WEAK PROGRESSIVENESS

there is a nonterminal-lettered leaf
$\Rightarrow$ some leaf is fertile

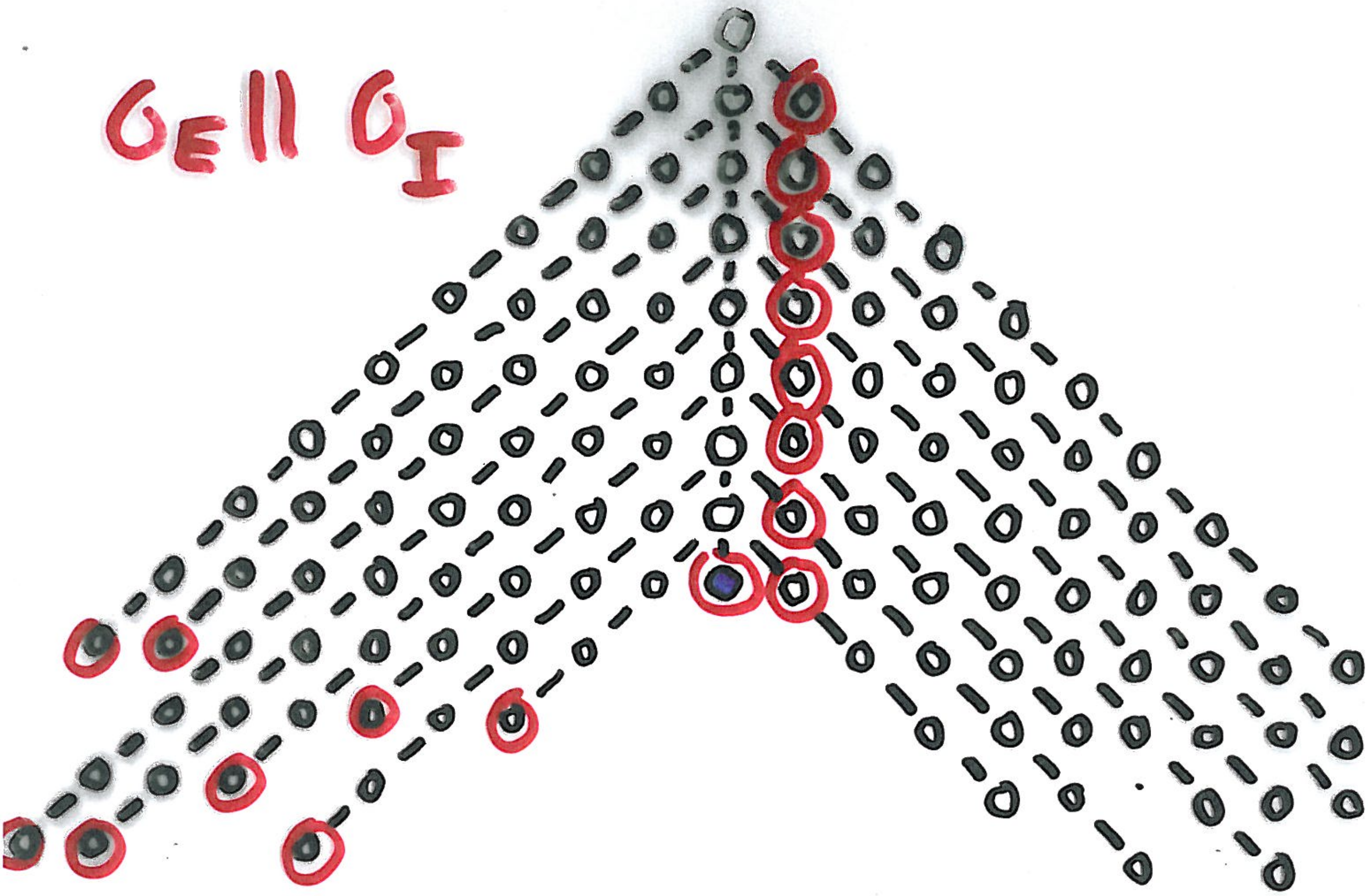
STRONG PROGRESSIVENESS

there is a nonterminal-lettered leaf
$\Rightarrow$ such a tree is producible in which the leaf is fertile

Note:

1. strong $\Rightarrow$ weak
2. these two properties are properties of S_7 only

$G_E \| G_I$

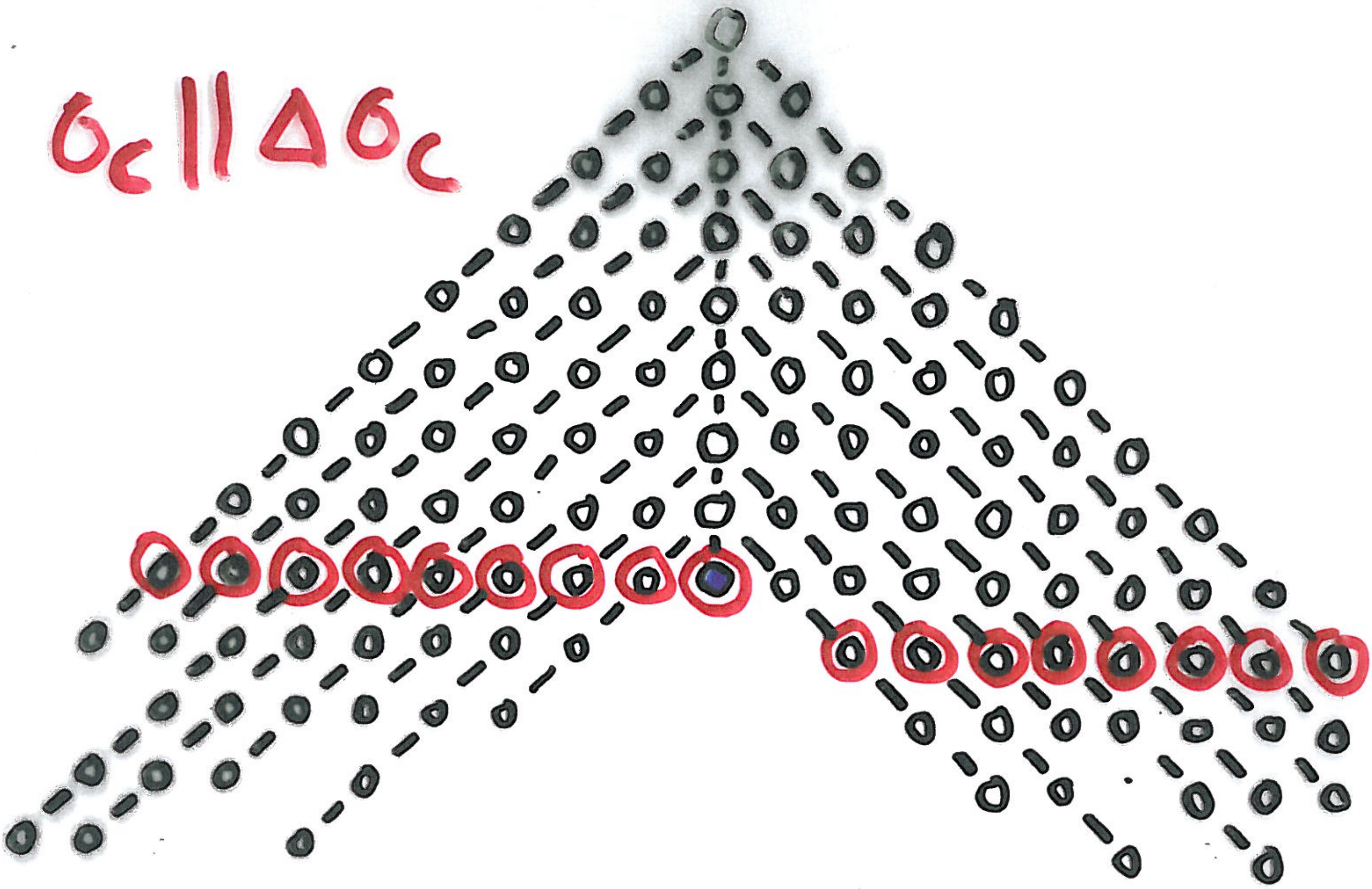


$G_E \| G_I$ is weakly but not strongly progressive (similarly to $G_I \| G_E$)

MOREOVER:

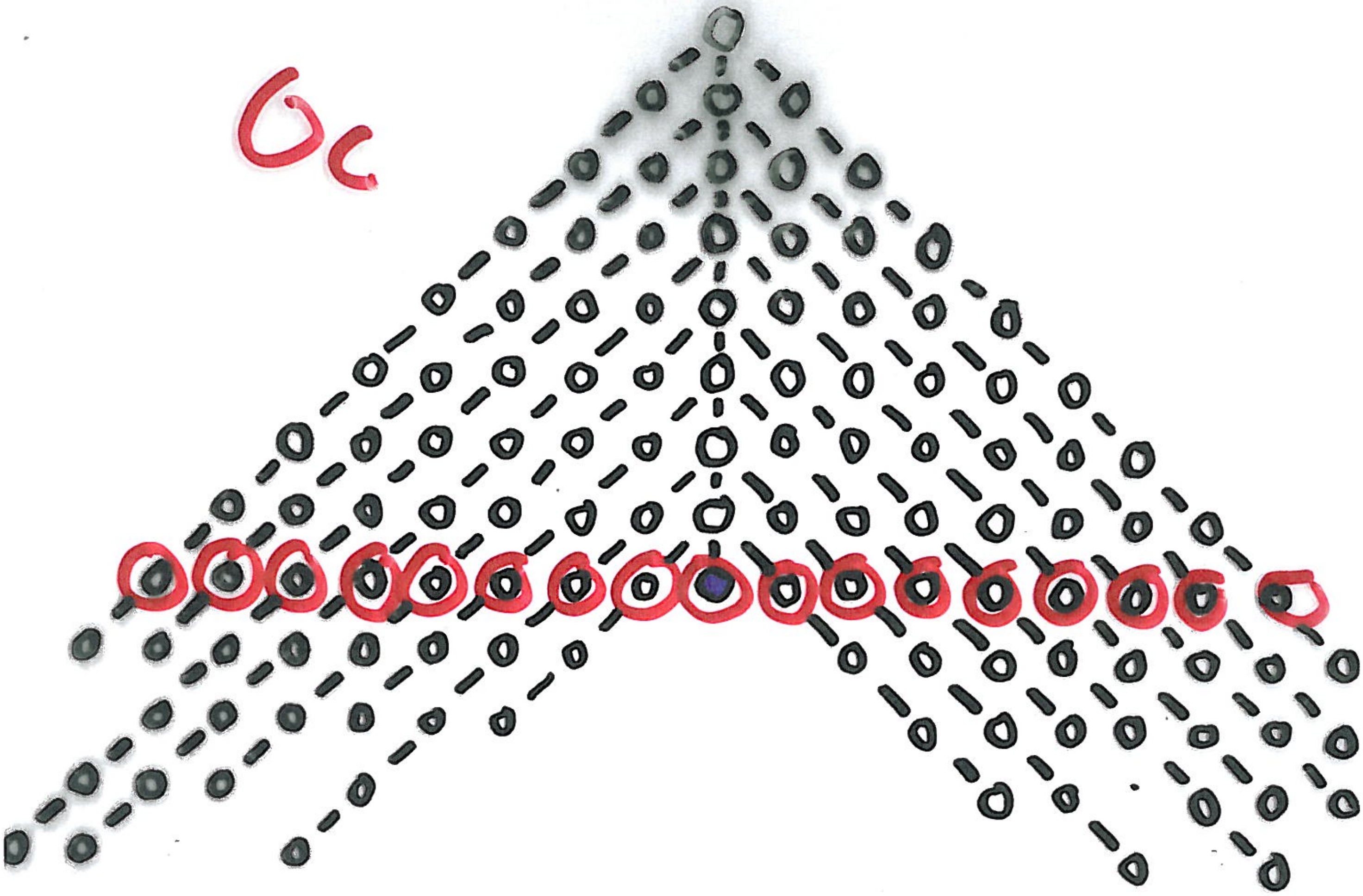
- G_E is not weakly progressive
- G_I is strongly progressive

$G_c \| \Delta G_c$



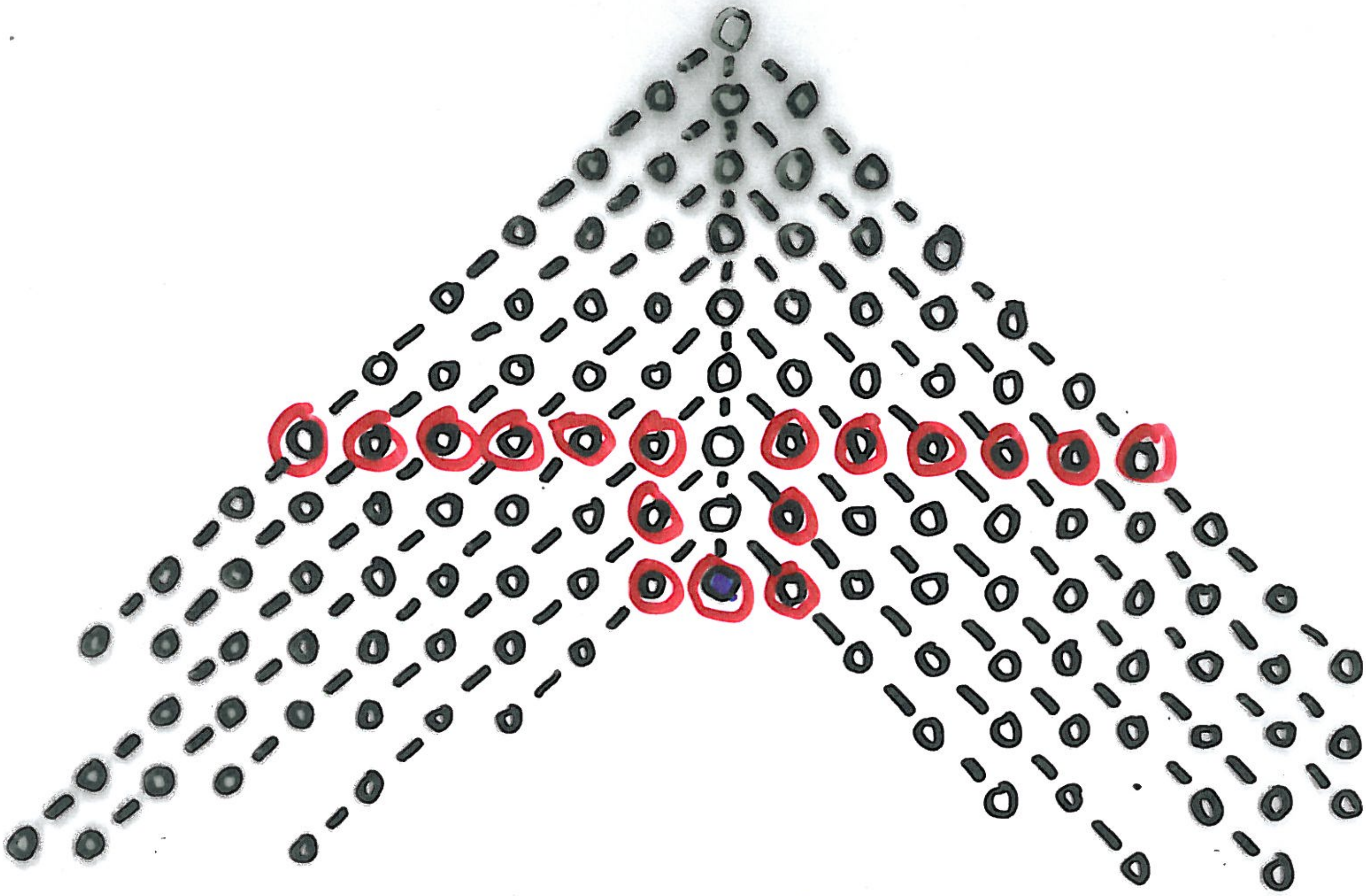
$G_c \| \Delta G_c$ is strongly progressive (similarly to $\Delta G_c \| G_c$)

NOTE: the figure depicts sequential traversal that is right-to-left and breadth-first



Oc is also strongly progressive (c.f. L systems)

- synchroneus parallelism with immediate re-synchronigation!



$$s \text{ with } \varphi_s(i) = \begin{cases} 0 & \text{when } i = 0 \\ 1 & \text{when } 0 < |i| < 3 \\ i-2 & \text{otherwise} \end{cases}$$

is again strongly progressive

- again synchronous parallelism, but now with a bit more relaxed resynchronization

EXACT CONDITIONS FOR WEAK AND STRONG PROGRESSIVENESS

weak: $\forall i$:

① $\varphi(i) > |i| \Rightarrow \varphi(-i) \leq |i|$

and

② $\varphi(i) > |i| + 1 \Rightarrow$

$\forall i' : i * i' < 0 \Rightarrow \varphi(i') \leq |i|$

strong: $\forall i$:

① $\varphi(i) \leq |i| + 1$

and

② $\varphi(i) = |i| + 1$

$\Rightarrow \varphi(-i) < |i| + 1$

[These formulations are not needed in this presentation]

Intuitively: "distributive progressiveness" means:

there is a nonterminal-lettered leaf
$\Rightarrow$ some leaf "close to" it is fertile

More formally:

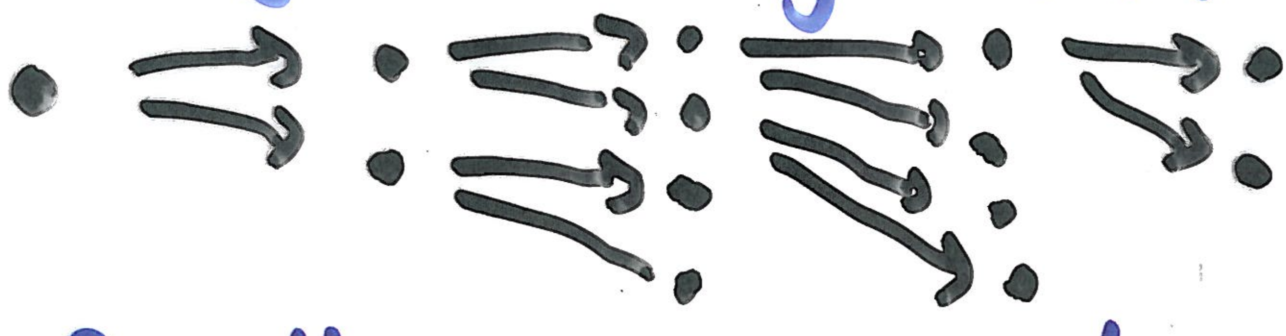
① n and n' are <u>k-close</u> if $i \leq k$ and $j \leq k$ when $\sphericalangle(n, n') = \langle i, d, j \rangle$

② <u>k-distributive progressiveness</u>: k-closeness used for "closeness"

③ <u>distributive progressiveness</u>: the preceding with some k $(0 \leq k < \infty)$

DISTRIBUTED PROCESSING

- when both confluence and distributive progressiveness: the process can fork – recurrently and without any resynchronization:



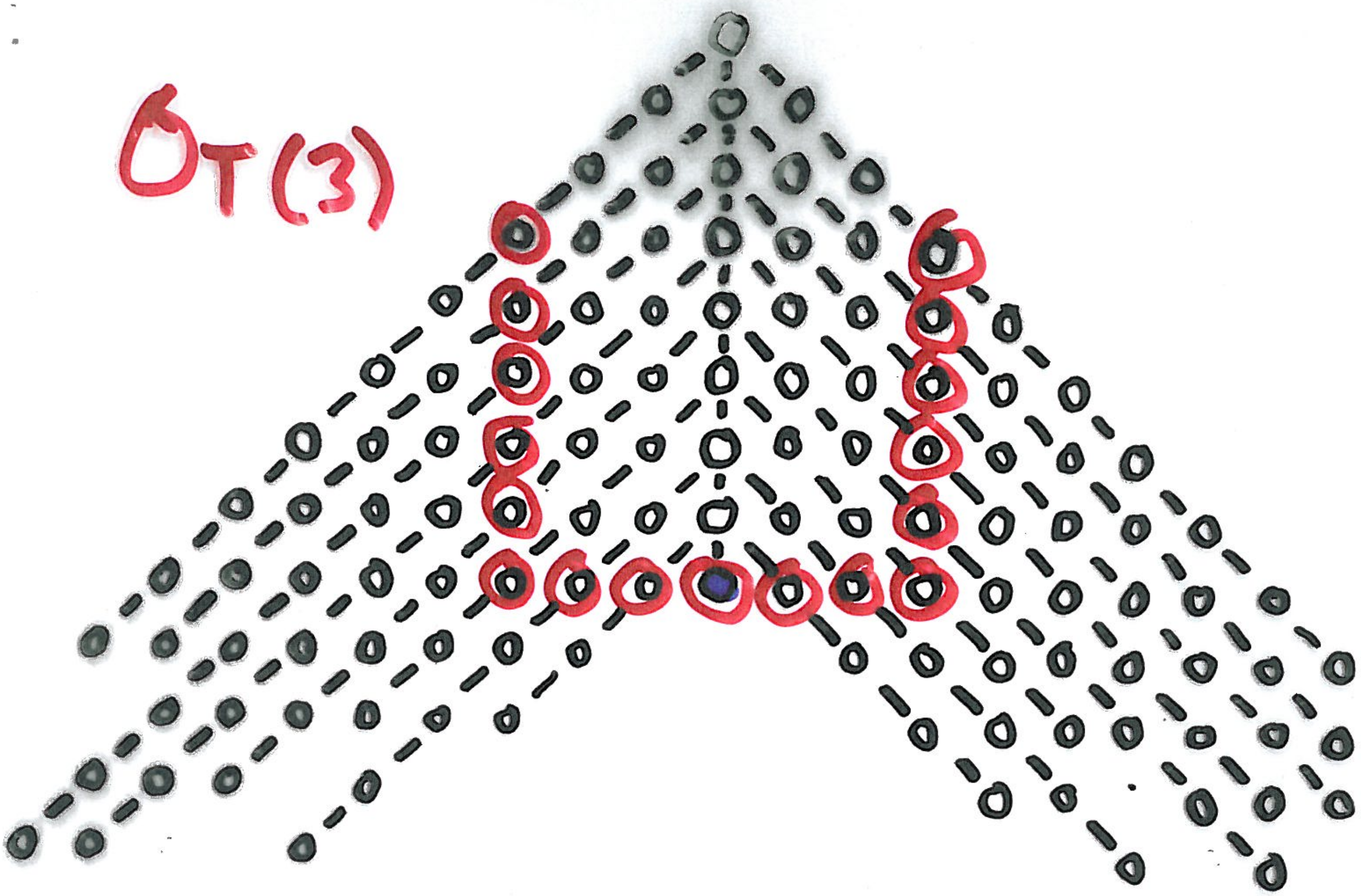
. finally: the resulting trees can be "merged" together (in the obvious way)

Notes:

1. distributive progressiveness implies strong progressiveness

2. G_I is 0-distributively progressive (as every nonterminal-lettered leaf is always fertile)

$OT(3)$



$$\varphi_{OT(3)}(i) = \min\{|i|, 3\}$$

This $OT(3)$ is
3-distributively progressive
(In general,
$OT(k)$ is k-distributively
progressive)

macro processors:
weak but not strong progressiveness

C-S Chomsky grammars and pure grammars
distributively progressive due to the dummy productions of type $A \to A$
- Of course: this is only a property of our tetrasystem model, and does not characterize the original systems well

L systems:
strong but not distributive progressiveness