Blue Box AI

An Artificial Intelligence Tool-set

Manual Version 2.0
for
Blue Box AI 2.0

8/29/99

Table of Contents

About Blue Box Software and Consulting

Blue Box Software and Consulting consists of Jay R. Kellett (that's me) and several associated companies and consultants. We are about as small as they come, but take great pride in the work that we accomplish. The goal of Blue Box Software and Consulting is to specialize in the field of software development for training and performance support. While most of our work is done on a contract basis, it is also a goal to develop and bring to market several tools that solve general market needs. If feel that we may be able to help you, please contact Jay R. Kellett at (610) 738-0235, or write to:

Jay R. Kellett
Blue Box Software and Consulting
218 New Kent Drive
West Chester, PA 19380

You can also visit our web site at **www.BlueBoxSW.com**.

About Blue Box AI

BB AI is a collection of (currently) three different applications that can be used to study and demonstrate various elements of Artificial Intelligence. Each application has its own interface and related file format. The three applications are CA2 (Cellular Autonima), GA2 (Genetic Algorithm), and PF2 (Path Finder). These programs are updated versions of three previous programs known as CA1, GA1, and PF1. With the next release I hope to include a hybrid neural network with the package. CA stands for Cellular Autonima, which are simple life forms that follow simple rules, but show a larger emergence of behavior when they are allowed to "roam free." GA stands for Genetic Algorithm. Genetic Algorithms are programs that randomly mutate generation after generation, but tend to create some pattern of behavior because they are selected based on natural selection. Path-Finding algorithms allow artificial creatures to find a goal in variable terrain.

What's New in Version 2.0

All three of the programs have changed in at least a few ways. I have tried to make to user interface cleaner, and have tried to squash all known bugs. The most dramatic change is the fact that colors can now be selected by using radio buttons, rather than the silly method of drawing rotating colors that was previously used. Also added is the ability for organisms to sense within a 3 by 3 grid (8 surrounding squares) rather than the previous 4-square limit. This will allow a true replications of Conway's Life game, as well as more interesting creatures and complex rules.

Upgrading from Version 1.0

Users of the previous version may choose to keep the previous version around. Because the feature set of version 2.0 has grown, this has caused the file format to chance and in turn has made the file format used incompatible with older versions. The good news is that there should be no problem recreating anything that was done in the previous version with the new tools.

Installing the Program

Minimum Requirements

1) Power-PC Mac OS based computer, System 8.0 or later
2) 8 megs of RAM
3) 4 megs of free hard drive space

Set-up Instructions

- From the Blue Box web site (**`www.blueboxsw.com`**), download "BBJworld20.sit".
- Expand this file with Stuff-It Expander (available at **`www.aladdinsys.com`**).
- You should now have a folder called "Blue Box Jworld 2.0" on your hard drive.

Blue Box Jworld CA2

CA2 is a program that allows you to create "Cellular Autonima" within an electronic format. Cellular Autonima are small, computer generated and controlled Petri dishes that hold very simple life forms. In the case of this program, the Petri dishes are 50x50 squares. Each square will hold one of five colors (Black, Red, Green, Blue or Teal). The given color designates the "breed," or behavior of the organism. Each breed has a controlling program that gathers information about the environment and decides what to do next. Even though the programs that control the breeds are limited in their complexity, when they are combined together they tend to create larger, more interesting behaviors.

The Main Screen

When you open the program you will notice a large 50x50 area on the screen. This is the "petri dish" in which you will create your organisms. To the right of the dish are a row of buttons, which allow you to do the following:

- Start- This starts the action by "awakening" the creatures on-screen.
- Stop- This stops the action on the screen.
- Set Env- This allows you to set the environmental variables.
- Set Behavior- This allows you to set the rules for behavior in the program
- Step- This advances the screen one single cycle, then stops again.
- Clear- This clears the screen with the black color.
- Colors (Black, Red, Green, Blue, Teal)- These radio buttons set the color for the cursor.

To add creatures to your world, select the desired color from the color selector on the right and use your cursor to draw them on the screen. You can either click once to add a single color, or click and drag to create a rectangle of color.

Set the Environment

By clicking on the "Set Env" button you will get a dialog box allowing you to set the environmental variables. From here you can set the wall colors in all four directions. Since breeds can react to the color of squares around them, the colors of the walls may play into the behaviors of the creatures inside.

You can also set the "Trippy Mode" and the "Black Aware" status. Trippy Mode changes the way that colors are draw on the screen by averaging the colors surrounding the color, with the color itself. Black Aware enables the color black to react to colors around it in the manner designated by its behavior program. Notice

that the default state for both of these values is off. Black will only react when this feature is turned on.

Set the Behavior

By clicking the "Set Behavior" button on the main screen you will get a dialog box that allows you to set the behavior of all five breeds. Each of the five tabs across the top allow a different breed to be programmed. Every cell functions in the following manner:

1) The environment is analyzed
2) The "If" portion of the program is analyzed.
3) If the "If" portion is true, the "True" behaviors are run.
4) If the "If" portion is false, the "False" behaviors are run.

When a set of behaviors are selected (True or False), the program will randomly pick which class of behavior to run (as long as it contains a check in at least one value), and then will randomly pick which of the checks to complete. A cell will only perform one behavior per cycle.

Terms used in setting behaviors:

- Directions – Allows a cell to sense up, down, left, or right.
- Directions(9) – Allows a cell to sense in a 3 by 3 grid.
- Color – Allows a cell to sense specific colors surrounding it.
- Color(9) – Allows a cell to sense colors in the 3 by 3 grid surrounding it.
- Numbers – Allows a program to sense a specific number of neighbors.
- Numbers(9) – Allows the cell to sense a specific number of neighbors in the 3 by 3 grid surrounding it.
- And – Used to state that ALL of the related conditions must be true in order for the value to be considered true.
- Nothing – Do nothing. This, as the name implies, does nothing. Sometimes used so that another behavior will be called only 50% of the time.
- Move – Moves the given cell color in a different direction.
- Spawn – Keeps the original cell color in place, but creates a copy in a given direction.
- Color – Changes the color of the original cell to the specified color.

Blue Box Jworld GA2

This program is based on the CA program, but rather than having you program the behavior, you give the program a start behavior and an ending behavior, and the program attempts to breed the behavior by using random mutations and natural selection. You should play with CA2 first, to get an understanding of how the program works, first. When you open the program you will notice nine petri dishes where there was previously one. Each of these petri dishes in smaller in size on screen, and also has been reduced to 25x25, instead of 50x50. Should you want to edit or view the environmental variables or the behaviors, the related buttons are provided for you in a similar 3x3 pattern. Step, Start, and Stop all behave in the same fashion as in CA2. What is different about this program is the Extra Mutate button and the "SetGAInfo," which allows you to set the goal and restrictions of the program. The Extra Mutate button introduces extra mutations into all nine of the petri dishes.

SetGAInfo Dialog

The SetGAInfo dialog contains four setting and two familiar petri dishes. The petri dishes allow you to generate both the starting pattern and the ending pattern for your experiment. The four setting function as follows:

- Cycles per Round – The number of cycles of life the mutations will receive before they are judged.
- Mutations per Round – The number of mutations all petri dishes receive at the start of each round.
- Kept per Round – The number of Petri dishes kept per round. All the rest are killed are replaced with "children" of the surviving petri dishes.
- Number of Parents – The number of parents each child has. Normal is 2, like humans. Each child receives "genes" from their parents randomly. Each color behavior is considered a gene.

Statistics

On the main screen there is an area in which the statistics for the life of this experiment are kept. Statistics are based on a rating system where "0" is a perfect match to the goal and any deviation cases a petri dish to receive a higher score. All statistics based on score are kept for both the previous round and the life of the experiment.

- Best – The best score received.
- Cut-off – The point at which petri dishes are kept and those with worse scores are killed.
- Last – The least successful score.
- Round – A counter that holds an incremented counter.

Blue Box Jworld PF2

The Pathfinder program, which it looks similar to the CA2 program, is based on a different set of principals than the CA2 program. The PF2 program allows you to set up simple or complex environments in which creatures will chase after goals or each other, sometimes in patterns that will move perpetually.

Drawing in the Petri dish is similar to the CA2 program, with the addition of the "Wall" structure. The wall structure has no color, but blocks the movement of any creatures, who therefore will never try to go through it. Walls are painted just like any other color, and may be erased with black, like any other color.

Setting the environment in this program is similar to CA2, with the exception that Trippy Mode draws slightly differently. Trippy Mode shows the distance for all open cells, from the color selected in the color selector on the main screen.

Setting the Behavior

Setting the behavior, on the other hand, is different, but easier than the other programs. In this program, setting the behavior is done via a dialog box which allows you to:

Activate the color – This means that it will, under its own power, move either toward or away from its goal.
Avoid – If this checkbox is checked, the color will try to AVOID its goal, instead of finding it
Goal – This is the color that will be sought or avoided.

Credits

Concepts	Jay Kellett
Programming	Jay Kellett
Manual	Jay Kellett
Publicity Coach	Tracy Daniels
Echocardiology	Matt Esham
Secret Crushes	Amy Rentner, Montrose, PA Kate Kelly, Media, PA
Heroes	Dr. Marvin Minsky Dr. Theodore X. Barber Dr. Hunter S. Thompson

Blue Box Software and Consulting License

PLEASE READ THIS LICENSE AGREEMENT ("LICENSE") CAREFULLY BEFORE USING THE SOFTWARE. BY USING THE SOFTWARE, YOU ARE AGREEING TO BE BOUND BY THE TERMS OF THIS LICENSE. IF YOU DO NOT AGREE TO THE TERMS OF THIS LICENSE, DO NOT USE THE SOFTWARE.

1. License. The software and documentation accompanying this License, whether on disk, in read only memory, or on any other media (the “Software”), are licensed to you by Blue Box Software and Consulting. You own the disk on which the Software is recorded but Blue Box Software and Consulting and its Licensor(s) retain title to the Software. This Software and any copies which this License authorizes you to make are subject to this License.

2. Termination. This License is effective until terminated. You may terminate this License at any time by destroying the Software and all related documentation and all copies thereof. Your rights under this License will terminate automatically without notice from Blue Box Software and Consulting if you fail to comply with any of the term(s) of this License. Upon termination you must destroy the Software and related documentation and all copies thereof.

3. Export Law Assurances. You agree and certify that neither the Software nor any other technical data received from Blue Box Software and Consulting, nor the direct product thereof, will be exported outside the United States except as authorized and as permitted by the laws and regulations of the United States. If the Software has been rightfully obtained by you outside of the United States, you agree that you will not re-export the Software nor any other technical data received from Blue Box Software and Consulting, nor the direct product thereof, except as permitted by the laws and regulations of the United States and the laws and regulations of the jurisdiction in which you obtained the Software.

4. Government End Users. If you are acquiring the Software on behalf of any unit or agency of the United States Government, the following provisions apply. The Government agrees that the Software shall be classified as "commercial computer software" as that term is defined in the applicable provisions of the Federal Acquisistion Regulation ("FAR") and supplements thereto, including the Department of Defense ("DoD") FAR Supplement ("DFARS"). If the Software are supplied for use by DoD, it is delivered subject to the terms of this License and either (i) in accordance with DFARS 227.7202-1(a) and 227.7202-3(a), or (ii) with restricted rights in accordance with DFARS 252.227-7013(c)(1)(ii) (OCT 1988), as applicable. If the Software is supplied for use by any other Federal agency, it is restricted computer software delivered subject to the terms of this License and (i) FAR 12.212(a); (ii) FAR 52.227-19; or (iii) FAR 52.227-14 (ALT III), as applicable.

5. Disclaimer of Warranty on Software. You expressly acknowledge and agree that use of the Software is at your sole risk. The Software and related documentation is provided “AS IS” and without warranty of any kind and Blue Box Software and Consulting and its Licensor(s) EXPRESSLY DISCLAIM ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. BLUE BOX SOFTWARE AND CONSULTING DOES NOT WARRANT THAT THE FUNCTIONS CONTAINED IN THE SOFTWARE WILL MEET YOUR REQUIREMENTS, OR THAT THE OPERATION OF THE SOFTWARE WILL BE UNINTERRUPTED OR ERROR-FREE, OR THAT DEFECTS IN THE SOFTWARE WILL BE CORRECTED. FURTHERMORE, BLUE BOX SOFTWARE AND CONSULTING DOES NOT WARRANT OR MAKE ANY REPRESENTATIONS REGARDING THE USE OR THE RESULTS OF THE USE OF THE SOFTWARE OR RELATED DOCUMENTATION IN TERMS OF THEIR CORRECTNESS, ACCURACY, RELIABILITY, OR OTHERWISE. NO ORAL OR WRITTEN INFORMATION OR ADVICE GIVEN BY BLUE BOX SOFTWARE AND CONSULTING OR AN BLUE BOX SOFTWARE AND CONSULTING AUTHORIZED REPRESENTATIVE SHALL CREATE A WARRANTY OR IN ANY WAY INCREASE THE SCOPE OF THIS WARRANTY. SHOULD THE SOFTWARE PROVE DEFECTIVE, YOU (AND NOT BLUE BOX SOFTWARE AND CONSULTING OR AN BLUE BOX SOFTWARE AND CONSULTING AUTHORIZED REPRESENTATIVE) ASSUME THE ENTIRE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OF IMPLIED WARRANTIES, SO THE ABOVE EXCLUSION MAY NOT APPLY TO YOU.

6. Limitation of Liability. UNDER NO CIRCUMSTANCES INCLUDING NEGLIGENCE, SHALL BLUE BOX SOFTWARE AND CONSULTING OR ITS LICENSOR(S) BE LIABLE FOR ANY INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES THAT RESULT FROM THE USE OR INABILITY TO USE THE SOFTWARE OR RELATED DOCUMENTATION, EVEN IF BLUE BOX SOFTWARE AND CONSULTING OR AN BLUE

BOX SOFTWARE AND CONSULTING AUTHORIZED REPRESENTATIVE HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. SOME JURISDICTIONS DO NOT ALLOW THE LIMITATION OR EXCLUSION OF LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.
In no event shall Blue Box Software and Consulting's total liability to you for all damages, losses, and causes of action (whether in contract, tort (including negligence) or otherwise) exceed the amount paid by you for the Software.

7. Controlling Law and Severability. This License shall be governed by and construed in accordance with the laws of the United States and the State of Pennsylvania, as applied to agreements entered into and to be performed entirely within Pennsylvania between Pennsylvania residents. If for any reason a court of competent jurisdiction finds any provision of this License, or portion thereof, to be unenforceable, that provision of the License shall be enforced to the maximum extent permissible so as to effect the intent of the parties, and the remainder of this License shall continue in full force and effect.

8. Complete Agreement. This License constitutes the entire agreement between the parties with respect to the use of the Software and related documentation, and supersedes all prior or contemporaneous understandings or agreements, written or oral, regarding such subject matter. No amendment to or modification of this License will be binding unless in writing and signed by a duly authorized representative of Blue Box Software and Consulting.