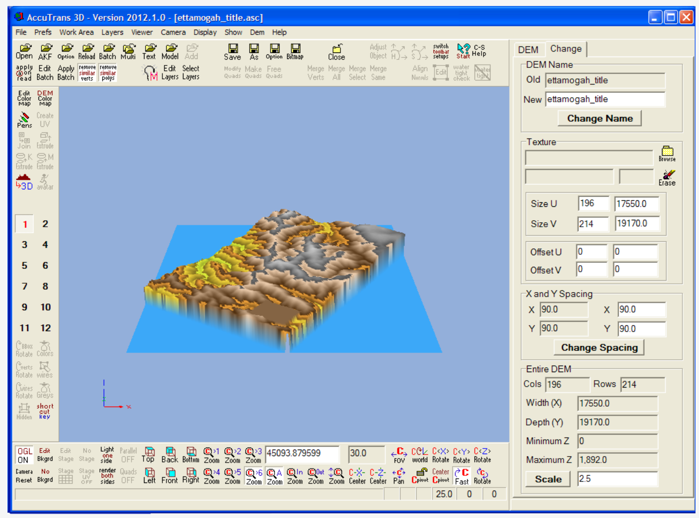


Figure 4. The Change tab at upper right lets you change the vertical exaggeration, at bottom right.

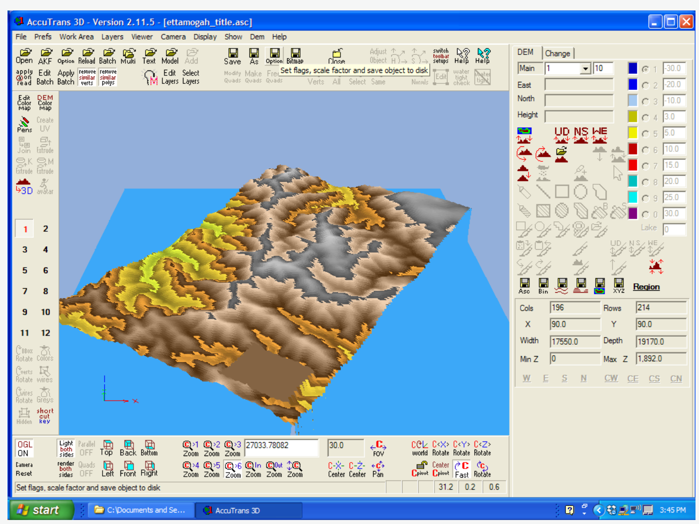


Figure 5. The "save with option" button, top center, will bring up a dialog window in which you can change parameters and save as another file format.

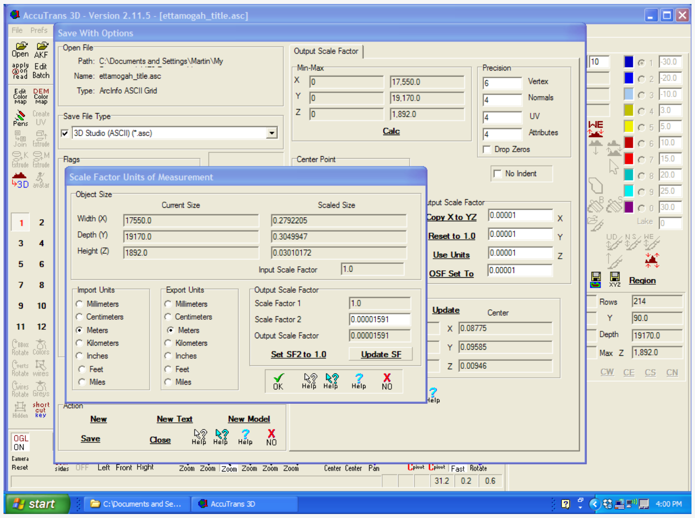


Figure 6. *If your preferred map scale is 1:62,846—and whose isn't?—enter 0.00001591 as the Scale Factor 2.*

3D printers are getting so big that they're printing houses these days (BBC News 2014). But even those printers won't be big enough to print our terrain, which is still at 1:1! So click the Option button with a floppy disk icon above it (Figure 5) and then the Output Scale Factor: Use Units button. I like to keep the import and export units in meters and then aim for the scaled size to be about 0.37 and 0.24 meters, or slightly smaller than the 10" × 15" final build size of the ProJet 600 Pro. The Scale Factor 1 button doesn't like to be changed, but the Scale Factor 2 button brings the desired result when you enter the scale of the map as a ratio expressed as a decimal (Figure 6). Change your value here, Click Update SF and check that the Scaled Size measurements, in the upper part of the window, are about the right order of magnitude for your printer's printing bed—in other words, less than a meter. For a model at 1:100,000, use 0.00001 as the scale factor; for a 1:160,000 model, use 0.00000625. Press Save to exit the Save With Options window and save as a new file.

What format to export depends largely on what your service bureau wants. I've settled on the Wavefront (.obj) format, which seems to be space-efficient and is easily opened again by AccuTrans 3D to give you the peace of mind that you're sending a good file. I've had mixed success with VRML 2.0 (.wrl). Its advantages are that it allows you to map the JPG to the 3D surface and it's an old format for which you can easily find another software package to view the file. STL is the venerable "stereolithography" format from the days when this industry was for prototyping only. These files are huge and consequently both the service bureau and I have had trouble opening them.

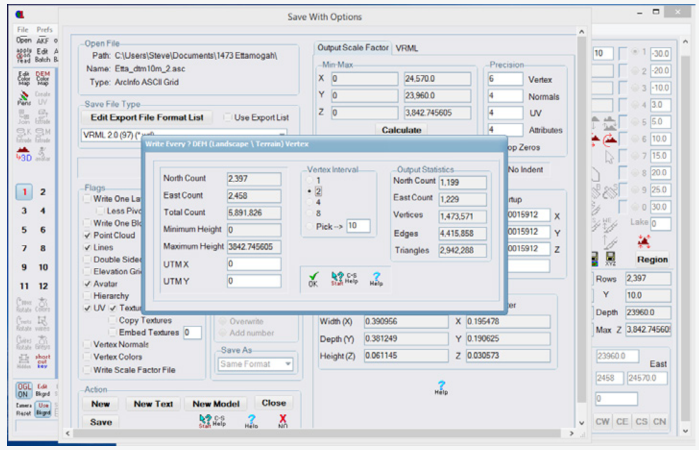


Figure 7. *A vertex interval of 1 is lossless. VI=2 halves the number of points in both the x and y dimensions, so you're left with a fourth of the data.*

Once you've selected your format, a new dialog box pops up in which you can reduce the number of vertices (Figure 7). Use a value of 1 to keep all data, use higher values to reduce the amount of vertices and therefore triangles in your mesh. As soon as you save, AccuTrans 3D writes the file but also leaves the dialog box open, so keep your eye on the spinning cursor to confirm the end of the writing of the file. Close to get rid of the dialog box, clearing your work, then open your new file. At this point AccuTrans 3D crashes a fair bit, especially if you've selected enormous .stl or .wrl files. Reducing the number of vertices by a factor of two as in Figure 7 above was required to get AccuTrans 3D to open the VRML file.

Your printer may want you to extrude the surface, which is presently not a 3D volume but a 2-and-a-half-dimensional surface. Use the Extrude Pseudo 2d Surface button

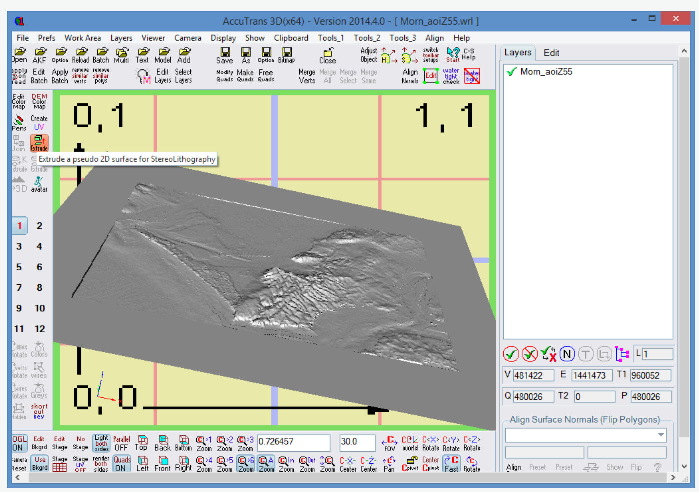


Figure 8. *To avoid a wafer-thin model, extrude your surface.*

at left and add a dimension (Figure 8). I chose .01 as the Thickness (Figure 9) so that a 1 cm thickness would be applied. Keeping the model thin keeps costs down since you're paying by the amount of material printed; 1 cm provides some strength so that the model isn't brittle.

I have also stipulated a flat bottom in the past but it's unclear from the printer whether that's helpful or not. Click Extrude and then the OK button.

As a final and maybe optional step, you can map the JPG you created to the DTM as long as it's a VRML file. It's much more satisfying looking at your model in the AccuTrans 3D environment with your pretty map on it than without it. But this step isn't essential and if your rectangle isn't oriented due north/south, it's downright impossible, as far as I can tell. Click Change tab and select the Texture button and browse to find your JPG.

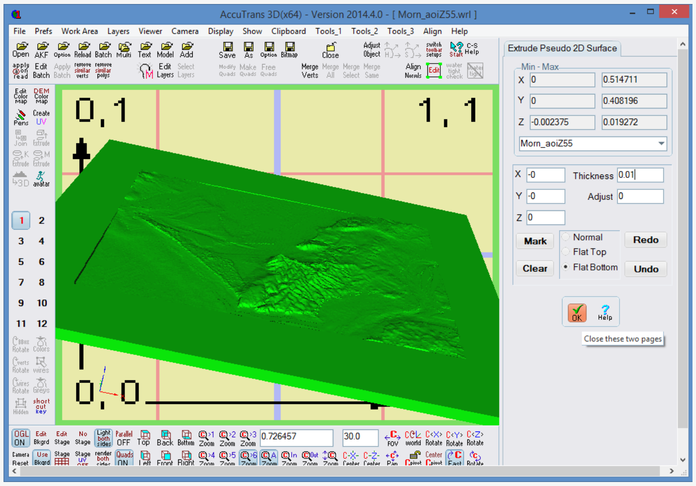


Figure 9. *Applying a thickness of 0.01 meters incurs cost but gives the model strength.*

Figure 10. *Ripe for research: How should we use relief shading and hypsometric tinting? Photo by Bonnie Savage.*

CONCLUSION

Many of us have fond memories of a visitor center with a large, 3D terrain map probably made of plaster or concrete. Will 3D printing spawn a new era of such interpretive maps that use the DEM data that are now so readily available? Not too soon, is my prediction, not just because the build sizes of full-color printers are small, but also because costs are high.

The tools are still a challenge, too. I was surprised to see, when sitting with a 3D printer operator while he was preparing my files for printing, how primitive the software is. Aligning the JPG to the terrain is done by eye rather than by snapping vertices. On the cartographic side of things there are challenges, too. AccuTrans 3D doesn't support map projections, but luckily its programmer is dedicated and offers great customer support for his remarkable software. And this territory is still new enough that the service bureaus are accustomed to spending time on our files, probably because they're not experienced enough with terrain models to be able to specify what parameters they prefer. Don't be surprised if they answer your questions with "just give me what you have and I'll make it work."

Further research from the academic community would be very welcome. For example, is cognition really improved with terrain models rather than maps with contour lines? And in terms of model design, should important labels be written onto flat sections of the model with a single z value, as I advocate for cartouches? What vertical exaggeration is appropriate, and how does that change depending on the map scale and the local relief of the subject area? Does the elevation in the model effectively explain the terrain, or should the water be colored with bathymetric tinting? Similarly, do the hills and mountains come alive under the lights shining on the model, or should the cartographer paint relief shading on the surface? And rather than simply representing the surface of the earth, are 3D models of space effective at showing the distribution of quantitative phenomena?

Costs will come down, software will improve, and future GIS packages will probably support 3D printing file formats the way Photoshop CC can now export to the STL format. But in the meantime, good luck with printing your terrains.

ACKNOWLEDGEMENTS

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DOI: 10.14714/CP79.1293

Jerry's Map

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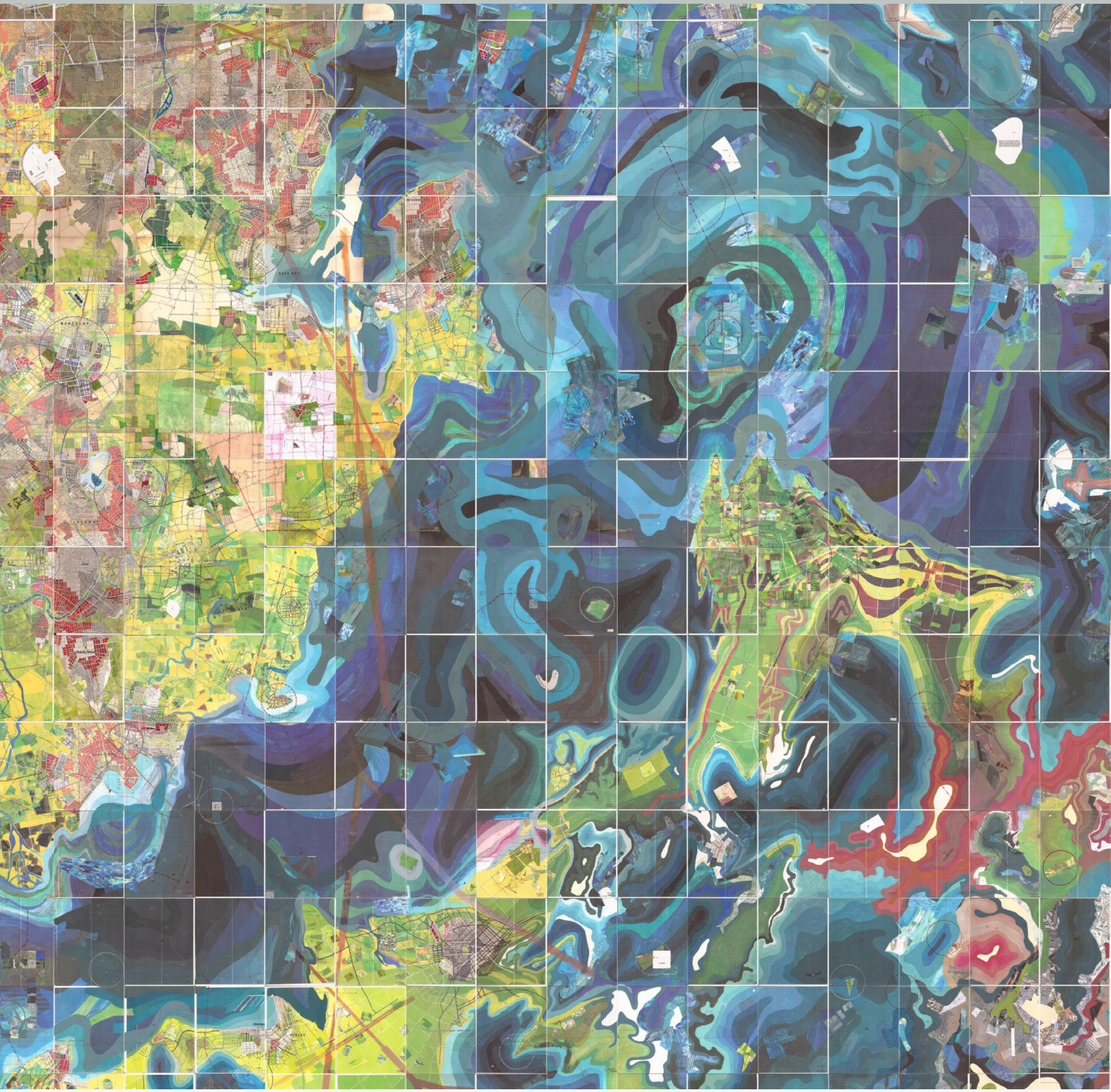
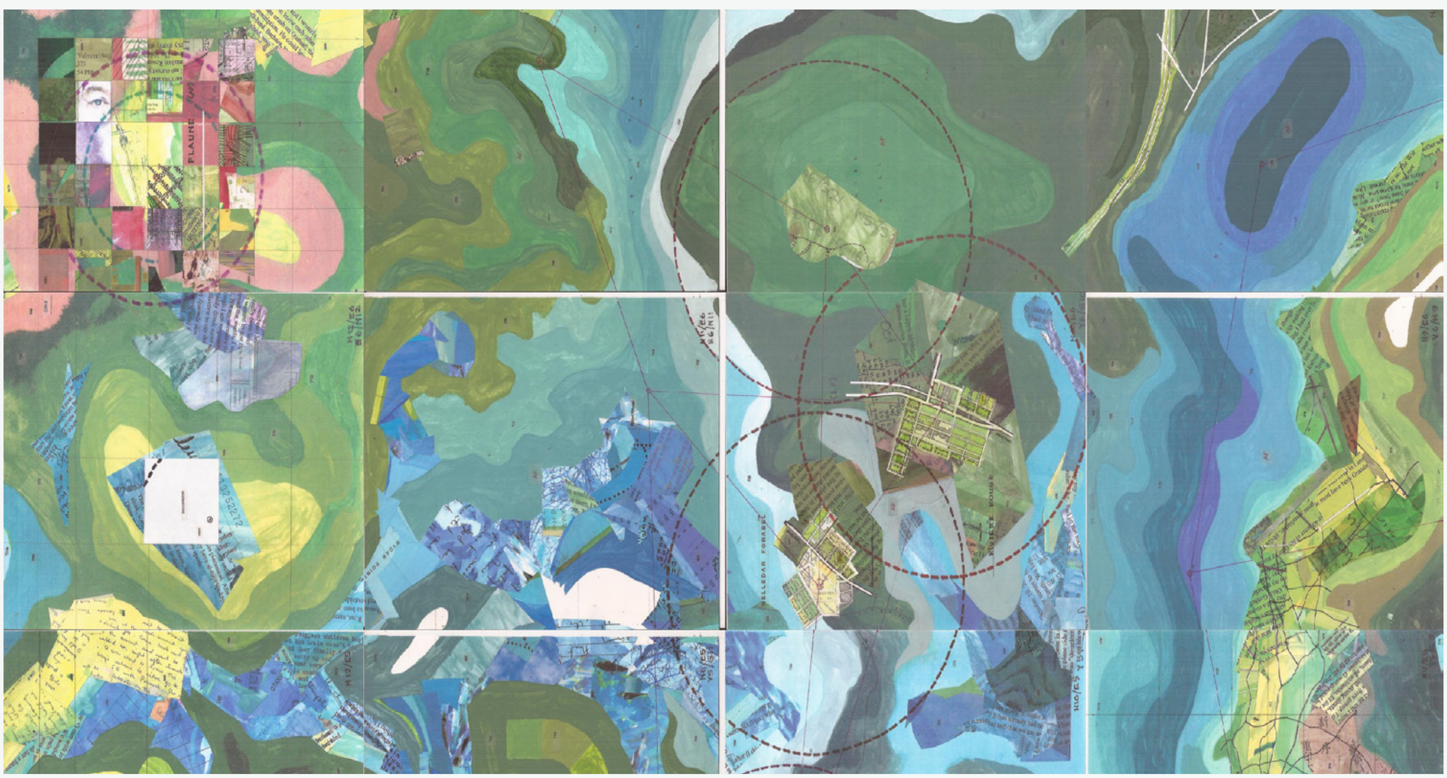


In the summer of 1963, between my third and fourth years of college, I had a job at the Hoover Ball Bearing Company in Ann Arbor, MI. I rode my bike back and forth the four and a half miles to work where I monitored the production of bearings from a room mounted with mechanical counters linked to the machines on the factory floor. When a machine had completed its run it was my job to page the foreman and let him know. In my idle hours I started drawing a map of an imaginary place.

Now, more than fifty years later I am still working on that map. What began on a single sheet of paper has expanded to over 3,200 eight by ten inch panels which, when combined, measure nearly 50 by 50 feet. The map in its entirety was displayed at MASSMoCA in 2012, and at Summerhall in Edinburgh, Scotland this past year. It is scheduled to be shown at the Palais de Tokyo in Paris early in 2015.

The map itself is arranged by row, and sits in stacks on the shelves of my studio in the countryside of northern Michigan. The materials used to create the map today are reused items such as an old cereal boxes, newspapers, photographs, printed documents, and magazine clippings. Acrylic paint, marker, ink, and colored pencils are utilized to bring the map to life. It grows in size, and each panel evolves over time. Each successive generation begins as a



copy made by an inkjet printer, which is then manipulated further.

A deck of modified playing cards holds an elaborate set of rules, which I draw upon for every modification of the map. Some rules involve "housekeeping" tasks like updating the inventory of map panels or scanning sections. Others directly bear on the execution of the map: new void, new city, add a panel to the periphery, add a new color to the palette.

Jerry Gretzinger, born in Grand Rapids, Michigan in 1942, studied architecture and liberal arts at the Universities of Michigan and California. He joined the Peace Corps in 1964 and spent 2 years in Tunisia, later returning in 1968 as an architect with an archeological team cataloging the Roman mosaics there. He came back to the United States in 1973 and started a handbag design company in New York. In the early 1980s Jerry was joined by his wife Meg Staley in the design and manufacture of women's clothing. He retired to Maple City, Michigan in 2004.

Visual Fields focuses on the appreciation of cartographic aesthetics and design, featuring examples of inspirational, beautiful, and intriguing work. Suggestions of works that will help enhance the appreciation and understanding of the cartographic arts are welcomed, and should be directed to the section editor, Laura McCormick: laura@xnrproductions.com.

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Interview with a Celebrity Cartographer: Jim Meacham

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James E. Meacham is a Senior Research Associate at the University of Oregon, and Executive Director and co-founder of the InfoGraphics Lab in the University's Department of Geography. He received his MA in Geography from the UO in 1992, and has served as the president of NACIS. His interests include map and atlas design, and data visualization. He is a co-creator of the Atlas of Yellowstone *(2012),* Archaeology and Landscape in the Mongolian Altai: An Atlas *(2010), and the* Atlas of Oregon *(2001). He teaches cartography courses at the University of Oregon. His current projects include the development of the* Atlas of Wildlife Migration: Wyoming's Ungulates.

For his atlas projects, Jim ventures into the field with wildlife biologists, archaeologists, and fellow atlas collaborators to further understand the sense of place and landscape that make the areas he is mapping unique, and ties these important aspects into the cartographic products of the InfoGraphics Lab. Jim is also an incredible mentor for students who take his advanced cartography course, as well as for those who work with him in the InfoGraphics Lab. Jim has inspired me and many other students to pursue studies and careers in cartography and data visualization, and he continues to be an integral part of the University of Oregon geography department, as well as the broader cartographic community.

Lauren Tierney
What first drew you to the fields of geography and cartography?

Jim Meacham
When I decided to return to college in my early 20s, after I had taken a break from studying business management, I wanted to get a degree more closely following my interests in the environment and the outdoors. I was leaning towards programs in environmental studies or planning, but then I took my first geography class, Geography of Oregon, and it just resonated with me. I felt everything I was learning from that class was so relevant, and I really got excited about the field of geography. After that first class my sophomore year, I was hooked. I was leaning towards physical geography—geomorphology and hydrology—but then took Bill Loy's introductory cartography class. I really enjoyed the process of creating and designing maps, and it really tapped into an early interest in art that I had gained in high school. It was the perfect mix of my affinity for geography and the creative aspect of art. I got an A+ in cartography, and took all the techniques classes Bill offered that year.

Lauren
Can you tell me a little about your experience working with Bill Loy?

Jim
Bill was a great teacher, and from him I learned about the importance of organization in cartography, attention to detail, clean design, and about building relationships with collaborators. He was always very positive and when projects were in stages that would get very stressful, he had a very calming effect. He would always say, "it will be fine." He also had a selfless quality, and truly cared about his students and the people he worked with. He loved Oregon, and his biggest project was the *Atlas of Oregon*, and through his sincere approach to cartography he was able to rally a lot of support and a large team to work with him on the atlas, both first and second editions. I learned a lot from him on how to manage large collaborative

projects. He was a very supportive mentor, which included guiding me in landing my first career job with the Oregon Department of Transportation (ODOT) after I finished my bachelor's degree. I returned to the Oregon geography program as a graduate student to help Bill set up a computer cartography lab with the main goal of building capacity to develop a second edition of the *Atlas of Oregon*. Bill and I worked together as a team to get the Lab going. The second edition of the *Atlas of Oregon* was not realized for several years.

Lauren

To clarify, was the InfoGraphics Lab founded immediately when you started your graduate program, or sometime later?

Jim

The InfoGraphics Lab's launch date was July 1, 1988, the day I arrived back at the University of Oregon, but it wasn't called InfoGraphics until sometime in the 90s. I was working at ODOT and took a leave of absence, which eventually became permanent. July 1st was the day when the Intergraph Unix workstation arrived. I learned how to operate the Intergraph workstation and MicroStation Computer Aided Design (CAD) software while working at ODOT. After the new system was set up, we immediately started making maps of local Lane County and maps supporting research for a few faculty members. Our first test atlas project was the *Atlas of Lane County, Oregon* published in 1990. Another early project was the *Official Oregon State Highway Map*, which evolved into my thesis research topic, focusing on the technological transition of moving from a manual to a digital cartographic process. We also started our campus mapping effort, and made the first base map of campus in CAD using newly obtained photogrammetrically derived digital files.

Lauren

What are some of your favorite memories working with Bill Loy?

Jim

One of my favorite memories in working with him was when we were doing the press check for the second edition of the *Atlas of Oregon*. Being there with Bill and Stuart Allan and watching the sheets come off was really an incredible experience and a great honor to be there. Other great memories included Bill Loy's annual canoe trip down

Figure 1. *Past atlas products of the InfoGraphics Lab.*

the McKenzie River with the Lane County Geographical Society.

Lauren

Over the years you have worked on a number of atlases. What have been the most rewarding aspects of working on these multi-year cartographic products?

Jim

I feel very fortunate to have been a part of so many atlas projects; I don't think a lot of cartographers get that opportunity. The second edition of the *Atlas of Oregon* was one of the most intense and rewarding experiences. Working on that project was where I really cut my teeth on high-end atlas making, working with Bill, Stuart Allan, and Aileen Buckley. Stuart was an intensely demanding Cartography Editor, which resulted in the great product we were all very proud of. We made it through, and I feel like I came out a much better cartographer for it.

In working on *Archaeology and Landscape in the Mongolian Altai: An Atlas* (Esri Press 2010) with Esther Jacobson-Tepfer, one of the greatest rewards was having the opportunity to work in the field and assist in surveying rock art and monuments that had never been documented.

At this same time we were working on the *Atlas of Yellowstone*, a project that again took me out into the field, and allowed me to apply what I had learned in the process of putting together the *Atlas of Oregon*. We focused on the Greater Yellowstone Area (GYA). No one had ever created a comprehensive atlas covering this intensely studied area, leaving the opportunity open to us. Our core atlas team included Dr. Andrew Marcus, who had previously done extensive research in the Yellowstone on the Lamar; Ann Rodman, the Yellowstone National Park GIS coordinator; and Alethea Steingisser, the InfoGraphics Lab cartographic production manager. Many students worked on the project too. This turned out to be an amazing multi-year journey of annually going to Yellowstone and working with wildlife biologists, geologist, historians, and a variety of other experts to pull together their stories to include in the atlas. One notable experience we had was with the art curators at the Buffalo Bill Historical Center. We were given a personal guided tour of the 14-foot wide Thomas Moran painting of "The Grand Canyon of Yellowstone," which at the time was on loan from the Smithsonian. Those experiences really make you appreciate the place, and the importance of that place to the people who have a strong connection to it. It would be really difficult to find a more incredible place than Yellowstone to make an atlas of.

Lauren

What has been the process for selecting atlas topics for you?

Jim

For the *Atlas of Yellowstone*, initially I was invited to come to one of Andrew's classes to tell students about my advanced cartography course, in which I typically would have an overall theme that student projects would draw upon, where each student would have an individual theme. Andrew had the idea of focusing on the Northern Range, an area in the northeast part of Yellowstone that is a rich area for wildlife habitat, in which we could potentially focus on for an atlas. Soon after, while talking about the Northern Range atlas over microbrews at a geography department party, we said, "Well, why don't we make an atlas of the *whole* Yellowstone National Park?". This idea evolved to include the whole GYA, as Yellowstone National Park is not in isolation and the Greater Yellowstone Ecosystem doesn't end at the park boundary. We presented the idea to Ann Rodman, and John Varley, Head of the Yellowstone Center for Resources, and they thought it was a fantastic idea to extend their public outreach goals. The project took on a life of its own, and over ten years of fundraising, relationship building, and of course compilation and production we were able to produce the atlas.

Lauren

For many of your atlas projects you have had the opportunity to go out into the field with researchers contributing to the atlas. How important do you think it is to experience the landscape you are mapping?

Jim

I believe it is critical to get to know the place that you are mapping. It adds credibility to the products you are developing, and it gives you a feel for the nature of the place that you can't get just from GIS data, or even topographical data or aerial photography. You get to know the people that study the place intimately, and in experiencing the landscape with them you get to hear about their research and the observations they're making. You get a sense of what is important about the place and what is important to include on the maps, in a much deeper way than you would remotely. This experience also potentially keeps you from having major blunders in your maps. I think it is hugely important.

For the lab's current project, the *Atlas of Wildlife Migration: Wyoming's Ungulates*, the opportunity to be out in the field with the biologists and participate in the primary data collection gave me a great appreciation for all that the scientists have to do to get the information they need for their research. I also gained a much more intimate understanding of how important the research and mapping efforts are to conserving the ungulate migration routes. It literally puts a face to all of the GPS data we have been working with over the years.

If you are not out in the field at least some of the time, you are not able to experience the full effect of the landscape. It is a chance to build bridges and relationships with researchers and scholars, as well as with the local people in the communities who are also stakeholders in the ongoing research efforts. That is a really big part of what I

Figure 2. *Jim out in the field for the* Archaeology and Landscape in the Mongolian Altai: An Atlas *project.*

love about making these atlases, is learning about these different places and their subject matter. I'm a geographer as well as a cartographer, and experiencing the sense of place enriches my work, and the fieldwork we participate in shows up in our maps and how they are designed. It is a really great way to expand my horizons and knowledge.

Lauren

What are a few of your most memorable experiences out in the field?

Jim

One of the most memorable experiences was from the Mongolian Altai project when we attended a Nadam celebration (a national festival celebrating the fermentation of mare's milk) in a valley near the border with China. We drove up with our group to the celebration, and there were lots of gers (yurts) and tents set up, and vendors selling food and crafts, and music playing. A horse race was in progress and other events. At one point we were speaking to some of the local Kazakhs, when all of a sudden a man with an air of authority approaches us and declares that he is the "Minister of Rocks" and demands to see our papers. We showed him, and he went on to inform us that we didn't have the right documents to be in that local area, and it escalated into a big argument that included our Kazakh driver and cook as well. Meanwhile, there was Chinese pop music blasting behind us out of this pickup truck selling stacks of shoes, and kids on horses were riding around the gathering group. It was very surreal. We felt we were moments from being thrown in jail when the Minister of Rocks was called away to announce a wrestling match. He left, and the situation diffused. Next our cook, whose family is friends with the "person in charge" of the local region, said we had been invited over for tea in the ger with the community leader and his family. So, we went from fear of arrest to being entertained by the head of the community, which included being served chai, snacks, and cold beer, with him playing us beautiful Kazakh folk songs on an accordion for us. He assisted us in preparing the proper paperwork for access to the region, we took group photographs of his family, and we were on our way. It truly went from one extreme to the other.

Figure 3. *Jim Meacham and Matthew Kauffman releasing a GPS-collared mule deer (photo credit: Mark Gocke, Wyoming Game and Fish Department).*

For the *Atlas of Wildlife Migration: Wyoming's Ungulates* project, having the opportunity to participate in a mule deer capture with wildlife biologists was an experience that was truly memorable. The mule deer are captured by helicopter, and brought back to the group of biologists to measure weight, take blood samples, check temperature, and secure or replace a GPS collar on the animal. When it is released, one person holds the animal to release it once the blindfold is taken off. The first time I was able to do that, I felt this intimate sense of wildness, when that animal released off and bounced out of my hold I had on it, and sprung out and took off into the wild. I really felt that interface of captive and wildness that I had never felt before. And that was a really moving experience.

Lauren

The upcoming *Atlas of Wildlife Migration: Wyoming's Ungulates* and the research conducted by the associated Wyoming Migration Initiative (WMI) has reached multiple media platforms, from "live tweet events" to news to video to research publications. How has this changed/expanded the atlas production experience, to provide maps and data graphics for multiple uses?

Jim

With this atlas project we have been working with the Wyoming Migration Initiative to take advantage of social media for the atlas, particularly with live tweets and Facebook, as well as movies and short documentary films. The Red Desert to Hoback migration film, for example, was hosted on both the *New York Times* and *National Geographic* websites. These media platforms provide an opportunity to get our work out to the public much sooner. Atlas making is a long process, from compilation to iterations to design, as well as piecing together how we want these maps and page pairs to flow together to produce the atlas. These intermediate steps of videos and Facebook posts, for example, get the information out there in a more timely way, and are aiding us in reaching our public outreach goals far in advance of publication time. I believe there is a lot of overlap between developing thematic maps for atlases and for these other media, and we are testing that with this project. More recently, we have even been experimenting with Mapbox Studio and CartoDB to represent this animal movement data for multiple platforms. This public outreach that includes the research of the WMI and the maps we design plays an important part in conserving these ungulate migration corridors through better communicating the existence and significance of these migration corridors to the survival of these ungulate herds. These offshoot projects also inform the public that the atlas is being created. Dr. Matthew Kauffman, the director of the project, is fantastic to work with, and truly understands the role maps and cartography can play in conservation.

Lauren

What do you feel is the most important aspect of having students actively participate with projects in the IG lab, and what do you feel students might benefit from most in the lab?

Jim

Bill Loy really set the example for the teacher-student relationship, mentoring, and the importance of incorporating real, applied experience coupled with concepts learned in the classroom, and making that bridge in a meaningful way. We have carried that out in the InfoGraphics Lab, and have both undergraduate and graduate students bring in what they have learned in the classroom and apply it

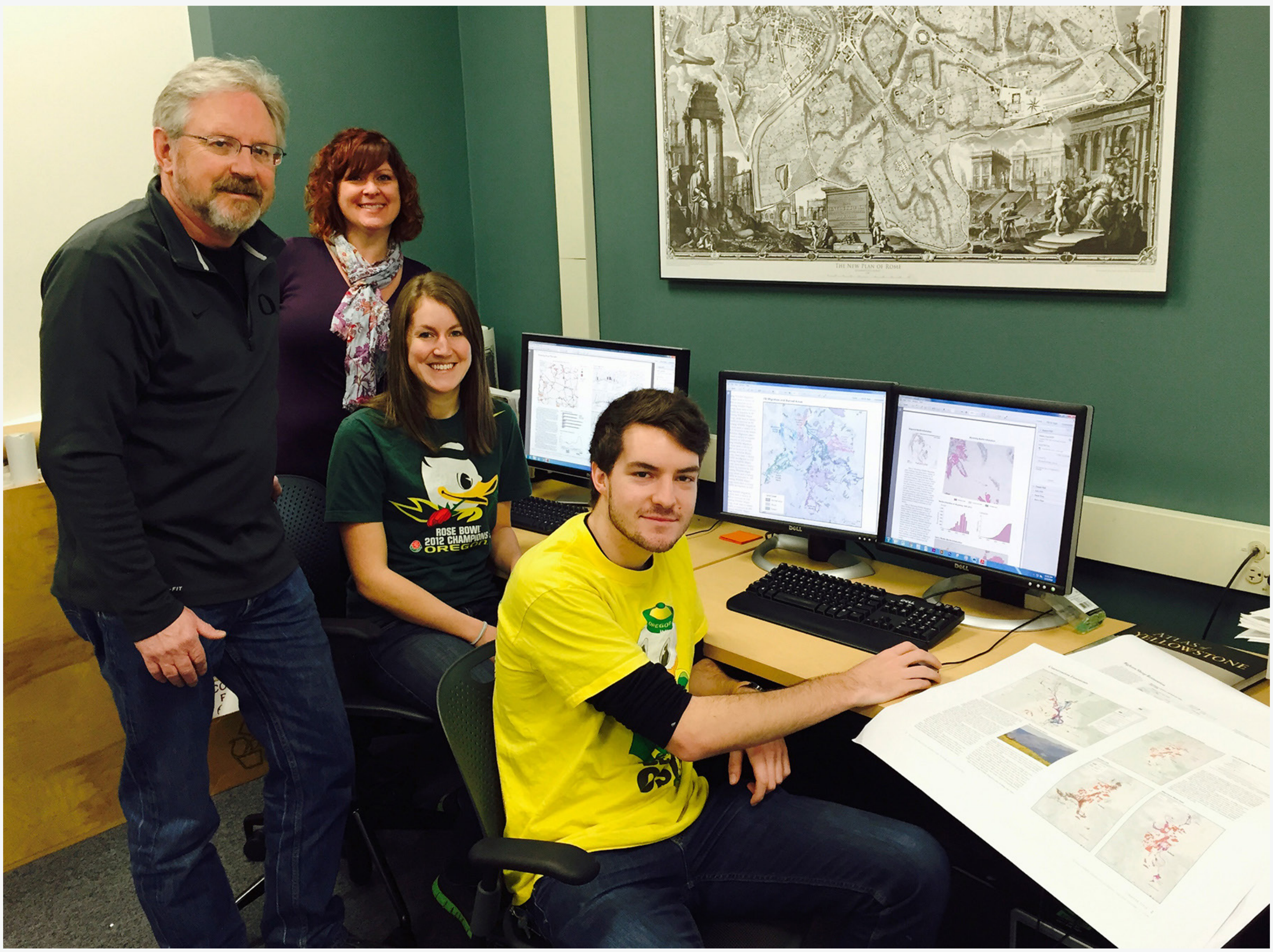

Figure 4. *Jim Meacham, Alethea Steingisser, and students Lauren Tierney and Riley Champine work on the* Atlas of Wildlife Migration: Wyoming's Ungulates.

to large ongoing projects. Having students in the Lab has always been a priority, and is an aspect of my job that I get the most reward out of. Publishing an atlas, making maps, and being out in the field is exciting, but to me helping students gain the skills they need to reach the career goals they want is so incredibly valuable. I never give a second thought to having students in the Lab, and we always budget students into the work that we do. Students first take courses in GIS and cartography, and some are from majors outside of geography. The students respond so well, are engaged in their work, and become indispensible members of the team. Most, if not all, are able to go out and start their careers after they graduate, and it is part of how we judge how well we are doing. There's mentoring all the way down from my position to Alethea to the graduate students, who then teach the undergraduates, so everyone is consistently working together at all levels. We have a work environment that is fun and people can feel comfortable in, but is also a professional environment. There is an expectation when they come in that they are going to be productive, and we try to serve as good examples to prepare students to work in the professional environment.

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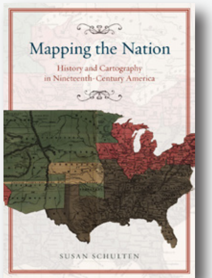
MAPPING THE NATION: HISTORY AND CARTOGRAPHY IN NINETEENTH-CENTURY AMERICA



By Susan Schulten.

The University of Chicago Press, 2012.

272 pages, 47 halftone illustrations.
$50.00, cloth.

ISBN 978-0-226-74068-3

Review by: Marcy Bidney, University of Wisconsin–Milwaukee

Susan Schulten's *Mapping the Nation* exemplifies the idea that geography is a large component of the story of the history of the world and—in the case of this book—the history of the United States. Focusing primarily on the nineteenth and early twentieth centuries, Schulten weaves many histories—of geography, geographic education, map making, and map collection—together with stories of the maps, atlases and individuals which were key to the development of these histories. In this book, Schulten gives us a window into somewhat esoteric parts of American history which have rarely been examined.

The book includes five chapters, divided into two parts tracing two developments: mapping the past and mapping the present. The first part, "Mapping the Past," focuses on historical mapping and the use of maps to illustrate the early history of the United States. Schulten masterfully traces the history of information visualization as it pertains to the development of a national identity in the early years of American independence. Pulling from her earlier work on Emma Willard, Schulten weaves in a discussion about the history of early education in the United States, using the crossroads of geography and history to illustrate the important role both disciplines played in the development of education in the United States. In addition to Willard, Schulten introduces us to Johann George Kohl, Frederick Jackson Turner, Charles Paullin, and John Kirtland Wright and explores their roles in the development of both a national identity for citizens and a National Identity as a country through the use of geographic visualizations.

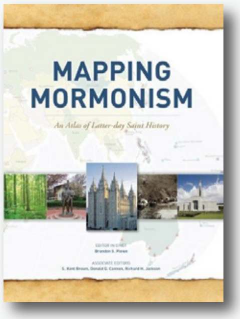
The second part, "Mapping the Present," does not focus on our present, but on mapping the present as it was in the nineteenth and early twentieth centuries in the United States, highlighting the shift from maps that focused on history to maps that focused on contemporary data and information. Here we are introduced to Alexander von Humboldt and Karl Ritter. Together these two men dramatically changed cartography by introducing the idea of thematic mapping and the creation of data visualizations for the purpose of cross disciplinary study. These final three chapters cover a range of topics, including mapping epidemics, medical geography, and the development of climate maps. Schulten goes on to use slavery in the United States to introduce the use of statistical cartography, and the role which the Coast Survey, Frederick Law Olmstead, and John Mallet played in mapping the strength of the southern rebellion during the Civil War. She finishes the book by discussing how government statistical mapping grew to include the social environment of the United States.

The companion website to *Mapping the Nation* is quite impressive. Schulten has included high resolution images of the maps discussed in each chapter, allowing readers to interact with them in ways that are not possible with the static, black and white images in the book. In addition to the maps, Schulten has also created a blog to continue the discussion of the relationship between maps and history, particularly as it pertains the history of the United States. With one to two posts per month, this blog offers additional insight into the development of visual representations of the United States and its history.

As a geographer, I'm of the belief that everything is geographical. As an undergraduate student I had a professor who was fond of saying, "If you can map it, it's geography." So, if you imagine the many ideas, facts, and statistics that can be mapped, then you can understand how difficult it is to tell the story of a *place* without talking about the many aspects and influences of geography.

Mapping the Nation is a well-written history of mapping in and of the United States, presented in an interesting and very readable manner. This book will be of interest to academics and non-academics alike. Anyone with a general interest in the history of the United States or the history of geography education and mapping will find this book accessible and easy to read. On the academic side, professors of history, political science, education, and geography would find this book a solid addition to their syllabus, particularly if they wish to bring a focus to mapping and spatial visualization.

MAPPING MORMONISM: AN ATLAS OF LATTER-DAY SAINT HISTORY



By Brandon S. Plewe, editor-in chief;
S. Kent Brown, Donald Q. Cannon,
Richard H. Jackson, associate editors.

BYU Press, 2012.

272 pages, maps, figures, illustrations, glossary, bibliography, index. $39.95, hardcover.

ISBN 978-0-8425-2825-2

Review by: Russell S. Kirby, University of South Florida

The history of the rise, migration, and spread of the Church of Jesus Christ of Latter-day Saints (hereinafter referred to as LDS) has fascinated historians, geographers, and the general public almost since the emergence of this faith in the mid-nineteenth century. This atlas, prepared by eminent historians and geographers, while not intended as a comprehensive history of the LDS, casts light on a wide array of topics of central interest, as well as some of more pedantic interest. That the book has succeeded in meeting the needs of its market may be reflected in the fact that the initial print run was exhausted shortly after publication; a revised printing was published in late 2014.

This atlas contributes far beyond the *Historical Atlas of Mormonism* (1994), a scholarly work with which many of the editors were also involved. *Mapping Mormonism* is organized in four main sections, focusing respectively on "the Restoration," "the Empire of Deseret," "the Expanding Church," and "Regional History." Each of these sections is subdivided into 14 to approximately 25 distinct topics, comprising two to four facing pages. While the topics generally follow events in the history of LDS, some of the information presented in the later sections also provides historical context from periods covered in earlier sections. The sections on North American regions provide both current and historical perspectives on church expansion and membership over time. Likewise, some topics presented in earlier sections provide a forward look to the present. For example, although included in the second section, the topic of church headquarters provides information on the headquarters as it appeared in 1860, 1900, 1950, and 2012.

Mapping Mormonism is an attractive atlas, printed in hardcover on high quality paper. The maps and graphics are very colorful, and utilize a variety of cartographic methods and techniques for enhanced data visualization. There is scarcely a topic in which a reader might have an interest relating to the LDS and its history that is not covered somewhere within its pages. One particularly interesting section compares the growth of the LDS with that of Seventh-day Adventists and Jehovah's Witnesses from their origins to the present day. The sections depicting the international distribution of LDS adherents and the locations of stakes, districts, and temples also hold considerable interest.

While *Mapping Mormonism* has very specific objectives, these objectives intersect with many related issues and domains. The editors have done an excellent job in maintaining their central focus while at the same time providing information on what might seem at first glance to be ancillary topics. For example, the topic of political affiliation is presented on pages 188–189. On these facing pages, data on global political office-holding of LDS members, party affiliation and political ideology of Mormons and non-Mormons, and the outcome of statewide and national elections in Utah from 1900 to 2008 are presented, together with sufficient narrative to provide a broad context. Not only is this very well done, it raises numerous intriguing questions for those interested in developing a deeper understanding of the relationship between religious belief and politics. As the Rolling Stones once sang, "Well, it just goes to show, things are not what they seem."

How does *Mapping Mormonism* fit within the genre of historical atlases? Surprisingly well, in this reviewer's opinion. There is no question that this atlas will be the definitive resource on its subject for some years to come. Atlas developers will find that the editors make use of best practices in cartographic technique and data visualization, but also employ many innovative approaches to display of complex information in its pages. The atlas also includes an index, bibliography with an extensive list of key documents, books, and scholarly articles, and a glossary to ensure that readers with limited familiarity with the LDS and its traditions can understand the usage and meaning of common terms such as elder, pioneer, auxiliary, and stake.

Mapping Mormonism should be added to geography and map library holdings focusing on the North American continent and will also be of interest internationally. Those interested in the cultural historical geography of the American West should also consider adding it to their professional libraries. Aficionados of fine examples of data visualization will also find *Mapping Mormonism* a delightful read that they may wish to refer to from time to time.

SECRET SCIENCE: SPANISH COSMOGRAPHY AND THE NEW WORLD

By Maria M. Portuondo.

The University of Chicago Press, 2013.

335 pages, 18 figures, 10 color plates, 7 maps, 5 tables. $60.00, Softcover.

ISBN 978-0-226-67534-3

Review by: Maria Martin, Michigan State University

During the Age of Discovery in the 15th century, European nations expanded their hegemony into the New World. In this time of colonization and exploitation, many reconnaissance missions were dispatched to collect information on the topography of the land, its resources, and the cultures there. The field of cosmography was born out of the demand for tangible and detailed representations of these newly acquired lands. Maria M. Portuondo, in *Secret Science: Spanish Cosmography and the New World*, argues that the Spanish, during the reigns of Charles V, Phillip II, and Phillip III of the Habsburg monarchy, made significant contributions to the science of map making.

Portuondo asserts that the Spanish had a significant impact on the development of cosmographic theory and practice. However, in an attempt to protect their interests and possessions in the New World, Philip II treated map making as a state secret: "the work of royal cosmographers was science with a mission, deployed solely for the benefit of the state" (3). Cosmographers were not allowed to publish any of their projects on the New World for fear of the information falling into the hands of enemies and rivals who wished to attack and acquire Spanish lands. This prohibition created a period of silence in Spanish scientific knowledge production which came to be interpreted as a Spanish proclivity toward humanistic rather than scientific pursuits. Portuondo, through analysis of lectures and curricula from the University of Salamanca, state documents from the Casa de Contratación (House of Trade) and the Council of the Indies, as well as the works of contemporary Spanish intellectuals investigates the silence to explore the ways in which the Spanish actually refined the field of cosmography.

Secret Science consists of seven chapters. The first chapter traces the intellectual development of Spanish cosmography as professors at the University of Salamanca led critiques of, and found innovative ways to apply, classical texts such as Ptolemy's *Geographia*, Pomponius Mela's *De Situ Orbis*, Pliny's *Historia Naturalis*, and Sacrobosco's *Sphere*. Their research informed the development of navigation books. The second chapter speaks to the growth of cosmographic practice in the state-run agencies of the Council of Indies and the Casa de la Contratación. New discoveries were constantly made and so previous methods of cosmographic representation quickly became outdated. Philip II's royal cosmographer Alonzo de Santa Cruz and scientific advisor Juan de Herrera addressed these inadequacies through illustrations based on humanistic and mathematical interpretations, respectively. Chapter three discusses the codification and confidentiality of map making. In the early 16th century, the Council of the Indies sought to keep confidential the location of strategic Spanish ports in the New World and legal scholar-priest Juan de Ovando y Godoy developed a standard format for cosmographic descriptions.

The fourth highlights the work of Juan López de Velasco, which was the first official cosmography of the Indies that followed the rules set by Ovando. The fifth chapter examines and critiques two of Velasco's major works. The sixth considers the development and implementation of the use of questionnaires and observation of lunar eclipses. The surveys helped to organize the cosmographic data/descriptions that explorers sent to state agencies, while the eclipses helped the explorers to determine their longitude. The seventh and final chapter describes the change in attitudes about cosmographic secrecy from the reign of Philip II to his son Philip III, who made the information public. At this time there was also a split in the office of royal cosmographer, into one position that focused solely on mathematical interpretations and one that concentrated on descriptive ethnography and natural history.

Portuondo identifies four main objectives for *Secret Science*. First, she seeks to argue that the Spanish did in fact have an interest in scientific, not solely humanistic, knowledge production. Second, to clarify that the Spanish made important developments in the field of cosmography. Third, to demonstrate that early methods of map making involved a dialogue, not a separation, between the physical and social sciences. Fourth, to give a "new perspective of the historical narrative of the Scientific Revolution on how practitioners of Western science responded to the new world" (16).

She achieves her first, second, and third objectives through her account of the *humanismo cientifico* (scientific humanism) movement, begun by professors at Salamanca. Portuondo establishes that from an early date Spanish intellectuals used physical sciences in conjunction with social sciences. Professors Ciruelo and Nebrija worked together to build a curriculum that would teach students how to incorporate a mixed method into cosmographic science. Their framework was used to develop a navigation book that was accessible to non-academics, by utilizing a narrative style to explain mathematical and astronomical concepts important to sailors. The *humanismo cientifico* and development of navigation books are evidence of both the presence of a scientific tradition in Spanish cosmography and their unique contribution to the field.

Portuondo goes on to further support objectives one through three by debunking the myth of Spanish disinterest in the sciences. This untruth developed as a result of the lack of publication of the innovative work done at the Casa de la Contratación and the Council of the Indies by royal cosmographers and scientific advisors, and other intellectuals. Philip II placed restrictions on authorship, publishing, and sales, controlled access to primary sources that informed map makers, and placed a ban on books that contained information about the conquest and colonization of the New World. Portuondo states: "The censorship policy was formalized on September 21, 1556, prohibiting the printing and sale of any book that dealt with the subject of the Indies before it had been seen or examined by the Council of the Indies. Local authorities were instructed to inform the Council about such books and could be directed to seize them" (105). This secrecy became a legal mandate: "When during the 1570s a legal code *Ordenanzas de Indias* (1571) came into effect that institutionalized cosmographical practice at the Council of the Indies, these standing secrecy and censorship policies limiting the diffusion of historical, geographical, and natural historical information about the New World became law" (107).

The monopoly that the crown had on the flow of cosmographic information prohibited intellectuals from sharing knowledge and making contributions to the broader scientific canon. Even so, the development of a legal code prompted Ovando to conduct a meticulous audit of the "spiritual, financial, and political governance of the Indies" (116). He conducted meticulous interviews with clergymen, businessmen, and colonists and compiled and revised the laws, royal orders, and edicts that had been released since the Age of Exploration began. With this information he produced *Recopilación de leyes de Indias* as a means of meeting the need for cogent laws and a standard cosmographic structure. The legal reformation of Ovando supports Portuondo's contention that the Spanish did develop original methods and paradigms that informed cosmographic practice. Ovando's work also further exemplifies that combination of humanistic and scientific methods that was characteristic of early Spanish cosmography. Likewise, her investigation of the secrecy of Philip II establishes that Spanish were indeed concerned with scientific knowledge production but that it was kept confidential for the protection of the state.

Portuondo reaches her fourth objective, to develop a new narrative within the literature on the Scientific Revolution, by uncovering and analyzing Spanish cosmography projects and their significance to the scientific intellectual tradition of the Renaissance period. The Age of Discovery was a pivotal time in cosmographic history because it signaled a transformation in scientific perspectives and methods in an attempt to understand the New World. According to Portuondo: "Nowhere was the determination to create a framework to explain the reality of the New World more steadfast than in sixteenth-century Spain. Spanish cosmographers brought to their discipline alternative epistemologies and new methodologies that eventually changed how Europeans saw the natural world" (1–2).

Her work is situated in the historic debate Portuondo calls the "polemics of Spanish science." Within this discourse she suggests that contemporary definitions of science place a staunch separation between the hard and social sciences; however the history of Spanish cosmography problematizes this notion of separation. The author also posits that this more stringent definition of science inherently excludes the work of those that combined the hard and social sciences. In order to highlight Spanish scientific traditions she defines science with more fluidity. This allows her to permeate the text with rich examples of the continuity between the hard and social sciences which characterizes a major era in Spanish cosmographic development.

Secret Science is a thoroughly researched and valuable resource that identifies the importance of returning to those progenitors of overseas exploration to really understand the development of cosmography and the origins of the Scientific Revolution. Portuondo presents adequate evidence to support her contention that Spaniards developed important, original, and innovative theories and practical methods in the field of cosmography as a function of their imperial goals. However, it does seem that her sources are reflective of the elite perspective and the voices of the non-elite do not receive as much attention. It would have been very interesting and refreshing, for example, to have included more in-depth discussion about the ways in which commoners (who were experienced sailors and colonists) contributed to the development of navigation books and cosmographies. Nonetheless, *Secret Science* is important in that it debunks the myth of Spanish disinterest in science and helps one to rethink the narrative of the Scientific Revolution through revisiting the Age of Discovery. In doing so it also enforces the notion that historical perceptions of science were more fluid and combined the hard and social sciences. Thus historical scientific methods cannot be judged by the rigid contemporary definitions of science. As Portuondo proves, this could exclude important periods and developments from further insightful analysis and consideration in the scientific canon.

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PEER-REVIEWED ARTICLES

TITLE: The title serves as the author's invitation to a diverse audience. It should be chosen wisely. The title section should include the full name(s) of the author(s) and academic or other professional affiliation(s).

ABSTRACT: An abstract of 250 words or less should summarize the purpose, methods, and major findings of the paper.

KEYWORDS: Five to ten keywords should be listed at the end of the abstract.

REFERENCES: References should be cited parenthetically in the text, following the author-date system found in *The Chicago Manual of Style*, 16th ed. (**chicagomanualofstyle.org**). When making a direct quote, include the page number. Examples: (Doe 2001) and (Doe 2001, 38).

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Robinson, A. H., J. L. Morrison, P. C. Muehrcke, A. J. Kimerling, and S. C. Guptill. 1995. *Elements of Cartography, 6th Edition.* New York: John Wiley & Sons.

Articles in Periodicals: Author's or authors' names as in *Books,* **v**above. Year. "Title of Article." *Title of Periodical,* volume number, page numbers, DOI if available. Follow punctuation and spacing shown in the following example.

Peterson, M. 2008. "Choropleth Google Maps." *Cartographic Perspectives* 60: 80–83. doi: **10.14714/CP60.237**.

Articles in edited volumes: Name of author(s). Year. "Title of Article." In *Title of Edited Volume*, edited by [Editor's or Editors' names, not inverted], page numbers. City of Publication: Publisher's Name.

Danzer, Gerald. 1990. "Bird's-Eye Views of Towns and Cities." In *From Sea Charts to Satellite Images: Interpreting North American History through Maps*, edited by David Buisseret, 143–163. Chicago: University of Chicago Press.

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A Plan of the City of New York and its Environs. P. Andrews, sold by A. Dury in Dukes Court, St. Martins Lane, surveyed by John Montressor, 1775.

E-mail correspondence: E-mail messages may be cited in running text ("In an e-mail message to the author on October 31, 2005, John Doe revealed…") instead of in a note or an in-text citation, and they are rarely listed in a bibliography or reference list.

Additional examples: For additional examples, please consult *The Chicago Manual of Style*, 16th ed. (**chicagomanualofstyle.org**).

DOI NUMBERS: DOI numbers for references must be included whenever available. You can look up DOIs at **www.crossref.org/SimpleTextQuery**.

REFERENCES LIST: The list of references should begin in a separate section, immediately after the text. Entitle the section "References" and list all references alphabetically by the author's last name, then chronologically. Provide full, unabbreviated titles of books and periodicals.

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UNITS OF MEASURE: *Cartographic Perspectives* uses the International System of Units (metric). Other units should be noted in parentheses.

EQUATIONS: Equations should be numbered sequentially and parenthetically on the right-hand edge of the text. If special type styles are required, instructions should be provided in the margin adjoining the first case of usage. Authors should carefully distinguish between capital and lower-case letters, Latin and Greek characters, and letters and numerals.

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