
Contents

1	Overview	1
1.1	An Example of a Meaningfulness Condition	1
1.2	Seven Examples of Abstract Axioms	2
1.3	Abstract Representations	3
1.4	Associativity and the Pythagorean Theorem	4
1.5	Order-Invariance under Transformations	6
1.6	Outline	7
1.7	Problems	8
2	Extensive Measurement	11
2.1	Ratio Scales and Interval Scales	11
2.2	Empirical Basis and Short History	12
2.3	Basic Algebraic Concepts	14
2.4	Main Results	16
2.5	Proofs	17
2.6	Independence of the Axioms: Counterexamples	24
2.7	Problems	26
3	Functional Equations	27
3.1	A Classic Application	27
3.2	The Cauchy Equation and Related Ones	29
3.3	Functional Equations with Several Functions	32
3.4	Vincze's Equation	34
3.5	Plateau's Experiment	41
3.6	On a Property of Interval Scales	43
3.7	Problems	44
4	Abstract Axioms and their Representations	47
4.1	Some Basic Concepts	48
4.2	The Associativity Equation	49
4.3	Permutability and Quasi-Permutability	49

4.4	The Bisymmetry Equation	53
4.5	The Translation Equation	53
4.6	The Autodistributivity Equations	55
4.7	The Abstract Lorentz-FitzGerald Contraction.....	55
4.8	Problems.....	56
5	Defining Meaningfulness	59
5.1	Motivation	59
5.2	The Definition	61
5.3	Applications	63
5.4	Falmagne and Narens Definition.....	65
5.5	Other Concepts of Meaningfulness	71
5.6	Duncan Luce's Concept of "Theory Construction"	74
5.7	Problems.....	77
6	Propagating Axioms via Meaningfulness	79
6.1	Propagating Solvability and other Conditions	79
6.2	The Self-Transforming Case	81
6.3	The Meaningful Lorentz-FitzGerald Systems.....	82
6.4	Problems.....	84
7	Meaningful Representations of Scientific Codes	85
7.1	Associativity and the Pythagorean Theorem	85
7.2	Meaningful Quasi-Permutable Laws.....	88
7.3	Meaningful Bisymmetric Laws	96
7.4	Meaningful Translatable Laws	98
7.5	Meaningful Quasi-Permutable LF-Systems.....	100
7.6	Problems.....	103
8	Order Invariance under Transformations	105
8.1	Outline	106
8.2	Transformation Families.....	106
8.3	Transformation Classes	110
8.4	Transformations Acting on Codes	111
8.5	Meaningful Transformations	120
8.6	The Lorentz-FitzGerald Contraction	125
8.7	Beer's Law	128
8.8	The Monomial Laws	130
8.9	A Counterexample: van der Waals' Equation.....	132
8.10	Problems.....	134
9	Dimensional Invariance and Dimensional Analysis	137
9.1	Introduction	137
9.2	Examples of Dimensional Analysis	138
9.3	The Pi Theorem	140

9.4	Further Comments on Dimensional Analysis	143
9.5	Meaningfulness and Dimensional Analysis	144
9.6	Meaningfulness, Dimensional Analysis, and the Monomial Laws	146
9.7	Problems	153
10	Open Problems	155
	Index	159
	Bibliography	165



<http://www.springer.com/978-3-662-46097-9>

On Meaningful Scientific Laws

Falmagne, J.-C.; Doble, C.

2015, XIII, 170 p., Hardcover

ISBN: 978-3-662-46097-9