



CANCER CELLS ARE LIKE WEEDS

Use of visual analogies to explain cancer treatments

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ABSTRACT

Estimates are that more than 50% of adults living in North America have low health literacy. Unfortunately, much of the available health education material is written at a grade level that most people don't understand. To facilitate understanding, a 3D animation was created to explain cancer treatment options using analogies between cancer cells and weeds. The goal is to create educational material that people of all levels of health literacy can understand and learn from.

INTRODUCTION

Health literacy is "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions"¹. Low health literacy is detrimental as it is associated with poor health status, low participation in preventive testing, and improper use of health care service^{2,3}.

People with low health literacy struggle with concepts about cancer diagnosis, prognosis, and therapy⁴. To help combat the lack of accessible cancer treatment educational materials, the author chose to create a 3D animation featuring an engaging character who guides the viewer through a series of analogies comparing cancer treatment options with ways to kill or remove weeds.

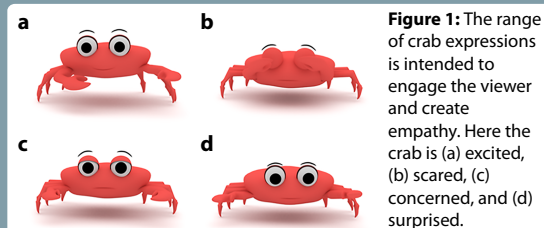


Figure 1: The range of crab expressions is intended to engage the viewer and create empathy. Here the crab is (a) excited, (b) scared, (c) concerned, and (d) surprised.

MATERIALS & METHODS

To make information about cancer treatment options more accessible, analogies are used to compare cancer cells with weeds and healthy cells with grass.

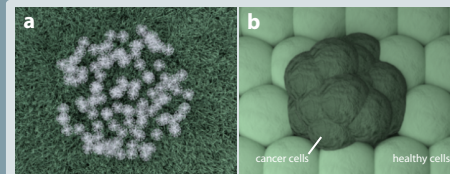


Figure 2: To help foster the use of analogies, the weeds within a field of grass (a) were distributed in a circular pattern to mimic the shape of the tumor growing among normal cells (b).

MASH Procedural Network

Maya's MASH network nodes were used to distribute and modify the grass and weeds. MASH network nodes are procedural meaning that systems are used to control objects eliminating the need to keyframe every object. The MASH nodes can be combined to modify the behavior of objects they affect.



Figure 3: The organic appearance of the grass was achieved by using a grid pattern distribute node and random nodes to randomized the height and the rotation of individual blades of grass. MASH was used to distribute the weeds in a spherical pattern. A transform node with a falloff object mimics wilting of the weeds. The position of the falloff object allows it to affect only parts of the MASH network.

Nparticle Systems

The nparticle system within Maya was used to create the dynamic interactions between the cancer cells and the surrounding healthy cells. In this scene, the cancer cells are growing and pushing the healthy cells away.

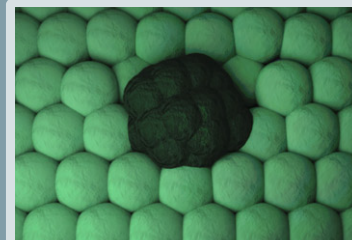


Figure 4: Both the healthy and cancer cells were created with nparticles. The healthy cells were distributed using an nparticle grid. An emitter was used to create new cancer cells, which enlarge the size of the tumor and push the healthy cells out of the way. Nparticles were used instead of a MASH network so that the healthy and cancer cells could collide with one another.

RESULTS

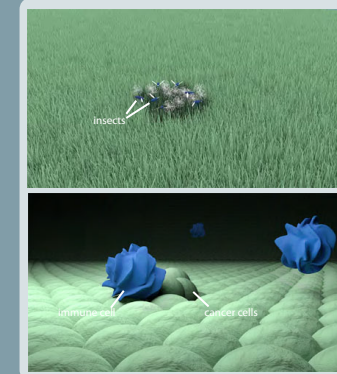


Figure 5: Immunotherapy is one of the cancer treatments featured in the animation. The author used an analogy between immune cells and insects. In immunotherapy, the body's immune system, in this case immune cells, specifically attack cancer cells. To complete the analogy, insects that specifically target the weeds are used in the animation.

DISCUSSION

The long-term goal for this project is to test this animation in the general population to determine if this helps people to better understand how different cancer treatment options work.

The author hopes that this animation empower people diagnosed with cancer and their loved ones by providing accessible information that will allow for discussion about cancer treatment options with their healthcare providers.

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Bibliography

1. Institute of Medicine. 2004. "Health Literacy: A Prescription to End Confusion". Washington, DC: The National Academies Press.
2. Berkman, N. et al. 2011. "Health Literacy Interventions and Outcomes: An Updated Systematic Review." *Annals of Internal Medicine* 155 (2): 97-107.
3. Oldach, B. and Katz, M. 2014. "Patient Education and Counseling Health Literacy and Cancer Screening: A Systematic Review." *Patient Education and Counseling* 94 (2): Elsevier Ireland Ltd: 149-57.
4. Chapman, K. et al. 2003. "Lay Understanding of Terms Used in Cancer Consultations." *Psycho-Oncology* 12 (6): 557-66.