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**Implementation of a successful
regeneration process within the
standard model**

***Work package 3
Healing and Regeneration***

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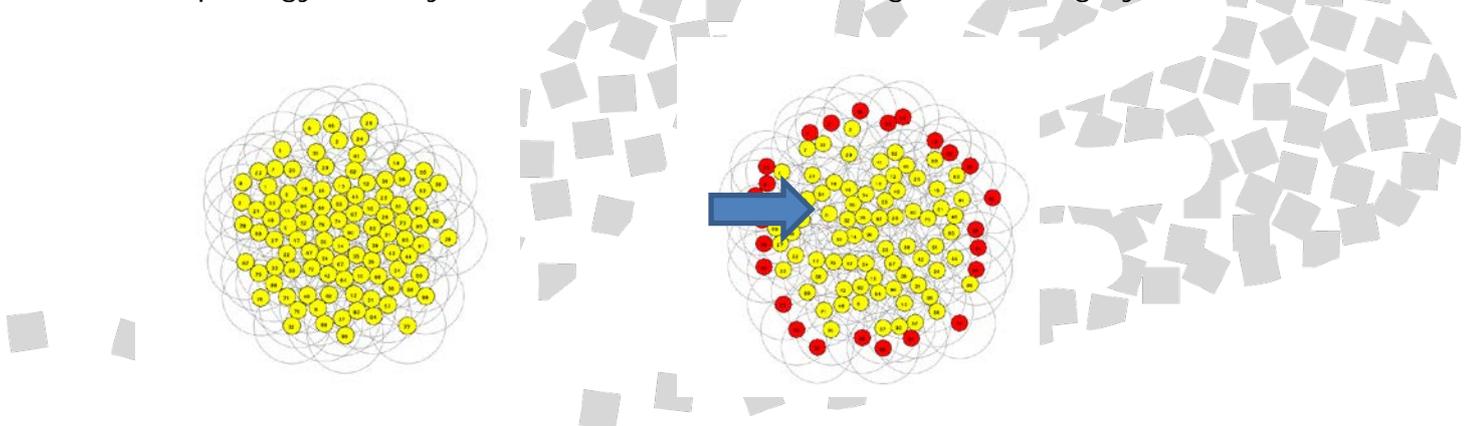
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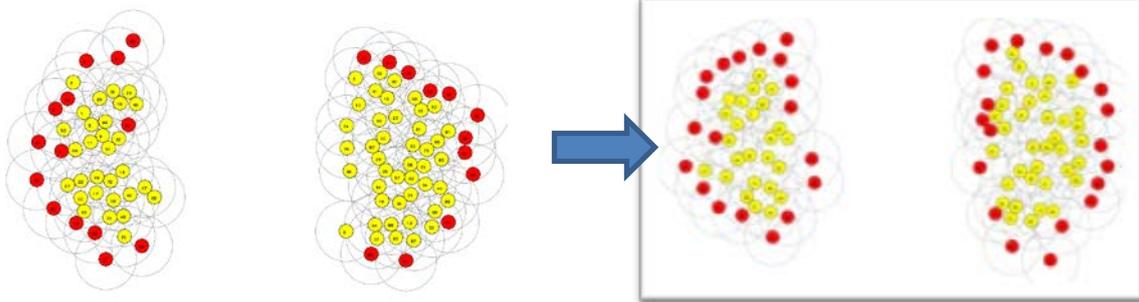
Abstract

Healing and regeneration represent the first real responses of our Swarm-organs to the outside world. The primary objective of this deliverable is an implementation of a successful regeneration process within the standard model as defined in Deliverable 1.1. In general, there are two ways to heal and regenerate a damaged tissue: ***morphallaxis*** and ***epimorphosis***. In ***morphallaxis*** the remaining tissue is re-patterned to recreate the original full tissue organization, while in ***epimorphosis*** the new tissue is grown to replace the lost tissue.

So far, in this deliverable we have been focused on studying one of the regeneration processes proposed, namely morphallaxis. We aimed for a simple initial morphology, namely a circular collection of two types of agents: “skin” bots (located in the outer layer) and “inside” bots located in the inner part of the initial shape. Before proceeding to healing and regeneration tests, two general behaviours were investigated necessary to achieve the initial target morphology, namely skin detection and maintaining tissue Integrity.



By developing and testing different algorithms based on the bots local information, like its immediate number of neighbours and their distance, both skin detection and tissue integrity were successfully achieved. With this starting point, the first test on healing (morphallaxis) was created. The idea is to see the skin regeneration process when a large “cut” is made into the swarm. We simulate this process by dividing the group into two subgroups which are physically separated – implying a “knife” has been drawn through the centre of the tissue - and see how well the two halves regenerate independently.



From the output of the simulation it can be seen that the skin definition is re-gained in the robots on the edge of the two new groups. The groups also become more coherent as a tissue, however they do not achieve a shape that is similar to the original swarm organ. Ongoing work is now seeking to generate swarms which self-organise into a more consistent morphology.

Details on the background, methodology and results can be requested to the project coordinator if needed.

