Introduction

Observations *Plus* Recipes

It has been said that science is the orderly collection of facts about the natural world. Scientists, however, are wary of using the word 'fact.' 'Fact' has the feeling of absoluteness and universality, whereas scientific observations are neither absolute nor universal.

For example, 'children have 20 deciduous [baby] teeth' is an observation about the real world, but scientists would not call it a fact. Some children have fewer deciduous teeth, and some have more. Even those children who have exactly 20 deciduous teeth use the full set during only a part of their childhood. When they are babies and toddlers, children have less than 20 visible teeth, and as they grow older, children begin to loose their deciduous teeth, which are then replaced by permanent teeth.

'Children have 20 deciduous [baby] teeth' is not even a complete scientific statement. For one thing, the statement 'children have 20 deciduous teeth' does not tell us what we mean by 'teeth.' When we say "teeth," do we mean only those that can seen be with the unaided eye, or do we also include the hidden, unerupted teeth?

An observation such as 'children have 20 deciduous teeth' is not a fact, and, by itself, it is not acceptable as a scientific statement until its terms are explained: scientifically, 'children have 20 deciduous teeth' must be accompanied by definitions and qualifiers. The standard way to put science into a statement is to define the statement's meaning operationally. Instead of attempting a purely verbal definition of 'teeth,' for instance, scientists define it by the procedure—the recipe—that has been used when making the observations about teeth.

In science, 'children have 20 deciduous teeth' is neither universal nor abstract. It is a record of the result of following a specific recipe, and the statement is scientific only when we include the recipe that was used. For 'children have 20 deciduous teeth,' one appropriate recipe would be: "I looked in the mouths of 25 five-year-old boys and 25 five-year-old girls in the Garden Day Nursery School in Cleveland, OH, on Monday, May 24, 2008, and I found that 23 of the boys and 25 of the girls had 20 visible teeth."

A meaningful scientific statement includes an observation and its recipe, and the standard form for recording meaningful scientific statements is the scientific research paper.