INVENTING WOMEN

SCIENCE, TECHNOLOGY AND GENDER

Edited by Gill Kirkup and Laurie Smith Keller

INVENTING WOMEN

SCIENCE, TECHNOLOGY AND GENDER

Edited by Gill Kirkup and Laurie Smith Keller

POLITY PRESS in association with The Open University

First published in the United Kingdom by Polity Press
in association with Blackwell Publishers Ltd and The Open University.
Reprinted 1998

Editorial office:
Polity Press
65 Bridge Street
Cambridge CB2 1UR, UK

Marketing and production:
Blackwell Publishers Ltd
108 Cowley Road
Oxford OX4 1JF, UK

Published in the USA by
Blackwell Publishers Inc.
350 Main Street
Malden MA 02148, USA

Edited and designed by The Open University.

ISBN 0–7456–0977–5
ISBN 0–7456–0978–3 (pbk)

A CIP catalogue record for this book is available from the British Library and has been applied for from the Library of Congress.

Typeset in 10 on 12 pt Palatino
by Photo·graphics, Honiton, Devon
Printed in Great Britain by TJ International, Padstow, Cornwall

This book is printed on acid-free paper.


INVENTING
WOMEN
SCIENCE, TECHNOLOGY
AND GENDER

This book is the third in a series of four published by Polity Press in association with The Open University. The complete list is:

Knowing Women: Feminism and Knowledge
edited by Helen Crowley and Susan Himmelweit

Defining Women: Social Institutions and Gender Divisions
edited by Linda McDowell and Rosemary Pringle

Inventing Women: Science, Technology and Gender
edited by Gill Kirkup and Laurie Smith Keller

Imagining Women: Cultural Representations and Gender
edited by Frances Bonner, Lizbeth Goodman, Richard Allen, Linda Janes and Catherine King

The books are one component of the Open University course *U207 Issues in Women's Studies*. Details of the course are available from the Central Enquiry Service, The Open University, PO Box 200, Milton Keynes MK7 2YZ. Telephone: 0908 653078.

The Open University U207 *Issues in Women's Studies* Course Production Team

Amanda Willett, Barbara Hodgson, Catherine King (Chair), Diana Gittins, Dinah Birch, Felicity Edholm, Fiona Harris, Frances Bonner, Gill Kirkup, Harry Dodd, Helen Crowley, Joan Mason, Judy Lown, Kathryn Woodward, Laurie Smith Keller, Linda Janes, Linda McDowell, Lizbeth Goodman, Maggie Riley, Maureen Adams, Meg Sheffield, Melanie Bayley, Randhir Auluck, Richard Allen, Rosemary Pringle, Siân Lewis, Susan Crosbie, Susan Himmelweit, Susan Khin Zaw, Tony Coulson, Veronica Beechey, Wendy Webster

External Assessor: Elizabeth Wilson, Professor of Policy Studies, Polytechnic of North London

Cover illustration by Christine Tacq

CONTENTS

INTRODUCTION

Technology touches us all, in every aspect of our lives. Every artefact we make or touch or use is the product of technology; most foods have been processed by some form of technology; even raw food is grown, harvested and transported by technological means. Yet how that touch feels – how we use technology, what technologies we think appropriate, whether a particular technology brings benefits or burdens, and to whom, whether it is useful or out of reach – is very much influenced by who we are: what gender, class and race we are and where we live.

Since the seventeenth and particularly the eighteenth centuries in the West, science has contributed increasingly to technology and technology has demanded answers from science. This has had a particular influence on science – how it is perceived, how it is carried out, by whom and why, and who pays for it and to whose benefit.

The aim of this book is to introduce students of women's studies to some of the most important areas of debate of women's studies scholars in the fields of science and technology. The articles selected have been chosen, as far as possible, for their accessible style as well as their content. There is still a mystique around scientific and technological material, and an expectation that women will find it hard to understand; we hope to demonstrate that when it is written by women's studies scholars this is not true.

Compared with the numbers of women's studies books that have been published in the fields of arts and social sciences, there have been relatively few in science and technology. One of the first edited collections to make feminist debates about science accessible to an interdisciplinary women's studies audience was *Alice through the Microscope*, edited by the Brighton Women and Science Group (1980). Since then the number of edited collections which have dealt with the wide range of issues to do with gender and science and technology has been small. Jan Zimmerman's *The Technological Woman* (1983), Joan Rothschild's *Machina Ex Dea* (1983), Wendy Faulkner's and Eric Arnold's *Smothered by Invention* (1985) and Cheris Kramarae's *Technology and Women's Voices* (1988) are well worth reading alongside this collection.

In this volume we have tried to present a wide variety of voices and informed comment about science and technology with particular reference to their influence on us according to our gender, but also with reference to race, class and place. We have sought to include those who 'make' science and technology: a woman who is a Nobel laureate, a working-class Jewish woman who became an important scientist at a time when science was virtually closed to women, and an Indian woman, Sarin, engaged in helping rural poor women to lighten their crushing burden of work and ameliorate the effects of deforestation. We have included military technology, household technology, medical science, but also Third World technology and appropriate technology.

All these voices speak from different experiences of life and in different styles. Most speak in prose and non-fiction, but some speak in poetry and one speaks in fiction of a vision of a Third World woman's science and technology. We consider this diversity to be an especial strength of this volume and have sought, in our editing, to maintain the styles of these different voices.

There are themes that run, like bright threads, through the book. Science, mostly done by men, seeks to define women in particular ways; not surprisingly, these definitions are often selective in the 'facts' they use and support cultural notions of male superiority and dominance/female inferiority and submission. Women, of whatever class, race, caste and in whatever part of the world, are deeply affected by technology, yet they are often the last to benefit, if at all. Often a technology which benefits men and affects work typically undertaken by men will not benefit the women at all, and it is not unusual to find that some technologies add to the burdens of women rather than relieve them. Whether a particular technology is done primarily by men or women almost always depends upon where that technology fits into pre-existing cultural notions of what is appropriate to each gender. Women can be and are excluded from certain technologies for a variety of reasons and rationalizations: women are thought to 'lack' such characteristics as bodily strength or intellectual capacity; certain activities may be thought to threaten the moral welfare of women; other activities are seen as threatening a woman's 'natural role'; women have less access to education, tend to be less experienced and less assertive until they gain experience and training (a Catch-22 if ever there was one!); education and training may be unfriendly. How men and women approach the same technology, and the reasons for their approaches, may also differ greatly.

The first chapter introduces the topic of what science is and what technology is. It attempts to draw some distinctions between the two – now so closely associated with each other in the West

that we have difficulty knowing where one stops and the other starts – and to place them in a general historical and social context. Once the general context is established, science and technology are then viewed in relation to gender. This relationship with gender is two-way: science and technology assume certain things about gender, and notions about gender affect science and technology. The question is asked: can feminist illuminations of gender affect science and technology – for the better?

Chapter 2 focuses more specifically on the relationship between science and gender at the physiological, anthropological, medical and genetic levels. Science defines biological sex (and sex defines gender), but the definition of sex is more complex and less straightforward than we may imagine at first glance. The definition of gender and the anthropological evidence for and against the 'natural' gender division of labour is also examined. Being defined as female places one in a particular category as medicine uses the scientific definition of biological sex to set a model of female illness and health against a male 'norm'. Aspects of the female experience have been taken over and defined as needing medical supervision. This has extended to the role of women as the bearers of children. Medicalization of the female role of gestation has expanded to include the detection of foetal genetic disease, but the techniques used and the outcomes of various tests are neither ethically nor emotionally straightforward. We become engaged with the conflict between a desire for health and perfection and a partial rejection of at least some of the logical outcomes of prenatal screening at both broadly social and very specific psychological and emotional levels.

The third chapter steps back to look at women (and men) producing science and technology: how women have achieved what they have and what has kept them from full participation. Women have had a long and arduous fight to gain entry to the sciences, particularly since they became professionalized in the nineteenth century. Despite this struggle and its lessons for collective feminist action, much of science remains – at best – uncongenial to girls and women. This begins with science education at the lowest levels. It is here that feminist insight has much to offer. In return, female scientists may contribute to science in ways that men have not, with different approaches and different insights. The fight to 'get in' is by no means over, particularly in respect to technology. We have to ask the question: how have men kept technology, at both the craft and the professional level, to themselves and why? Gender, class, caste, race and location enter into our dialogue between science, technology and our daily lives, both in paid employment and in the ways in which we carry out common tasks. The impact

of high technology in the West on Western women and the impact of various types of high and intermediate technologies on women in the Third World illustrate this.

Whatever other relationships we may have individually and collectively with technology and its associated sciences, we are all consumers. The final chapter looks at this aspect of our lives. How much has technology actually helped Western women in their daily tasks? For that matter, what can technology do for women and their work in the Third World? What kind of technology is appropriate? How can a better technology be disseminated and made available to the women who need it? How can women come to control this major influence on their lives? What happens when women take a stance with respect to science and technology and its impacts – many of them negative – on our lives? What sort of relationship do we make for ourselves with our world? In the final analysis, what dreams can we dream?

Gill Kirkup
Laurie Smith Keller

1
THE NATURE OF SCIENCE AND TECHNOLOGY

We need an appreciation of what science and technology are – at least at this historical moment within this culture – in order to understand feminist critiques of science and technology. As Evelyn Fox Keller (1986) asserts in Article 1.3:

> Modern science, as we know it, has arisen once and only once in cultural history. That is, we cannot say of [modern] science what we can say of gender – namely that all cultures do it . . . The point to keep in mind, however, is that this inability reflects not so much the failure of other cultures, but precisely the social character of the process by which science gets named – even, or especially, good science.

To some people this might sound like a piece of ethnocentric arrogance, especially to those who associate science with intellect, rationality and a search for truth. But Fox Keller's statement is just the opposite; it is in fact, an assertion that one particular way of searching for truth – through experimental method and abstract theory building, often grounded in mathematic models – is not the *only* way. All cultures try to make sense of the material world around them, predict cause and effect and develop techniques and knowledge to make artefacts, but many of the methods they use would not qualify as 'scientific' in our terms. (See Plate 1.)

Since Thomas Kuhn wrote *The Structure of Scientific Revolutions* in 1962, most historians and philosophers of science no longer view science as progressing historically through better and better theories by which to understand reality. Kuhn demonstrated, with examples from early modern Europe, that 'old' theories were often discarded and replaced by 'new', different theories, not simply because the new theories had better explanatory power, but because events within society made the new theory more acceptable. This was often to do with the nature of ideological and political change. The internal logic of science itself was seen to be a less powerful agent of change than previously believed, and certainly never an autonomous agent.

This kind of critique of science fits well with a Foucauldian[1] analysis:

> [O]ne could say that truth is not a collection of insights or information floating about, parts of which are sooner or later revealed or discovered, nor does it lie deep within us waiting to be freed. Truth is produced through discourse (based in science upon 'proper' scientific methods and investigations) and its production is involved with relations of power.
>
> *(Bleier, 1984, p. 195)*

An understanding of the historical and cultural relativity of modern science frees us to be open to other methods and systems of thought which can now be seen as valid explanations of the world within their own context. It also enables us to see science as a product of a gendered culture and to speculate about the possibility of a 'gender-neutral' or feminist science. It gives us firm ground, as feminists, on which to stand in order to do a job of deconstructing science. During the 1980s that ground has been inhabited by a growing number of feminist theorists and feminist scientists. It is, however, important also to be able to evaluate what has been and is useful about science rather than occupy this ground simply to propose anti-science or anti-technology positions.

Fox Keller discusses this when arguing that it is important that the 'personal' should be incorporated into any kind of new science:

> Faced with the charge that 'women always get personal', Mary Ellman counters: 'I'd say men always get impersonal. If you hurt their feelings, they make Boyle's law out of it.'
>
> . . . The fact that Boyle's law is not wrong must, however, not be forgotten. Any effective critique of science needs to take due account of the undeniable successes of science as well as the commitments that have made such successes possible. If individuals tend to be drawn to science by the desire (or need) to escape the personal, or by the promise of quasi-religious communion, they are also drawn by another, equally personal but perhaps more universal ambition: namely, the search for reliable, shareable knowledge of the world around us. Indeed, scientists' shared commitment to the possibility of reliable knowledge of nature, and to its dependence on experimental replicability and logical coherence, is an indispensable prerequisite for the effectiveness of any scientific venture. What needs to be understood is how these conscious commitments (commitments we all share) are fuelled and elaborated, and sometimes also subverted, by the more

> parochial social, political and emotional commitments (conscious or not) of particular individuals and groups.
>
> Boyle's law does give us a reliable description of the relation between pressure and volume in low density gases at high temperatures, a description that stands the tests of experimental replicability and logical coherence. But it is crucial to recognize that it is a statement about a particular set of phenomena, prescribed to meet particular interests and described in accordance with certain agreed-upon criteria of both reliability and utility. Judgements about which phenomena are worth studying, which kinds of data are significant – as well as which descriptions (or theories) of those are most adequate, satisfying, useful, and even reliable – depend critically on the social, linguistic and scientific practices of those making the judgements in question.
>
> *(Fox Keller, 1985)*

The first article in this chapter – 'Discovering and doing' by Laurie Smith Keller – sets the context for the chapter, and the book. It analyses the historical formulation of science and technology, to uncover how, when we use the words in a commonsense fashion, we often convey erroneous, exaggerated or fictional notions of the nature of science and technology. Many of us women, even those with post-school education, stopped doing formal science in our early teenage years (and never did 'technology' activities at all). Smith Keller describes in simple language the process of experimental method, as well as the history of it.

She also examines the nature of technology and its relationship to science, a debate of considerable interest to feminists. For many people technology is simply 'the appliance of science', a view promoted through the formal teaching of technological subjects as applied science. However, if we accept that modern science is an historically and culturally specific activity, we are left with the question of whether cultures without science can have technology which is both rational and systematic. And, since they patently can and do, then the relationship between technology and science is not the simple cause and effect that might be presumed. The association of technology with modern science has had negative as well as positive effects. Women have always engaged in technological activities, making containers, clothing and various domestic artefacts, but their exclusion from industrial, technical processes has caused them to be seen as non-technological, and their technological activities to be redefined as art and craft.

The second article, 'Women's voices/men's voices: technology as language' by Margaret Lowe Benston, discusses technology as a language in a way different from a Foucauldian analysis. She

describes the use of technology by people living their lives and 'doing' as a kind of language. Access to this language is through the ability to use and understand tools and artefacts. The analogy here is with words. Having limited access to the vocabulary of a language is at worst silencing and at best allows only limited participation in the discourse. This is the position women are in with respect to tools and technology and, although she does not say it, with respect to modern science too. Access to technology, and science, is access to a variety of sorts of power, some real and some symbolic.

This issue of access has sometimes been confused with the activity of 'fixing things'. Because many feminist workshops of the 1970s and 1980s contained 'hands-on', confidence-building activities based around demystifying common mechanical objects, such as car engines, bicycles or washing machines, this was sometimes interpreted as a notion that liberation entailed doing your own mechanical repair jobs. This was countered by the argument that if women could and did fix cars and washing machines this would simply add to their already onerous list of domestic tasks. But if access to skills is seen as access to a particular kind of power, then it becomes unarguable that access for women is a good thing. Whether we choose to use it to 'fix things' is a different question. Benston is the first of many authors in this book to argue for the importance of women's access to technology and science. She also opens the argument, which runs through many of the articles in this book, that male and female experience of the world is different and that some of this experience is mediated by technology. This different, gendered world view means that men and women bring to science and technology different visions.

Evelyn Fox Keller – the author of Article 1.3, 'How gender matters, or, why it's so hard for us to count past two' – has been influential during the 1980s in conceptualizing how a feminist science might be different from 'malestream' science as it exists at present. In an important book about the work and life of geneticist Barbara McClintock (discussed in more detail in Article 3.3), she argued that women, because of their gendered location in the world, could bring new and useful methods of thought to a male science. Fox Keller herself originally worked as a mathematical biophysicist, and she retains a commitment to a feminist revolution in science that will ultimately make science better at achieving its own aims.

Fox Keller analyses what the question about women and science means for different people. The most basic version of this question, and one which certainly is not part of the feminist agenda, is: what is wrong with women that they can't do science? The next simplest version, and one which still has many feminist adherents today, asks: since men and women are equals, what are the barriers

which keep women out of science and how can they be removed so that women can join (a presumed gender-neutral activity) on the same grounds as men? She then identifies a shift – certainly within modern feminism – to arguments that because women and men are not the same, then there is masculine science and could-be feminist (or feminine) science. Fox Keller is obviously worried about this position. She sees it as giving up on attempts at objectivity, which she values, for a relativism which asserts that there are as many different kinds of science as there are people. She argues for shifting the focus of inquiry into how ideas of gender have shaped the construction of science and how ideas of science have shaped our construction of gender – a more complex agenda altogether. She argues that we must move away from dualisms – male/female, mind/nature, self/other – and look instead for difference. She is also very careful to say that she doesn't see this way of thinking as being biologically determined – by being female – although she argues that women have more to gain by thinking this way than men. She ends her piece with a discussion of the language of evolutionary theory, in which she argues that debates about competition or co-operation disguise the richness of what is actually happening through the use of a gendered language that romanticizes both competitive masculinity and co-operative femininity and forces theorists into one camp or the other. This for her is an example of the unhelpfulness of allowing gender to play a crucial role in science.

Sandra Harding in Article 1.4, 'How the women's movement benefits science: two views', is also concerned about the different arguments adopted by feminists working for change. She sees a core of solidarity in the struggle that all feminists have against scientific conservatives who believe that change originating from the women's movement must be bad. She identifies feminist positions differently from Fox Keller, and in a way that is perhaps initially simpler to grasp. She identifies feminist empiricists as critics of bad science interested in improving its practices, and feminist standpoint theorists as critics of all modern science who believe the whole enterprise should be dismantled. The first position she relates to liberal political and moral theory and the second to Marxist epistemology. Harding, like Fox Keller, feels that the agenda of modern science as well as some of its practices are worth defending and that it is regressive to discourage women from learning to do it, or from working in it. And yet she argues at the same time that radical critiques are necessary. The important thing is to bring the two positions close enough together to co-operate on a 'science of science'. She sees both positions as claiming benefits from the involvement of more women in modern science: the empiricists see the missing talents and abilities of women as having the potential to make new contributions; the feminist standpoint

theorists see women as bringing a wholly different perspective to science stemming from their particular social location. Harding argues that it is very important to all feminists to have a theory about doing science, and this should connect what happens in laboratories with social relations in society at large, something that will become more apparent in later chapters of this book.

There is a more recently developed position, beyond that of feminist standpoint theory, which is likely to play a significant part in feminist theory debates of the 1990s, that is 'feminist post-modernism'. It has been described by Mary Hawkesworth, who is very critical of it, as rejecting

> . . . the very possibility of *a* truth about reality. Feminist post-modernists use the 'situatedness' of each finite observer in a particular socio-political, historical context to challenge the plausibility of claims that any perspective on the world could escape partiality. Extrapolating from the disparate conditions that shape individual identities, they raise grave suspicions about the very notion of putative unitary consciousness of the species. In addition, the argument that knowledge is the result of invention, the imposition of form on the world rather than the result of discovery, undermines any belief that the Order of Being could be known even if it exists.
>
> *(Hawkesworth, 1989, p. 536)*

This is a position of epistemological relativism. It suggests that there are as many truths as individual people and that no single truth has any claim to be better than any other. This is what Fox Keller calls a step from 'the twoness of us, to the infinity of us's'. As a position it runs counter not only to the aims of science, but to those of feminism of the 1970s and '80s. Feminism as a theory, and a political movement, claims that there are 'facts' and 'realities' about the position of women, such as rape, domestic violence and unequal pay that are a key to understanding sexual oppression, and that these have been hidden or distorted. For people like Fox Keller, Harding and Hawkesworth, science and feminism have similar agendas in that they are both concerned to remedy distortion and move closer towards a more accurate description of how things are. Both feminism and science claim that there *are* things that can be known. This position brings us back full circle to Smith Keller's paper about the activity of science. Science is a systematic attempt to know about the material world; it presumes that there is an external reality that we can know in some form – that Boyle's law works.

Gill Kirkup