State Atlas Design

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This paper covers principles that were useful, and many times essential, in the design and production of the *Atlas of Oregon, Second Edition* (Loy et al., 2001). Design principles and experience guided the creative process from drafting the table of contents to building the final layouts. Key points covered in this paper include: the development of a table of contents; setting up a network of topic experts; data source/compilation and organizational issues; page layout issues; book design issues; choosing type; data classing and quantitative mapping methods; color schemes; prepress issues; and public reaction.

Introduction

After producing the first edition of the *Atlas of Oregon* in the 1970s, Loy (1980) noted "The primary reason for an *Atlas* project should be to depict the geography of a state with the map being the dominant mode of expression." Through this depiction of geography with its dominance of maps, state *Atlas*es are very well suited to promote geographic understanding and communicate fundamental geographic knowledge. *Atlas*es, having maps integrated with other forms of information (graphs, tables, and text), strive to get to the heart of effective, geographically based communication. The *Atlas of Oregon, Second Edition* (Loy et al., 2001) was designed with this goal in mind. Key design principles and practices guided the *Atlas* creation process from drafting the table of contents to building maps, and final page pair layouts. This paper will explain how these principles and practices shaped the second edition of the *Atlas of Oregon*.

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Background

The *Atlas of Oregon* was first published in 1976, and soon became the authoritative reference on the geography of Oregon (Loy, 1980). Since the mid-1980s, funding for an updated edition of the *Atlas* was sought. This funding goal was realized when the University of Oregon administration proposed a new edition of the *Atlas* to help celebrate the University's 125th anniversary. A group consisting of William Loy in the Department of Geography at the University of Oregon, Allan Cartography of Medford, Oregon, the InfoGraphics Lab in the Geography Department at the University of Oregon, and the newly revived University of Oregon Press came together to produce the new edition of the *Atlas*.

Work on the second edition *Atlas* project began in 1999. It was an advantageous time to start a comprehensive state *Atlas* project because of several factors. First, there was a wealth of digital data on Oregon available to produce the *Atlas*, and cartographic tools available to convert this data into effective graphics. Second, the University of Oregon's 125th celebration served as a catalyst to gain administrative and financial support. Third, the project was embraced at the end of a decade of unprecedented growth in the economy, helping set the stage for the half-million dollar fund raising effort. However, it was bad timing in relationship to the release of the 2000 Census demographic data, which came out after our deadline. In lieu of current census data, we needed to use sur-rogate data sources for some of the demographic topics. For example, for "Race and Ethnicity" we relied on recent school district enrollment data.

Atlas Format and Content

The format of the *Atlas of Oregon, Second Edition* is 9.5 in. wide by 13.25 in. tall, 320 pages, bound in both hard and soft cover. The format shifted from the *First Edition* to a slightly smaller format, book-bound (along the long dimension) rather than album-bound (along the short dimension). This shift was suggested by practical considerations: large format album binding is more costly (it doesn't fit into automated bindery lines) and less durable (the shorter binding is subjected to greater shearing forces). Also, album binding makes for awkward handling. At first, a smaller standard base map scale was anticipated as a cost of this format, since the individual pages of the *Second Edition* were slightly smaller than those of the first edition. However, it was soon realized that modern image-setting and press capabilities allowed excellent cross-gutter registration. By extending the maps across the facing pages, the standard base map scale was increased from 1:2M to 1:1.7M.

In the first edition of the *Atlas*, all page layouts were for single pages, with complete borders and neat lines—thus, the page pairs showed two facing sets of borders and neat lines. This approach was dictated by two conditions at the time: not knowing exactly which pages would prove to be executable, and the small format of the photomechanical equipment used. For the *Second Edition*, all designs were for two-page spreads.

The *Second Edition* contains four sections: Human Geography, The Economy, Physical Geography, and Reference Maps. Human Geography begins with locator sections placing Oregon in the world, followed by a series of reproductions of early maps, then another series of thematic maps showing early exploration of the state. After this stage was set, topical page pairs take the reader through American Indian wars and epidemics, pioneer land acquisition, settlement, and growth. The section concludes with a series of socioeconomic topics, for instance politics, health care, and prisons. The Economy section contains 26 topical page pairs on employment, manufacturing, land use, and infrastructure. The Physical Geography chapter includes maps of landforms, vegetation, and climate. The Reference section includes the most detailed maps in two series, one focusing on population centers (scale 1:150,000) and the other a complete reference map coverage (scale 1:500,000) showing land use classes over shaded relief.

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Table of Contents *Atlas of Oregon, Second Edition*

The table of contents for the second edition of the *Atlas of Oregon* closely followed the original 1976 edition. The greatest differences between the two editions are the deletion of the wildlife maps as the Oregon State University's authoritative 1997 *Atlas of Oregon Wildlife* made those pages unnecessary, and the expansion of the section on urbanization in the reference chapter (Csuti et. al, 1997:12–54). A complete listing of topics follows.

FRONT MATTER: Foreword; The University of Oregon; Acknowledgments; and Introduction.

HUMAN GEOGRAPHY: Oregon in the World; Location; Maps: 1762–1814; Maps: 1838–1859; Indians; Exploration: 1800–1845; Oregon Trail; Epidemics, Wars and Reservations; Donation Land Claims and Public Land Survey; Political Boundaries; Land Grants; Place Names; County Populations; Cities: 1870–1960; Cities: 1970–2000; Historic Portland;

Willamette Valley Population; Population Growth and Density; Age Structure; Immigration; Race and Ethnicity; Income; Religion; Politics; School Districts; Education; Colleges and Universities; Crime and Prisons; Health Care; and Newspapers and Broadcasting.

THE ECONOMY: Economic Sectors; Labor; Public Employment; Taxation and Revenue; Manufacturing; Lumber and Wood Products; High Technology; Business Activity; International Investments; Public Lands; Land Ownership; Zoning; Minerals and Mining; Fisheries; Timber; Farmlands; Cattle and Crops; Crops and Wine; Energy Sources; Energy Distribution; Development of the Road Network; Highway Traffic; Railroads; Public Transportation and Airports; Ports and Trade; and Tourism and Recreation.

PHYSICAL GEOGRAPHY: Landforms: Elevation; Landforms: Shaded Relief (five page pairs); Cross Sections; Ice Age Lakes and Floods; Ice Age Glaciers; Volcanoes; Earthquakes; Landslides; Geology; Geologic Ages; Geologic Evolution; Soil Orders; Soil Suborders; Soil Interpretations; Annual Precipitation; Precipitation and Seasonality; Temperature and Seasonality; Climate Indicators and Change; Rivers; Stream Flow; Lakes; Drainage Basins; Water Quality and Dams; Ecoregions; Biotic Systems; Vegetation; Wildlife Habitat; Wildlife Habitat Detail; and Protected Areas.

REFERENCE MAPS: Population Centers (13 page pairs); Reference (14 page pairs); USGS Quadrangles; Map Index; Gazetteer; Oregon Place Names Essay; Sources; and Index.

Design and Compilation

The first steps in the development of the *Atlas* included drafting a table of contents, initially based on the *First Edition*. This list was influenced by the availability of data sets on relevant topics, and the knowledge and expertise of the current staff. Most topics in the table of contents became two-page spreads, though a few lent themselves to multiple spreads. From the start, the table of contents was a tentative and provisional list. As work proceeded on the *Atlas* the table of contents changed. For example, the quality and richness of the data on Population Growth led to our expanding the coverage from one to three page pairs. Similarly, the availability of detailed 10-meter digital elevation model (DEM) data encouraged us to expand the landforms topic. Conversely, we dropped a few topics because of a lack of usable data, e.g., Threatened and Endangered Species and Wireless Communication.

While every other aspect of the *Atlas of Oregon* production was entirely digital, initial page layouts were manually drawn with felt-tipped pens on butcher and tracing paper. The process proved to be a quick and efficient method of getting initial ideas for each topic into an organized format, and it encouraged a fluid approach to page layout. Neighboring page layouts were easily compared, both as overlays, and as side-by-side, full-size comparisons. These manually drafted mockups served as the guide to compiling data sets and working with potential experts on the topics.

Compilation and Organization

The *Atlas* team was able to develop an extensive network of leading experts in government, academia, and private industry because of Loy's

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long history of atlas and statewide community involvement, and because of the University of Oregon's InfoGraphics Lab's longstanding involvement with state agency mapping projects. The importance of the contributions of participating experts in their fields cannot be overstated. Without those contributions, the *Atlas* would not be nearly the authoritative reference source that it is. The experts helped identify the best way to explain topics and pointed us to the best data sets. They reviewed early drafts of the page pairs and wrote the accompanying text, then often rewrote several versions to accommodate changes to the page content, or changes to the target word count. The *Atlas'* text editor reworked the experts' draft text, insuring a consistent and readable quality to the page pairs both in terms of space considerations on a page, and for syntax and style.

Design Principles

The design principles applicable to any map or book remain basic to a state *Atlas*, but the format involves additional design concerns. Tufte's (1983) information design principles were an important influence. More general graphic design principles helped guide the book and typography design decisions (Williams, 1994). The authors' *Atlas* and map design experience was, of course, fundamental.

The *Atlas of Oregon* paid close attention to several of the design principles laid out by Tufte in *The Visual Display of Quantitative Information* (1983). Examples of Tufte's principles of *graphical excellence and integrity* can be found on nearly every page in the *Atlas*. We tried to make the displays interesting by preparing presentations that communicate the complex nature of a particular subject in a way that was clear, simple, and meaningful to the reader. Much effort went into creating multivariate maps and graphs with a great deal of attention into making the graphics bias-free, well labeled, and contextually appropriate. These representations were designed to reveal spatial patterns of the geographic information at general overview scales, and to show subtle details that allow the user to put his/her nose on the page and see actual data values or detailed feature names. For time-series graphs that contained dollar amounts, the dollar values were adjusted for inflation so that the reader could make useful comparison of historical information. For each page pair layout, diverse forms of page elements—maps, graphs, tables, and copy—were carefully integrated to develop cohesive topic presentations.

The Highway Traffic page pair (Figure 1, see page 77) is one example of the implementation of many of these principles. The purpose of this pair page is to give the reader a clear idea of traffic volume and flow on the state's highways, and how they have changed over time. The page pair contains a 1:2M scale, statewide flow/volume map. The lines are classed and symbolized according to the volume of average daily traffic. The data for this map came from an Oregon Department of Transportation GIS database file. The statewide map of Oregon's flow lines show the overall pattern of traffic in the state, and includes detailed labels informing the reader of the actual values for more precise comparisons. The map is also labeled with city names and highway numbers. The flow alignments are based on detailed highway centerlines so their spatial accuracy is good and the flow information is detailed enough that the reader can identify where significant changes of traffic volume occur, for instance, at a town or a road junction. The page also provides an enlargement of the Portland metro area, which is difficult to show at a state scale. Multiple small line graphs give a detailed picture of the volume percent increase over the last 40 years at 22 locations keyed to the maps. The graphs all chart percent-

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ages of change instead of volume, making them easy to compare, and list volume and change rate for 1959 and 1998. An overview graph containing total vehicle miles and vehicle miles traveled per capita is included to help complete the story. The line showing vehicle miles per capita helps give context to the total miles by factoring in population change. A short discussion helps guide the user through the map and graphs. The page pair presents a very extensive transportation dataset in an easily readable form. It can be briefly perused to see general patterns throughout the state, or it can be studied in detail as a reference to compare traffic numbers between locations and over time.

A fundamental change since the production of the *First Edition*—one that is so dominant that many cartographers take it for granted and hardly notice it—is the rise of both GIS technology and GIS data sets. This change accentuates the design challenge of balancing the desire for more data detail while maintaining simple, easily understood maps. In 1976, inked maps were laboriously copied and then generalized for peelcoat color production methods, resulting in over-generalized summaries. Such generalization was an unavoidable necessity of the production technology of the time. For the *Second Edition*, the availability of GIS technology and spatial data enabled us to show extremely intricate detail, for instance, down to the quarter-section level even at 1:3M scale on land-ownership maps, producing more compelling displays (Figure 2, see page 78). The cartographic challenge shifted from production limitations to design issues.

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Reference Information and the Virtues of Repetition

The inevitable overlay of successive thematic treatments over the same state base map threatens to make any state *Atlas* boring, no matter how well executed the individual pages are. On the other hand, that same repetition allows the cartographer to presume a depth of background reference that cannot be taken for granted in a single map. Thus, it is no longer essential to name all significant rivers and lakes on every base, when several page pairs are devoted specifically to these features. Highway shields and numbers, an astonishingly time-consuming item of cartographic production and often an intractable design problem, can be blithely disregarded on many maps in which roads are a useful but secondary reference. Built-up area tints may stand in for unnamed towns, reducing type clutter with minimal loss (or even gain) of comprehensibility. And very fine type, or light gray type, may be used much more freely than would be advisable on a stand-alone map.

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Another variation on the virtues of repetition is the *Atlas'* complete 1:500,000 reference map series (Figure 3, see page 79) in 24 pages, and the 54 additional pages at 1:150,000 (Figure 4, see page 79), covering nearly all the cities and towns in the state. Two scales are better than one; we had much greater design freedom for each of these series because the other was there. Reference maps at 1:500,000 could use bolder colors, broader strokes, less comprehensive (and therefore cleaner) type compilation, while the 1:150,000 series relies on subtler color and finer type, and enjoys the freedom of cropping to optimize page layout, without the need to include all of any particular outlying area since it was already covered in the smaller scale reference maps.

These advantages of repetition are important—and liberating to the cartographic designer—but the risk of descending into boredom is significant. The goal of optimal page design poses the danger of an essentially static sequence of pages. Our initial page layout sought to avoid that by continually comparing all neighboring pages, shifting the position of

major page elements within the framework of two basic column configu-rations (two and three columns per page) and a few frequently-used state scales. We used inset maps and graphs liberally to break up the potential monotony of the state base, and varied both scale and style within a single page pair (Figure 5, see page 80). For instance, Health Care includes a small United States state choropleth map, six Oregon county choropleth maps at two scales, two Oregon proportional symbol maps at two scales, two bar charts, two graphs, and a table. The Health Care page pair is an extreme example, and purists might argue that it descends into design cacophony. On the other hand, the reader is certainly aware that this is a new subject, with its own distinct issues.

Data Classification

In early drafts of choropleth maps, the method of natural breaks, a data-classing option in ESRI ArcView GIS software, was used. However, the technique resulted in confusing and counterintuitive class breaks that conflicted with our goal to create an easily understood publication for a general audience. Instead, we used equal-interval class breaks, with the addition of "less than" and "more than" classes when needed. In some cases, where mapping a data set did not lend itself to equal intervals, a variation was applied with generally recognizable benchmark values (for instance 25, 50, 100) as class limits.

Use of Color

Atlas color, like page layout, must be treated with one eye toward overall book design and the other to the dangers of overuse. There are *Atlas of Oregon* pages built with what many may regard as ugly colors. Ugly is in the eye of the beholder, of course. Functionally, these pages may be described as not the same old comfortable colors, and that is a significant virtue in a 320-page book. For instance, on the Immigration page pair there was a need to display 15 distinct, qualitative categories. A few of the colors that were used disrupt the overall color balance and harmony of the page, but it succeeded in making all the categories distinct, keeping the page readable and, we hope, interesting.

A variety of sequential and divergent color schemes (Brewer, 1994) were employed for the *Atlas'* quantitative maps. Many maps relied on a sequential scheme, increasing value within a single hue to communicate quantity, for instance, *Percentage of Employment Rates* on the Labor page pair. A divergent red-blue scheme was used to symbolize the *Presidential Elections, 1928–2000,* small multiple series with the midpoint data value at 50% for the *Percentage of Two-Party Votes*, showing, in effect, the winning party in each county. On the isometric *Average Annual Precipitation* map (Figure 6, see page 81), an asymmetrical variation on the divergent scheme with a hue and value transition (orange to purple to black) was applied. The scheme is asymmetrical because it adds more classes above the divergent midpoint, the state's average precipitation, because of the wider range of wetter values. Black was used here, and on the *Population Density* map, to emphasize the extreme upper end of the range. The *Atlas* project had the benefit of using the proven and popular *Raven Maps* elevation tint color scheme for the Landforms, Elevation, Landslides, and the Early Exploration maps, among others.

Many maps and graphs were designed with no color fill—that is, white—to enhance the legibility of color point symbols and fine type. To establish figure-ground on these page pairs, a light background tint was

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applied. Ideally, such a background tint would be applied as a fifth spot ink. To hold down costs, we built the background tint from CMY. That placed unreasonably tight demands on ink fountain controls on the press, and we sometimes had perceptible color shifts in the background tint across page pairs.

Book Design

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A book is not merely a collection of pages, but an assemblage of like parts and subparts with attention to the flow throughout. The first decisions to be made were with the subparts—the page grids. We chose to use two- and three-column layouts. All pages stayed within the grid, save the opening spread, "Oregon in the World." The *Atlas* was divided into four chapters, each with a subtle yet unifying color tab-line underling each page title. Sections were separated by simple divider pages, which were aligned with the elements on the title pages. Flow was maintained by adhering to the two- or three-column grid, with no bleed and no distracting flourishes. All pages have strong structure because of the close attention paid to the alignment of page elements. Unlike newspapers and most magazines, the *Atlas* used white space freely. The white space helps keep the pages from feeling crowded. Common page elements are thoughtfully grouped to let the white space flow well through each design, helping to organize the "sometimes overloaded" layouts.

Typography

Early in the design of the book, we decided to use a classic look, and minimize the use of flashy graphics. The *Atlas of Oregon* would try to look more like an authoritative, even staid, reference work that has a timeless quality. One of the early decisions to be made was the choice of typefaces. There would be latitude for the maps, but the text needed to be consistent throughout the *Atlas*. Heads, subheads, body copy, and sidebars needed to have both harmony and contrast. For contrast, serif and sans serif typefaces needed to be chosen. For harmony, differing weights of the same typeface would be used.

The first edition of the *Atlas of Oregon* set heads in Century and body copy set in Ronaldson. Some charts and graphs used Univers for the sans serif typeface. The look was au courant for the time, but there was a decided lack of contrast between the heads and the text. In the *Second Edition,* contrast would be provided by choosing a serif face for text, heads, and page titles, while choosing a sans serif face for sidebars, graphs, charts, lists, and titles of individual elements on the page. Though not unimportant, the sans serif face was intended to be relatively clear and flavorless. Frutiger, the chosen sans serif face, has a bit more color and flavor than Helvetica or Trade Gothic, but its readability and elegance exceed theirs. We are fairly certain that in 25 years, the authors of the *Third Edition* will consider Frutiger to have been au courant for the time.

In the first edition of the *Atlas*, the maps and text shared nearly equal status. With the changes brought on by the conversion from manual to digital production, the maps for the second edition would gain dominance over the text. The text became subordinate, while the maps, charts, graphs, and tables carried the message. We needed a delicate, classic typeface that would be very readable but not conflict with the more dominant graphics on each layout. A serif face seemed necessary for the text—and thus heads and subheads—to lend a feel and look of classic book design. The typeface needed to be light, to compliment, not dominate, the maps and graphics.

An oldstyle face was preferred. Berkeley Light was chosen for the text because of its nearly diaphanous elegance. Then, Berkeley Bold was a complimentary use for the heads and subheads, as well as the titles for the page pair topics.

Prepress and printing

As most pre-press departments prefer not to work with native files, final FreeHand files were saved as EPS, then placed in QuarkXPress pages. To streamline the work flow, all *Atlas* pages except front matter, chapter dividers, and index pages were prepared as single XPress documents, and prints were made from these XPress files. The final deliverables sent to the printer for each page included (except as noted above) a one-page XPress document, a placed EPS file, and a print of the page. The printer returned a series of color proofs for review and final sign-off.

Public Reaction

Soon after the second edition of the *Atlas* was released it received positive reviews. Book sales were brisk—within the first six months the *Atlas* was in its second printing. Readers and reviewers were pleased by the unexpected amount of thematic information:

> "The best book on Oregon…This new *Atlas* is much more than a gallery of artful maps. It's an incredibly detailed and wonderfully accessible look at Oregon's human, economic and physical geography."
>
> *Jonathan Nicholas,"PDXtra" columnist*
> The Oregonian*, Portland, October 12, 2001*

> "There's no better snapshot of Oregon in 2001, and none more beautiful…So much information, so intelligently presented…"
>
> *The Best Books of 2001*
> The Oregonian*, Portland, December 30, 2001*

In addition to reference maps, the *Atlas of Oregon* also displays a wide range of topics including where the high traffic flow is and how it has changed over time, where the earthquake epicenters were, where the wettest places in the state are, and, with a graph going back to the 1870s, why there is an endangered salmon problem. Thousands of coffee tables in Oregon became geographic reference centers, sources that encouraged the understanding of Oregon's diverse geography.

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CONCLUSION

Designing and producing the *Atlas of Oregon* was a long and complex process that began by thinking about potential geographic topics and how they might best be represented. The lengthy process involved the crucial steps of establishing a network of topic experts, the compilation and definition of page pairs, followed by the design of page layouts, maps, and other page elements. Several established design principles, along with the extensive experience of the *Atlas* team, guided the development of the final designs.

express our gratitude to Bill Loy, whose determination and leadership on the *Atlas* was an inspiration, and a necessity for the completion of the project.

The key members of the *Atlas* team included Bill Loy as director; Stuart Allan as co-author and cartographic editor; Aileen R. Buckley (previously Assistant Professor in Geography at the University of Oregon) and InfoGraphics Lab Director James E. Meacham as co-authors; Allan Cartography Production Manager Lawrence J. Andreas and retired Geography Professor Gene E. Martin as contributing editors; and University of Oregon Science Writer Ross West as text editor. The *Atlas* team also included several Allan Cartography cartographers and University of Oregon InfoGraphics Lab staff and students.

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