

# Bones v.3 Construction Kit Interactions

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## Abstract

This paper describes interactions with Bones v.3 (1998), implemented by in Java for Macintosh. A subsequent version is now in preparation for PC. Bones v.3 is installed at Boston's Museum of Science as a Test Tube trial relating to the NSF-funded Making Models exhibits and programs (projected to open ca.2003).

Bones players put dinosaur parts together, identify the creature's legs, and then set them into motion. Based on a constructed creature's number of legs, the location and mass of its center, and a user-selected speed of movement, the software analyzes structural integrity and whether the creature can maintain balance as it moves. Animations, including a rich set of gait patterns, derive from literature on biomechanics and animal locomotion.

Further information about Bones can be found in:

MERL Notes 99-02 and 99-03 (on Tangibles and TangoTiles);

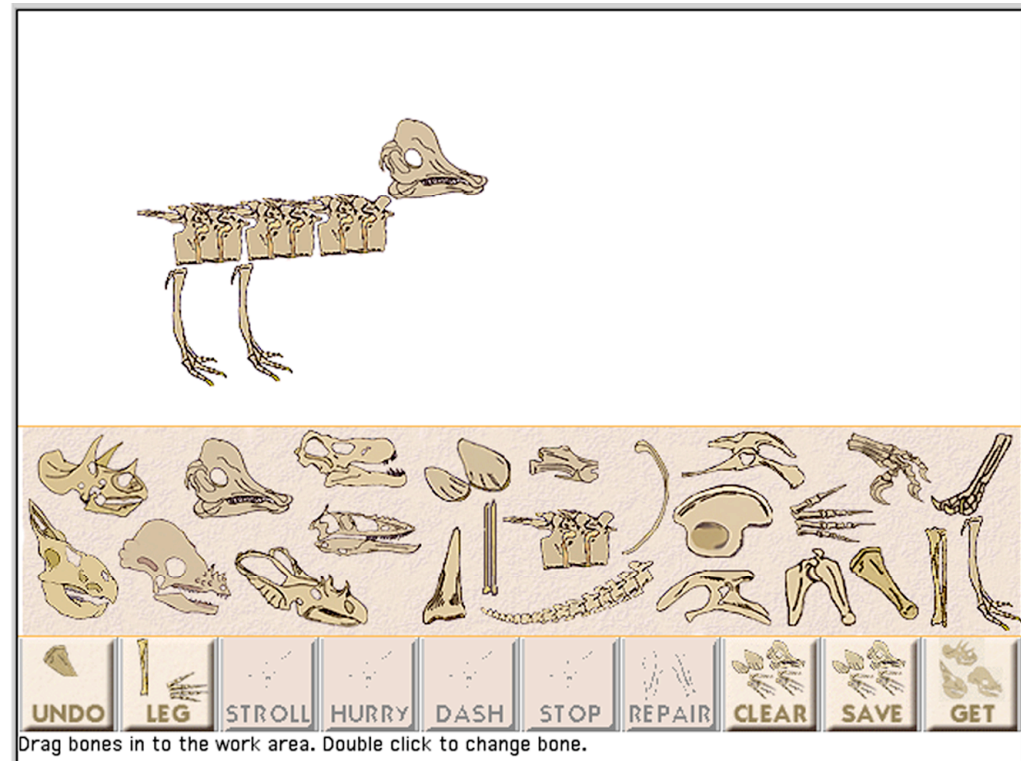
MERL Working Paper 96-03 ("A model for museum outreach based on shared interactive spaces," published in *Multimedia Computing and Museums: Selected Papers from the 3rd International Conference on Hypermedia and Interactivity in Museums, Archives & Museum Informatics*, 57-66);

and MERL Technical Report 95-07 ("Embedded microworlds for a multiuser environment"), which includes a detailed list of references.

# BONES CONSTRUCTION KIT SOFTWARE

Museum visitors create dinosaur skeletons that balance as they walk and run.

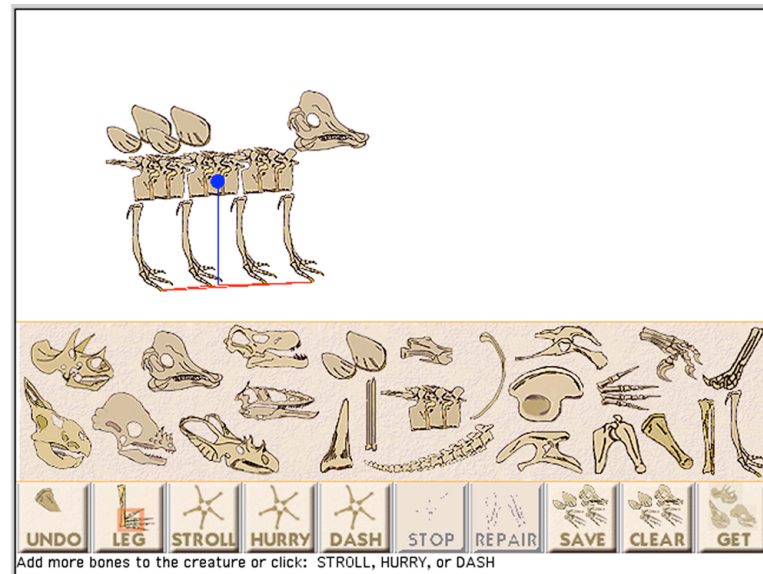
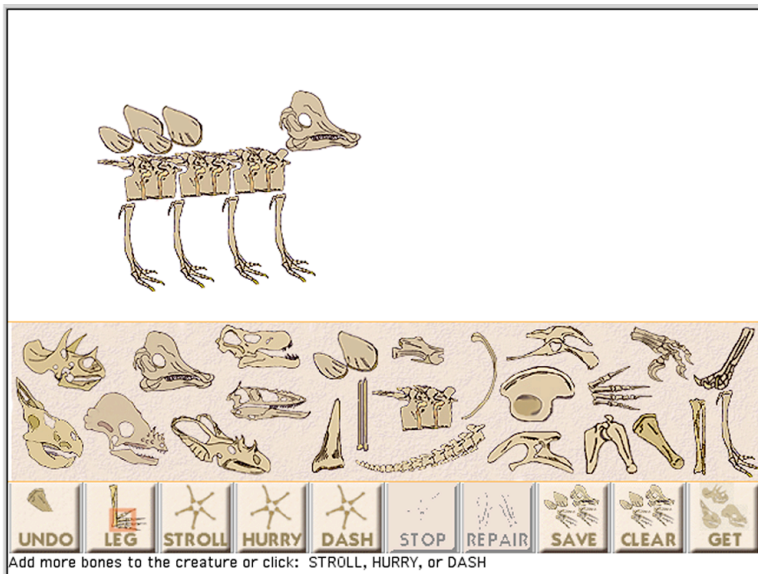
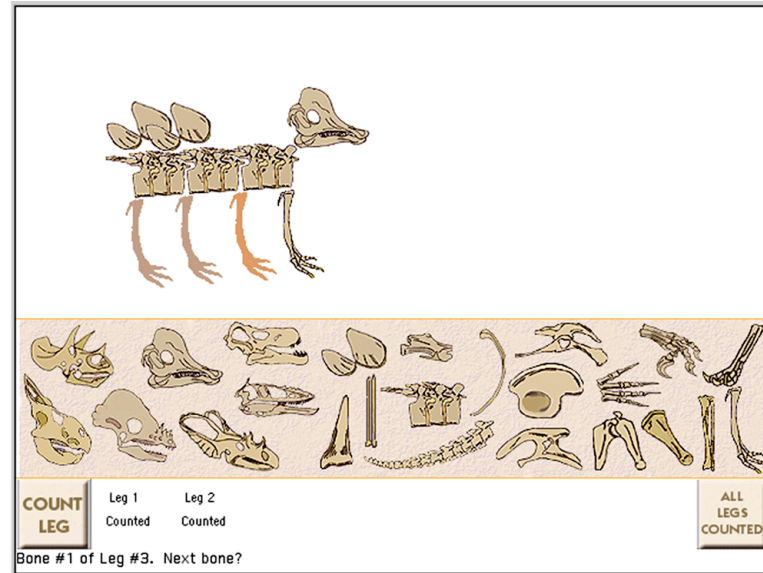
The visitor drags bones into the work area and arranges them into the form of a skeleton.

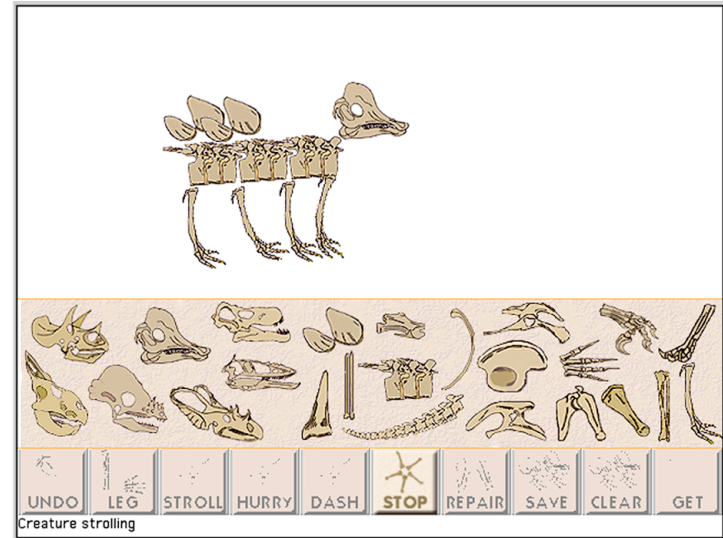
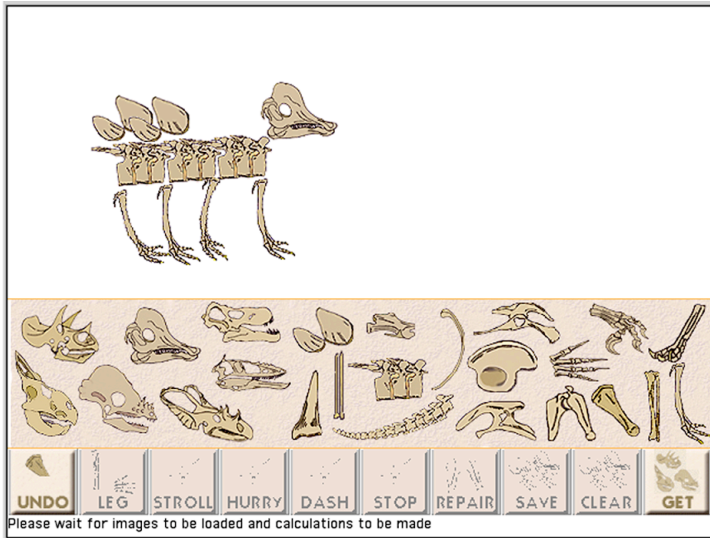


Then the visitor designates which bones are the creature's legs.

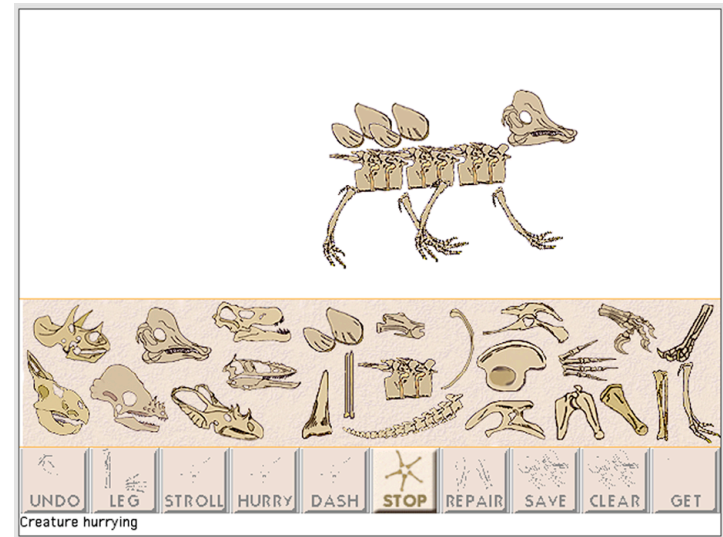
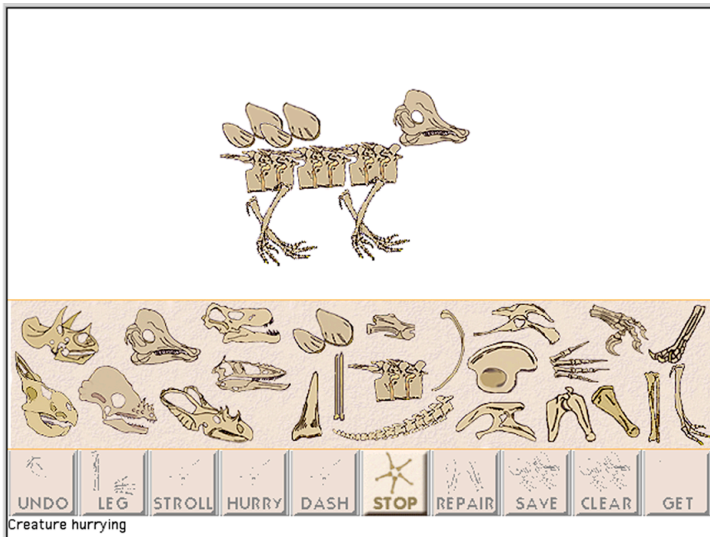
The visitor chooses a speed for the creature's movement....

...and the software calculates the location and mass of the creature's center. This determines whether the creature will remain sturdy and balanced as it moves.

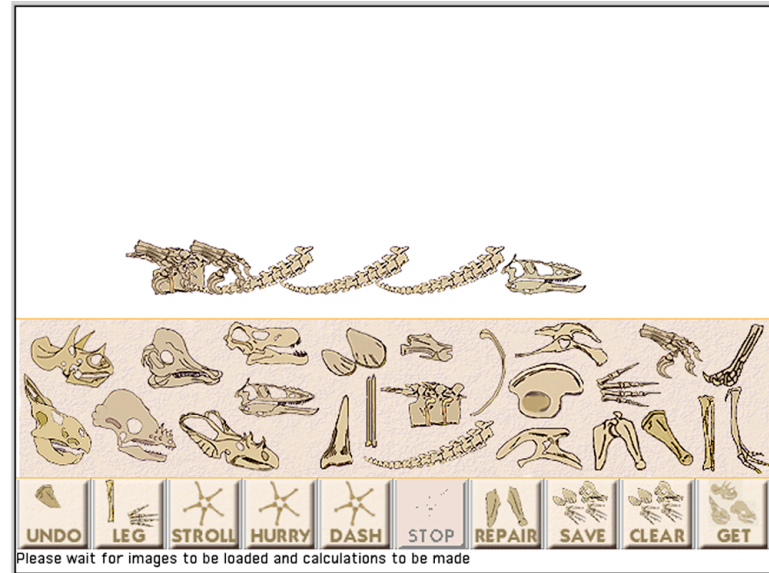
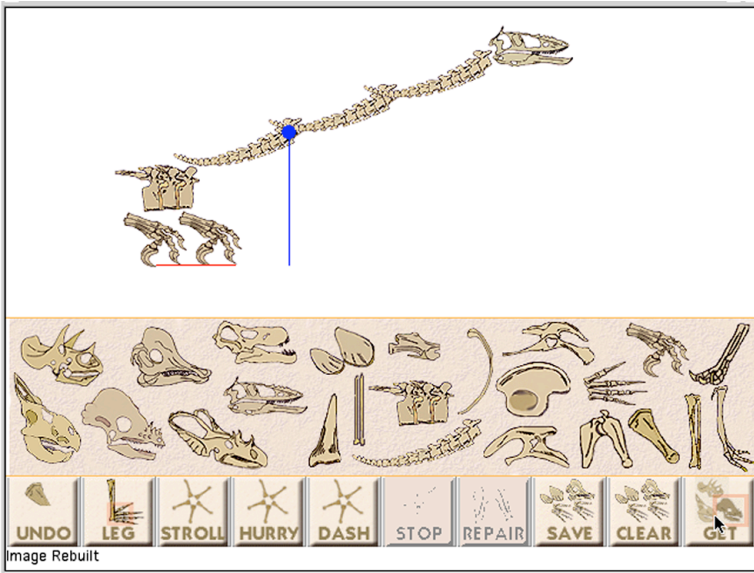




The software includes gait patterns for three speeds, for creatures with any number of legs, and for front-loaded or back-loaded creatures.



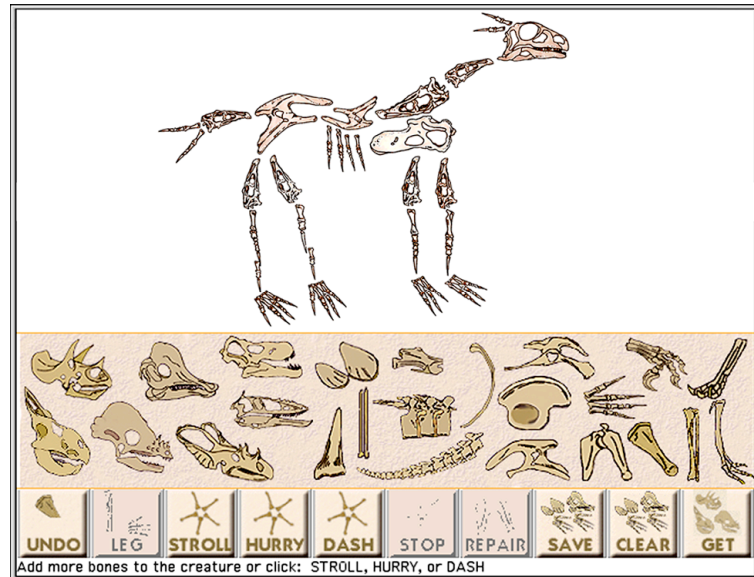




Creatures that cannot balance crash into a heap of bones.

Visitors can match their creations to textbook illustrations or invent their own whimsical creatures.

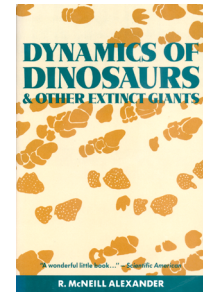
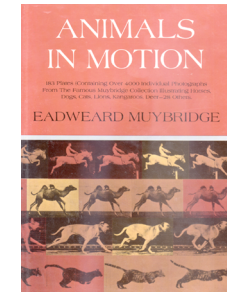
This fanciful creature is composed of just three kinds of bones: skull, pelvis, and digit.



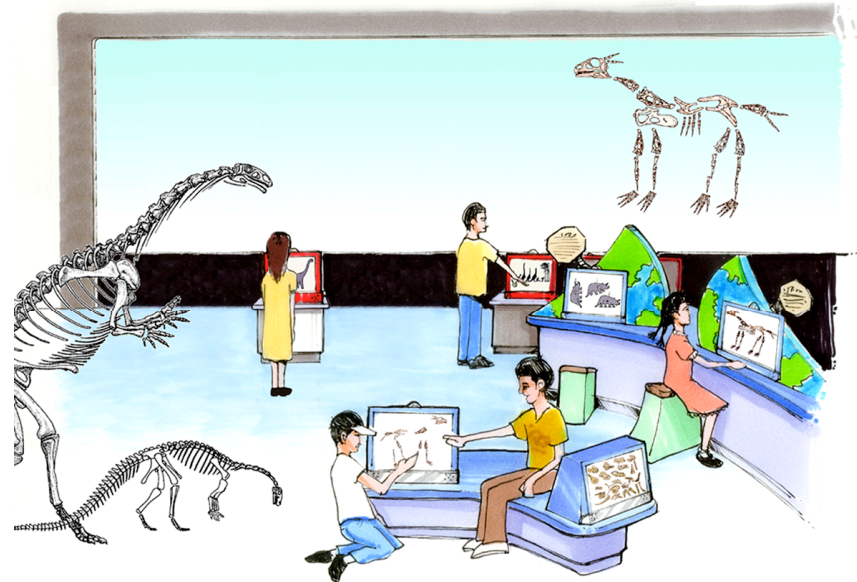
Planned improvements to the prototype:  
refined visualizations of balance lines, and addition of  
articulated joints, music and sounds, and footprints that further illustrate gait patterns.

The algorithms are based on sciences of  
biomechanics and paleontology.

In using the software, museum visitors have fun while learning about aspects  
of dynamics, a basic study in physics.



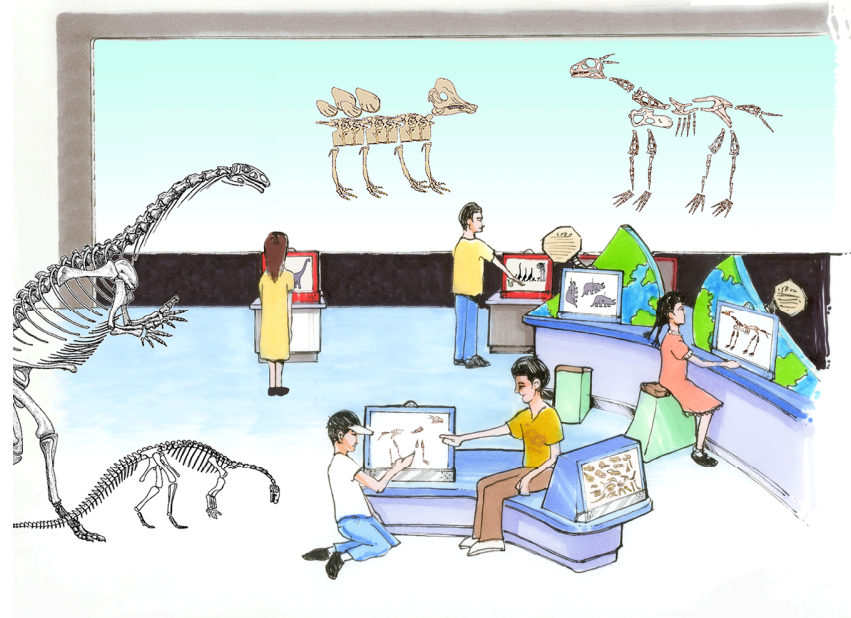
Items in the science museum's collection combine  
with computer software and display technologies to  
create a collaborative, interactive learning  
environment.



ITA's SCHMOOZER infrastructure can further shape conditions for collaborative learning.

Visitors at different museums can connect as their constructed creatures meet in a shared virtual world.

Schmoozer capabilities can further enhance DemBones with 3D models and balance algorithms, and ease of exhibit maintenance.



The same infrastructure can support other content themes.

We have plans for interactive environments that support museum visitors' learning about genetics and about additional aspects of motion study.

In this motion study environment, visitors create characters that dance and sing. In this way visitors experiment with relationships between time and space, and learn about the fundamental human behavior of speech.

