

# CAUSALITY FOR FREE

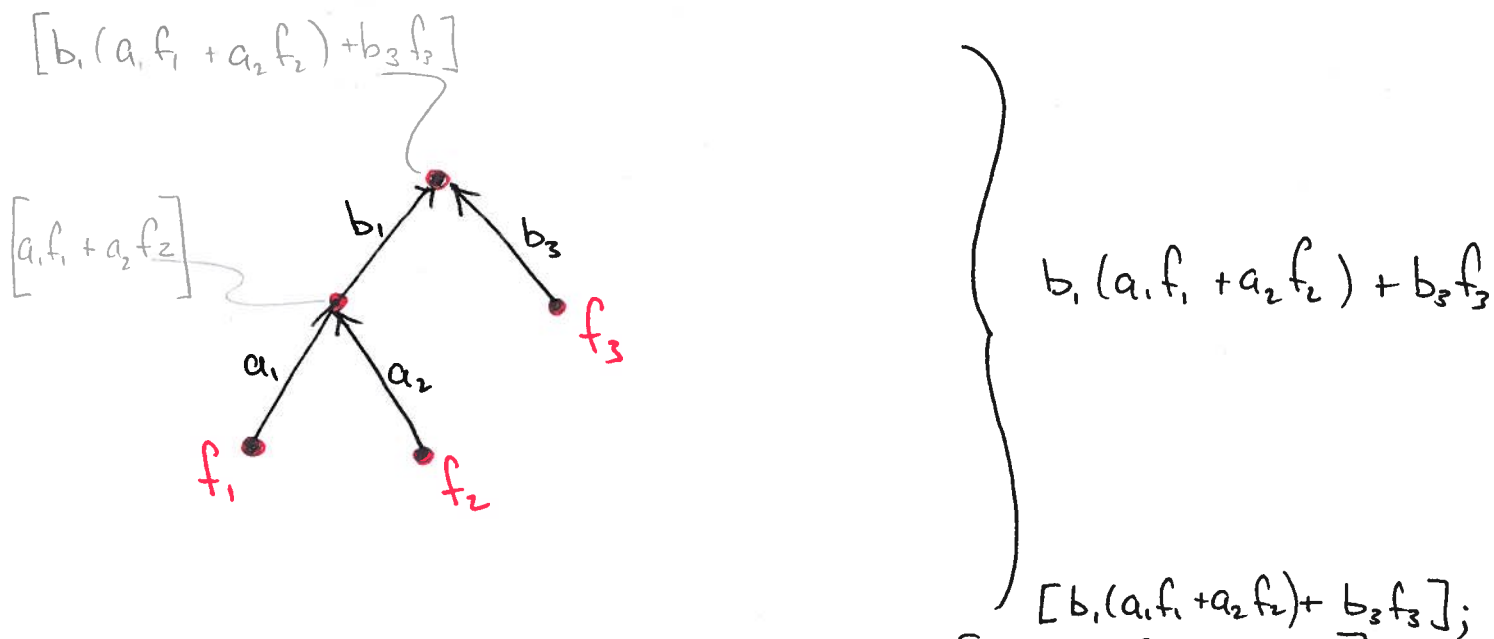
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CONSIDER THE EXPRESSION

$$b_1 (a_1 f_1 + a_2 f_2) + b_3 f_3$$

IT CORRESPONDS TO A CAUSAL SET:



WHERE THE ENDPOINT CORRESPONDS TO  $[b_1(a_1 f_1 + a_2 f_2)]$ ,

$[...]$  REFERS TO THE EXPRESSION EVALUATED.

eg 7, AS OPPOSED TO  $2 \cdot 3 + 1$ .

MULTIPLICATION  $\Leftrightarrow$  PROPAGATION ALONG AN EDGE

ADDITION  $\Leftrightarrow$  JOINING TWO END POINTS  $\nearrow$

THIS PICTURE IS WHAT GOT UTI (UNIFIED THEORY OF IDEALS) STARTED. THE  $f_i$  COULD CORRESPOND TO ELEMENTS OF IDEALS: IN THIS CASE, FRACTIONS UNDERGOING LEFT MULTIPLICATION AND ADDITION. THE INTENDED ALGEBRA WOULD BE  $\mathbb{R} \otimes \mathbb{C} \otimes \mathbb{H} \otimes \mathbb{O}$ .

## - TIME -

### FROZEN TIME

THERE IS A QR-FRIENDLY PICTURE WHICH CORRESPONDS TO THE ENTIRE EXPRESSION, UNEVALUATED. IT IS TIMELESS.

### TIME $\Leftrightarrow$ CALCULATION

HOWEVER, THERE IS ALSO A NOTION OF TIME WHICH IS MUCH MORE ALIVE. THE TIME WE EXPERIENCE IS THE EVALUATION OF EXPRESSIONS.

eg IT IS THE PROGRESSION FROM  $3 \rightarrow 6 \rightarrow 7$   
 AS 3 GETS MULTIPLIED BY 2 TO GIVE 6  
 AND THEN 1 GETS ADDED TO 6 TO GIVE 7  
 IN THE EXPRESSION  $2 \cdot 3 + 1$ .

TIME HERE IS A SEQUENCE OF EVENTS.  
 IT IS AN ENTIRELY LOCAL CONCEPT.

THIS IDEA IS BACKGROUND FREE IN THE STRONGEST SENSE. IT IS NOT EMBEDDED IN A BKGD.

THE DIMENSION OF THE ALGEBRA SHOULD DICTATE THE DIMENSION OF EMERGENT SPACETIME.

TECHNICAL POINT - ALGEBRAIC EXPRESSIONS HAVE A SINGLE ENDPOINT. TO GET A MORE GENERAL CAUSAL SET, ALGEBRAIC EXPRESSIONS WOULD NEED TO BE GENERALIZED.