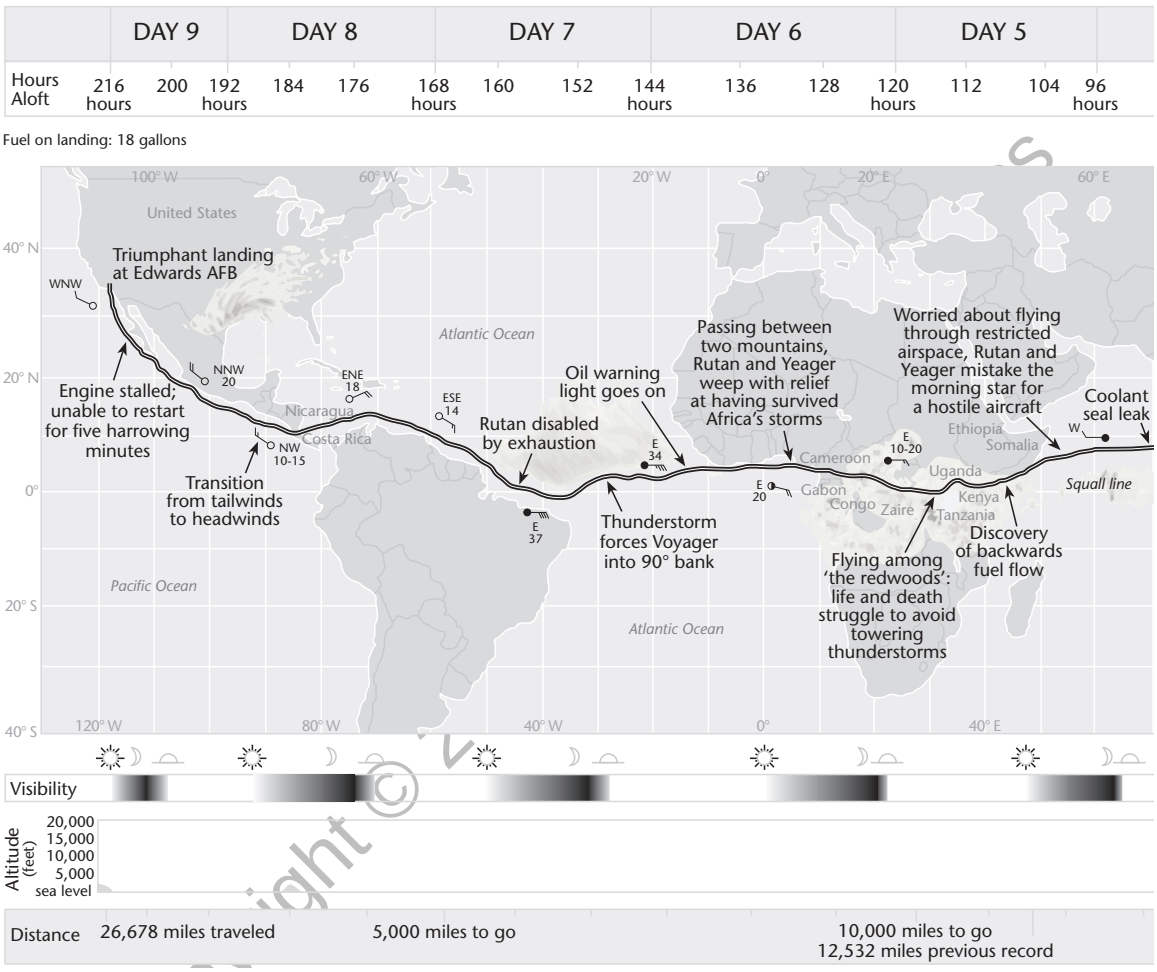
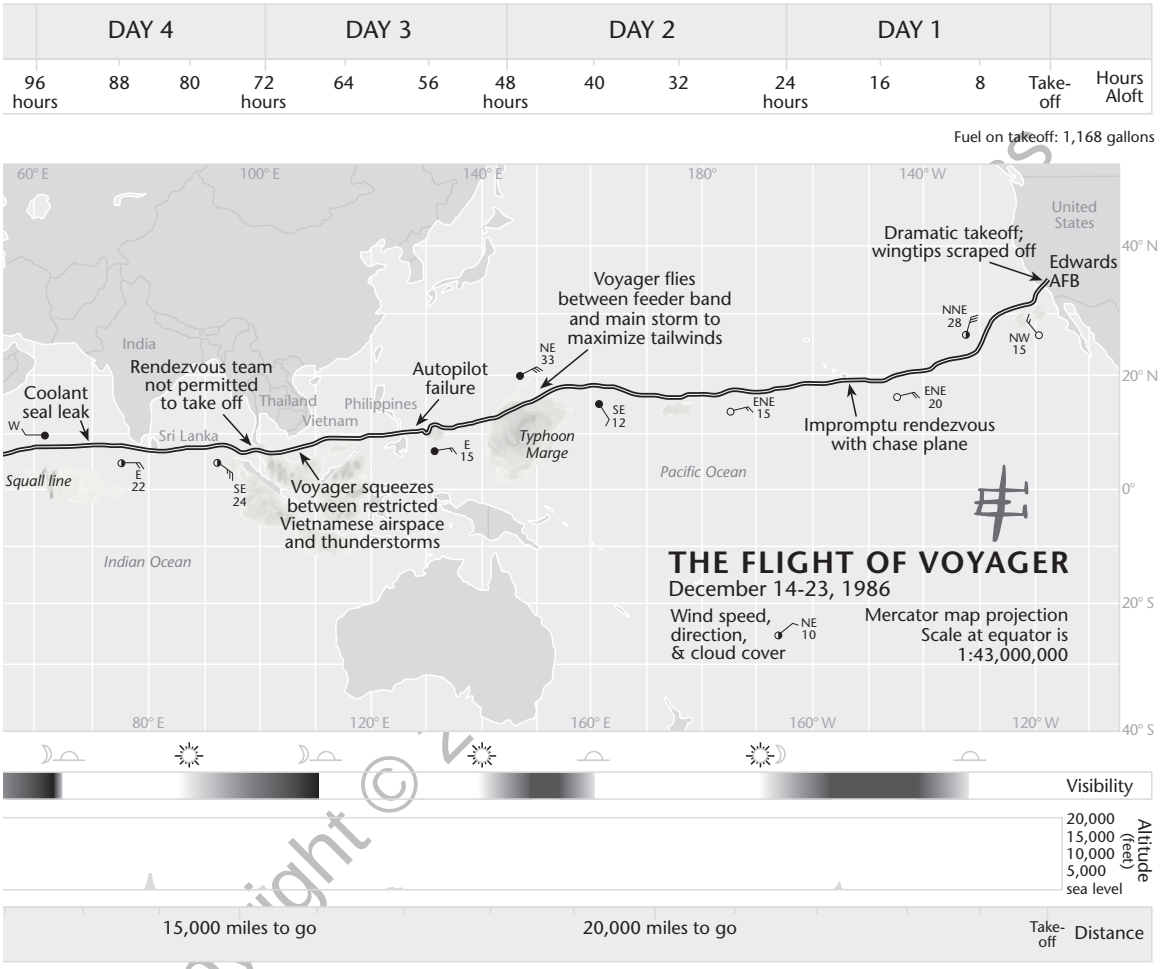
This is a chapter excerpt from Guilford Publications. *Making Maps: A Visual Guide to Map Design for GIS, Second Edition.*
By John Krygier and Denis Wood. Copyright © 2011. Purchase this book now: www.guilford.com/p/krygier

In December 1986 an experimental aircraft named Voyager became the first piloted aircraft to circle the earth without refueling.



Flight data courtesy of Len Snellman and Larry Burch, Voyager meteorologists
Mapped by David DiBiase and John Krygier, Department of Geography, University of Wisconsin-Madison, 1987



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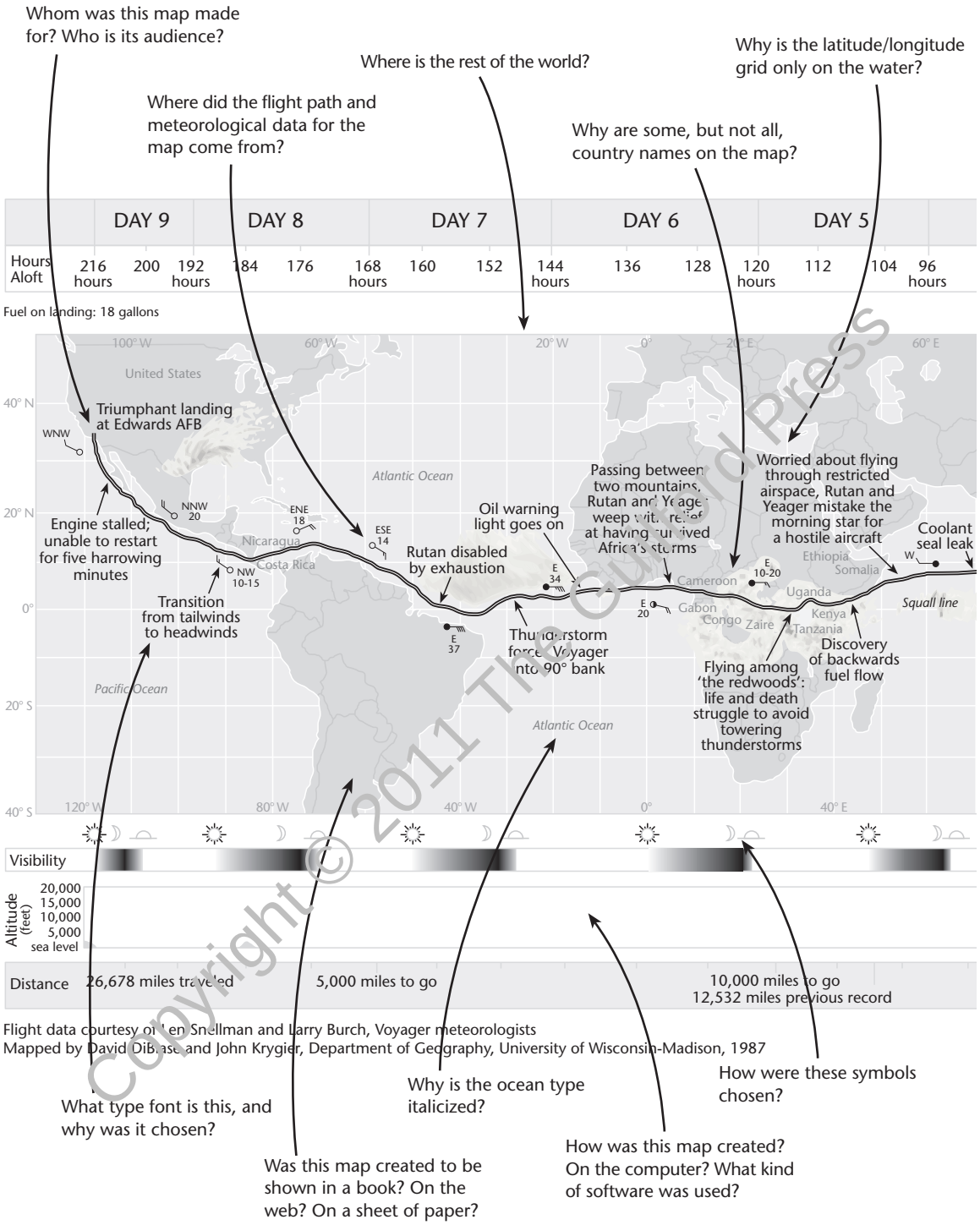
What do you need to know to make this map?



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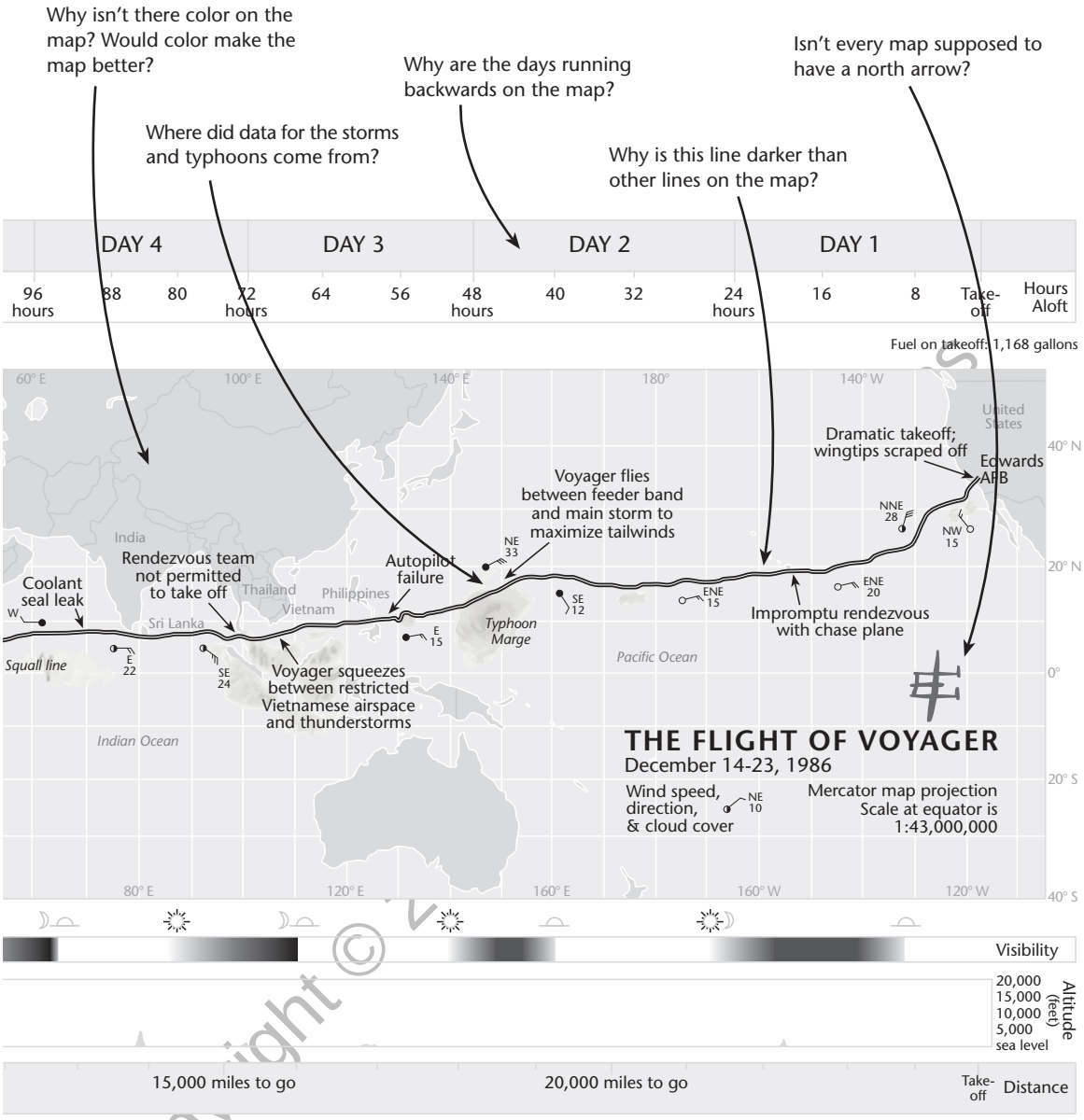

Voyager pilots: Dick Rutan and Jeana Yeager
Voyager designer: Burt Rutan

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CHAPTER 1

How to Make a Map

Start by looking; what do you see? Looking at maps is easy. Not really. You can glance at the Mona Lisa in a second. But to *get* the Mona Lisa you have to look more carefully. What do you see on the Voyager map? Words, lines, continents, a grid. A story, some information with the story. What do you notice first? Black lines, gray lines, white lines ... why are they different? Making maps requires that you answer such questions, and many more. Throughout this book, in nearly every chapter, we annotate *The Flight of Voyager.* By the end of the book, you will understand how to really see – and make – a map.

Making Maps is Hard

Whether looking at or making maps, there is a lot to see, think about, and do. Throughout this book, myriad subjects are considered in general and in relation to *The Flight of Voyager* map. A systematic critique of an existing map or the successful making of your own map is accomplished by considering the following issues. When making maps, think about everything before starting; then, when your map is complete, reconsider them all once again.

The Whole Map

Write out exactly what the map is supposed to accomplish: does the map meet its goals?

Are you sure a map is necessary?

Is the map suitable for the intended audience? Will the audience be confused, bored, interested, or informed?

Look at the map in its final medium: does it work? Has the potential of a black-and-white or color design been reached?

Is the map, its authors, its data, and any other relevant information documented and accessible to the map reader?

Look at the map and assess what you see; is it:

confusing or clear
interesting or boring
lopsided or balanced
amorphous or structured
light or dark
neat or sloppy
fragmented or coherent
constrained or lavish
crude or elegant
random or ordered
modern or traditional
hard or soft
crowded or empty
bold or timid
tentative or finished
free or bounded
subtle or blatant
flexible or rigid
high or low contrast
authoritative or unauthoratative
complex or simple
appropriate or inappropriate

Given the goals of the map, are any of these impressions inappropriate?

The Map's Data

Do the data serve the goals of the map?

Is the relationship between the data and the phenomena they are based on clear?

Does the map symbolization reflect the character of the phenomena or the character of the data?

Does the origin of the data – primary, secondary, tertiary – have any implications?

Are the data too generalized or too complex, given the map's goals ?

Is the map maker's interpretation of the data sound?

Are qualitative and quantitative characteristics of the data effectively symbolized?

Have the data been properly derived?

Has the temporal character of the data been properly understood and symbolized?

Is the scale of the map (and inset) adequate, given the goals of the map?

What about the accuracy of the data? Are the facts complete? Are things where they should be? Does detail vary? When were the data collected? Are they from a trustworthy source?

Have you consulted metadata (data about data)?

Does the map maker document copyright issues related to the data?

Is the map copyright or copyleft licensed?

The Map's Framework

What are the characteristics of the map's projection, and is it appropriate for the data and map goals? What is distorted?

Is the coordinate system appropriate and noted on the map?

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The Design of the Map

Does the title indicate what, when, and where?

Is the scale of the map appropriate for the data and the map goals? Is the scale indicated?

Does textual explanation or discussion on the map enhance its effectiveness?

Does the legend include symbols that are not self-explanatory?

If the orientation of the map is not obvious, is a directional indicator included?

Are authorship and date of map indicated?

Are inset and locator maps appropriate?

Is the goal of the map promoted by its visual arrangement, engaging path, visual center, balance, symmetry, sight-lines, and the grid?

Has the map been thoroughly edited?

Does the map contain non data ink?

Has detail been added to clarify?

Do the data merit a map?

Do variations in design reflect variations in the data?

Is the context of the map and its data clear?

Are there additional variables of data that would clarify the goals of the map?

Do visual differences on the map reflect data differences?

Do important data stand out as figure, and the less important as ground, on the map? Are there consequences of data not included on the map?

Have visual difference, detail, edges, texture, layering, shape and size, closure, proximity, simplicity, direction, familiarity, and color been used to reflect figure-ground relationships appropriate to the map's goals?

Are the level of generalization and the data classification appropriate, given the map's goals?

Do map symbols work by resemblance, relationship, convention, difference, standardization, or unconvention? Are the choices optimal for the map's goals?

How do the map symbols relate to the concepts they stand for? Is the relationship meaningful?

Have the map symbols been chosen to reflect the guidelines suggested by the visual variables?

If symbolizing data aggregated in areas, is the most appropriate method used? How will the choice affect the interpretation of the map?

What do the words on your map mean? How do they shape the meaning of the map?

Has the chosen typeface (font) and its size, weight, and form effectively shaped the overall impression of the map as well as helping to symbolize variations in the data?

Does the arrangement of type on the map clarify, as much as possible, the data and the goals of the map?

Do color choice and variation reflect data choice and variation on the map?

Is color necessary for the map to be successful? Does color add anything besides decoration?

Do color choices grab viewer's attention while being appropriate for your data?

Does the map's design reflect the conditions under which it will be viewed?

Are color interactions and perceptual differences among your audience accounted for?

Have symbolic and cultural color conventions been taken into account and used to enhance the goals of the map?

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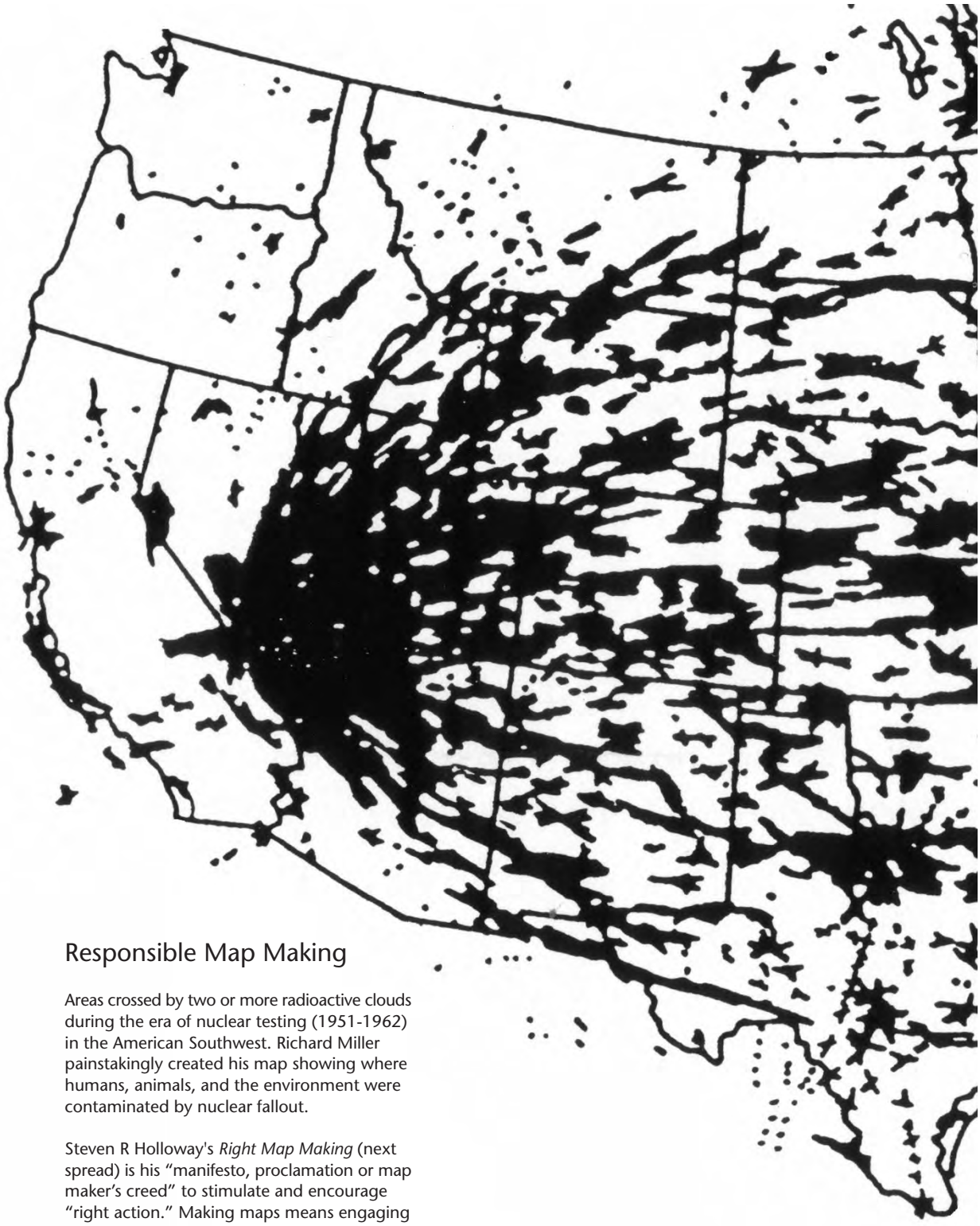

Responsible Map Making

Areas crossed by two or more radioactive clouds during the era of nuclear testing (1951-1962) in the American Southwest. Richard Miller painstakingly created his map showing where humans, animals, and the environment were contaminated by nuclear fallout.

Steven R Holloway's *Right Map Making* (next spread) is his "manifesto, proclamation or map maker's creed" to stimulate and encourage "right action." Making maps means engaging your mind and your heart. Develop an ethics of map making, however you may define it. The maps you make make a difference.

Right Map Making

"The most obvious characteristic of our age is its destructiveness." TH. MERTON

THE PROBLEM *for the maker of maps being that our maps are, in part, engaged in the active and wanton destruction of the world.*

Thus AWAKENED, *we* VOW *to take right effort & engage in cartographic disobedience, map making "for a future to be possible."* T. N. HANH *Unacceptable it is not to* ACT.

Five Ways to MAKE MAPS for a Future to be Possible

REVERENCE; *the first precept of right map making*

From the awareness that our maps are, in part, responsible for the great and unnecessary destruction of life taking place in the world today. We vow to map and comment on spatial relationships in a manner non-harming, with reverence and with respect, and to reflect and reveal the beauty of life in a manner non-objectified, where the economic, the non-economic, and the unseen elements are given voice. We vow to recognize and incorporate story with the arguments on our maps. In agreement with M. Gandhi, *"first... non-cooperation with everything humiliating,"* we vow to refrain from economicism, the objectification of sentient beings, and cartographic pornography. Such mapping and maps reflect agreement with the first principle of right action: REVERENCE.

THE PRACTICE OF GENEROSITY; *the Second precept*

From the awareness that our maps are, too often, in our self-interest, greedy consumptions of endless desire, human biased and nationalistic. We vow to engage in a mapping of that which desires to be mapped and shared, not taking that into map form that which does not belong to us; desiring to remain unmapped. We vow to be generous to all sentient beings on our maps and in our mapping. Where generosity is also the courage to leave blank on the page that which does not belong to us, not mapping to take what is not ours, and honoring the sancity of the commons. Leviticus: *"fields are not to be reaped to the border."* Such mapping and maps show agreement with the second principle of right action: GENEROSITY.

COMMITMENT TO THE RELATIONSHIP WITH THE PLACE; *the third precept*

From the awareness that our maps are, in part, reflective of a lack of relationship and commitment to the place in which we reside and map. We vow to resist the temptation to map places with which we have no intimate or committed relation. We seek to remember and honor our relationship to the place; mapping with an honesty of lines, colours and shapes, the naming of places, the unnaming as well, without gossip or intent to harm, or to divide, but rather with a clarity of intent to all sentient beings with whom we are committed to with & in the relationship. Such mapping and maps show agreement with the third principle of right action: COMMITMENT TO THE RELATIONSHIP WITH THE PLACE.

DEEP LISTENING THROUGH DIRECT ~ CONTACT & STOPPING; *the fourth precept*

From the awareness that our maps are, in part, a failure to deeply listen and have been made without stopping to directly contact and listen to the place we are mapping. We vow to refrain from mapping what we do not know to be the truth, to first stop to experience the interconnected, ever-changing and interwoven space we are privileged to map. These maps acknowledge the intimate Other, the desire for the awakened heart and mind with & in direct contact with the place itSelf. Such mapping and maps show agreement with the fourth principle of right speech: DEEP LISTENING THROUGH DIRECT-CONTACT AND STOPPING.

ON BELONGING TO ONE BODY; *the fifth precept for a future to be possible*

From the awareness that our maps are, in part, disconnected from the body of the earth. How can this be? Kabir says, *"Whose Body is it anyway?"* We vow to make our maps about the body living; our own body, the body in motion, ever-changing and interconnected, the body free from addiction and enslavement to the toxicity of drugs: ownership, objectification, disconnection, greed, capitalism, all the *isms*. We vow to map that delight in the body that serves to reduce suffering and misery. Maps, and the making of maps that respect all sentient beings; the living breathing air, the changing clouds, and the wind and the tides in motion, the soils, the interwoven rocks, the waterways and the water bodies entwined & circling, mountains rising & falling, compost building. Maps respecting and awakened to belonging to the OneBody without separation. Such mapping and maps show agreement with the fifth principle, oikos as the ecologic, economic and ecumenical whole of right livelihood: BELONGING TO ONE BODY.

Who died and made you the map police?

Jill, *Home Improvement* (1991)

For the execution of the voyage to the Indies, I did not make use of intelligence, mathematics or maps.

Christopher Columbus, *Book of Prophecies* (15th century)

I presume you have reference to a map I had in my room with some X's on it. I have no automobile. I have no means of conveyance. I have to walk from where I am going most of the time. I had my applications with the Texas Employment Commission. They furnished me names and addresses of places that had openings like I might fill, and neighborhood people had furnished me information on jobs I might get.... I was seeking a job, and I would put these markings on this map so I could plan my itinerary around with less walking. Each one of these X's represented a place where I went and interviewed for a job.... You can check each one of them out if you want to.... The X on the intersection of Elm and Houston is the location of the Texas School Book Depository. I did go there and interview for a job. In fact, I got the job there. That is all the map amounts to.

Lee Harvey Oswald, *Interrogation after Kennedy assassination* (November 24, 1963)

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More...

The blog for this book, makingmaps.net, contains a curious collection of materials on maps and mapping and serves as an extension of this book. Check out cartotalk.com, a great discussion forum about maps and map design chock-full of cool map people.

Engage your *thinking* about maps: Jeremy Crampton, *Mapping: A Critical Introduction to Cartography and GIS* (Wiley-Blackwell, 2010); Brian Harley, *The New Nature of Maps* (Johns Hopkins University Press, 2002); Alan MacEachren, *How Maps Work* (Guilford Press, 2004); Mark Monmonier, *How to Lie with Maps* (University of Chicago Press, 1996); and Denis Wood, *Rethinking the Power of Maps* (Guilford Press, 2010). For a terrific overview of the diversity of maps througout history, see Brian Harley and David Woodward's multi-volume *History of Cartography* (1987-date, University of Chicago Press) series. Tony Campbell's website www.maphistory.info is a tremendous resource for the history of mapping.

This book, like all books, draws from numerous other texts, old and new, that can be consulted for more information than you'll ever want or need: R.W. Anson and F.J. Ormeling (eds.), *Basic Cartography* (International Cartographic Association, 1984); Borden Dent, Jeff Torguson, and Thomas Hodler, *Cartography: Thematic Map Design* (McGraw-Hill, 2008); J.S. Keates, *Cartographic Design and Production* (Wiley, 1973); Menno-Jan Kraak and F.J. Ormeling, *Cartography: Visualization of Spatial Data* (Longman, 1996); Juliana Muehrcke, A. Jon Kimerling, Aileen Buckley, and Phillip Muehrcke, *Map Use: Reading and Analysis* (ESRI Press, 2009); Arthur Robinson, Joel Morrison, Phillip Muehrcke, and A. Jon Kimerling, *Elements of Cartography* (Wiley, 1995); Erwin Raisz, *General Cartography* (McGraw-Hill, 1938) and *Principles of Cartography* (McGraw-Hill, 1962); Terry Slocum, Robert McMaster, Fritz Kessler, and Hugh Howard, *Thematic Cartography and Geovisualization* (Prentice Hall, 2008); and Judith Tyner, *Principles of Map Design* (Guilford Press, 2010). These folks *are* the "map police."

Check out the journal *Cartographic Perspectives* and the North American Cartographic Information Society (nacis.org), the journal *Cartographica* and the Canadian Cartographic Association (cca-aac.org), the *Cartographic Journal* and the British Cartographic Society (www.cartography.org.uk), and the International Cartographic Association (icaci.org).

Sources: Richard Miller, "Areas crossed by two or more radioactive clouds during the era of nuclear testing in the American Southwest, 1951-62" in *Under the Cloud: The Decades of Nuclear Testing* (Two-Sixty Press, 1999), between chapters 4 and 5. "Right MAP Making" copyright 2007 by Steven R Holloway. Designed and produced by toMake.com Press. "Right MAP Making" is intended to articulate the fundamental principles of ethical conduct in mapping and maps and to stimulate "right action." Set in Operina and Dante and printed from a freely distributed digital file. Forty letterpress copies are signed and numbered by the author. Editioned on the occasion of the 2007 Pecha Kucha of the North American Cartographic Information Society.

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