**The World of Objects**



**My Girl Scouts Are Badder Than Your Girl Scouts**

**BY ROGER SESSIONS**

orne of the best program­ ming students I've taught have been 15- and 16-year

S

old Girl Scouts. At this age they are old enough to deal with intellectual issues, but still young enough to have wonder. This is the general age of my daughter Emily's troop. When the troop leader (who also happens to be my wife, Alice) asked me to help them get their computer badge, I was delighted.

I had two meetings. The first was easy. We spent an hour on the Web learning to do searches and dis­ cussing censorship and an hour at our local computer store learning to configure systems. But this still left me a second meeting to fill.

I decided that I would use that meeting to teach them C++ and how to work with object frameworks. Now I know most adults spend years learning these topics, but I figured these girls had three advantages. First, they liked computers. Second, they had nothing to unlearn. Third,



nobody had ever told them these topics were hard.

I set up a simple game framework.

The Girl Scouts then split into teams and programmed game players. The players then plugged into the game framework and played against each

other.

The game was very successful. The

girls developed some fascinating strategies, learned (with the help of

some knowledgeable C++ program­ mers) to turn these strategies into algorithms, and then to turn those algorithms into working C++ objects. They also learned what it means to work within an object framework.

It occurred to me that this project

would be even more interesting if opened up to a larger audience. So that is what I'm doing in this article. I invite all of my readers to program players for this framework, and we will have a large playoff.

I especially urge readers who are

working with youth groups, such as

Girl-5couts and Boy Scouts, to in-

volve their youth and help them to design strategies and submit players. Many of these groups offer computer badges, for which this project will probably make them eligible. To sweeten the pot, I am offering a first prize ($100), second prize ($50), and third prize ($25) to the best submis­ sions from youth groups. These prizes have been donated by Object­ Watch Inc.

Here is the basic game setup. The name of the game is "Dog Meets Dog." The goal is to program various types of dogs. The framework will create one instance each of the vari­ ous dog types, and then set up a series of rounds. In each round, two dogs will be chosen to play against each other. Each dog is told which dog it is playing against in that round. The dog then has to decide whether it will share or steal from the other dog. Both dogs make the decision. Both dogs are then informed of what the other dog

decided.

In each round, the framework

assigns payoffs to each dog. The unit of payoffs is dog biscuits. If both dogs deCide to steal, each dog is

awarded one dog biscuit. If both dogs decide to share, each dog is awarded three dog biscuits. If one dog steals and the other shares, the stealer gets five dog biscuits and the sharer none.

A full game consists of many rounds, many more rounds than there are dog objects. In the course of a game, each dog will meet each other dog many times.

I did not originate the idea for this game. I first ran into it in a book that was published several years ago,



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and one I consider highly influential in shaping my own philosophy. I am not going to give the reference now, because I want to encourage readers to develop their own game strategies rather than turn this into a research project. I will give the reference in a later article when I discuss the results of this contest.

Although I did not originate this

basic game, I have added several fea­ tures I believe to be novel. First, I have turned this into an object-ori­ ented framework. Second, I have set up the players as instances of C++ classes and have programmed both the overall framework and the dog players in VisualAge C++ running on OS/2. Third, I have made the players dogs, which for some reason has never before been done.

The game framework is typical of many frameworks: it defines and implements an architectural frame­ work in which objects operate and interact. The framework itself is a program. It instantiates specialized objects and coordinates their inter­ actions. The pseudo-code for the game framework program is shown in Listing 1.

Two related interactions occur in each round of the game. In the. beginning of the round, the dogs are asked what they want to do with their opponents. At the end of the

round, the dogs are informed of

what their opponents decided to do with them.

Each dog is assigned a unique, stable ID, which is a long integer. This ID is assigned by the frame­ work at the time the dog is instanti­ ated, and it never changes. The dogs are identified to each other by this ID. So when a dog is asked how it

wants to interact with dog 14, it can

base its decision on its history of previous interactions with dog 14. When the dog is told what dog 14 decided to do, it can make a note of

that information to be used in

future interactions when it meets dog 14 again.

The dogs are not told about inter­ actions in which they did not partici­ pate; for example, dog 11 is not told

**Listing 2: C++ Definition of a dog player.**



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of the outcome between dog 12 and dog 3.

In an object-oriented framework,

base classes are typically provided. These base classes contain both con­

1: crete methods (ones that have been fully implemented) and abstract

methods (ones that have been defined but not implemented). The

**Listing 3: Definition of niceDog.**



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abstract methods are the hooks by which programmers provide special­ ized objects.

As an example, let's look at the

C++ definition of dog, shown in List­ ing 2. I have simplified the definition by showing only protected and pub­

lic areas.

First of all, let's consider the pur­

pose of the different protec­ tions. C++ provides three dif­ ferent protection types within a class definition. The *public* region defines information about the class that anybody can use. The *protected* region defines information that can be used only by methods in this class or derived classes. The *private* section defines information that can only be used by methods of this class (dog).



The dog's public region contains both virtual and

method cannot be overridden. If you are not familiar with the concept of overriding methods and polymor­ phism, see the February issue of *OS/2*

*Magazine* ("littleDogs, Polymor­

phism, and Frameworks," p. 46).

Two of the virtual methods are declared using the peculiar C++ syn­ tax =0 (for example, lAmA()). This syntax is used to declare an abstract virtual method.

So the dog methods have the fol­

lowing characteristics:

Ill They may be public or protected.

Ill They may be virtual or nonvirtual. Ill They may be abstract or concrete.

Let's see how we make these choices.

Methods that will be called by the framework are public. An example of this is the method meetOtherDog, the method used by the framework to ask the dog how it wants to inter­

act in this round. Methods that are

nonvirtual methods. A virtual used only within dog are private, method can be overridden in and those intended for derived dog a derived class. A nonvirtual types are protected. An example of a protected method is whatHappened­ lnPreviousMeetingWithThisDog, a

**Listing 5: Implementation of sneakyDog's meetOtherDog.**



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method intended to be used by the override of meetOtherDog.

Methods that the dog types either may or must override are virtual.

Methods that the dog types *may* override are concrete and virtual. An example of a method that the dog types may override is thislsWhat­ Happened, the method used by the framework to tell the dog the result of the round. The base class provides a perfectly acceptable implementa­ tion of this but also allows the dog types to override it, if the program­ mer has a better idea.

Methods that the dog types *must* override are abstract and virtual. An example of such a method is meet­ OtherDog. The whole point of this game is for the dog to provide a dif­ ferent implementation of this method, so no default is provided.

Methods that the dog may not override are nonvirtual. Dogs are not allowed to change their IDs, so the methods that deal with IDs, such as whatlsYourNumber are nonvirtual.

A typical dog type will be relative­ ly simple, overriding exactly two methods: lAmA and meetOtherDog.

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lAmA is used by the framework to determine the class of the dog. meet­ OtherDog is used to determine the dog's decision on the round.

A typical example of a dog type is

niceDog ( Listing 3). Like all players, niceDog is derived from our frame­ work-provided dog. As you can see, the actual work involved with defin­ ing a new dog type is much less than you would expect from the dog discussion. Notice that while nice­

Dog doesn't say anything about

overriding the meetOtherDog method, this is implied by the fact that the base class declared the method virtual.

niceDog uses one of the simplest possible algorithms in its implemen­ tation of meetOtherDog. Its code is shown in Listing 4. It always shares. We might rename niceDog to be patsyDog.

I have also implemented a bad­ Dog, a dog that always steals.

Most dogs will base their decision on whether to share or steal with a particular dog on information about previous encounters with that dog. The protected virtual methods defined for dog are provided for that purpose. One example of such a dog is sneakyDog, who always does the reverse of what he did last time he met that dog. If last time he shared, this time he steals. sneakyDog's implementation of meetOtherDog is shown in Listing 5. sneakyDog is one of the dogs the Girl Scouts invented.

sneakyDog bases his share/steal decision only on the last interaction

with the other dog. unforgivingDog

Figure **1:** Six rounds of dog meets dog. •



looks through the entire previous history of interactions with the other dog. If the other dog ever stole, then unforgivingDog steals. She never gives you another chance. Her implementation is shown in Listing 6.

Notice that both sneakyDog and unforgivingDog make extensive use of the protected dog methods. None of the dog implementations shown here take advantage of the opportu­ nity to override these methods. I don't see why anybody would want to override these, but I also don't want to eliminate the possibility.

Let's look at a few rounds of this game. Figure 1 shows six rounds and

the decisions each dog makes based on their own implementations of meetOtherDog. Notice that the framework instantiates only one of each dog type.

This should give you an idea of the game. Now it's your turn. Can you beat puddingHeadDog, another of Troop 161's inventions? Or how about jeanBobDog? (This is a Texas

troop!)

**Fine Print**

OK. Here is the deal:

1. All entries must be e-mailed to *roger@{c.net* before September 1st. All entries must have a return e-mail address.

2. All entries must compile on VisualAge C++ on OS/2 without warnings or errors. I will not fix errors or warnings.

3. In the event that I am inundat­ ed with entries, I reserve the right to limit the contest to the first SO entries from youth groups.

4. One instance of each dog will be instantiated and played against each other dog. Each dog will play against each other dog at least five times, perhaps much more.

5. An entry consists of a header file (similar to Listing 3) and an

implementation file consisting of code for lAmA, modeled after the The World Of Objects, *cont'd on p. 63*

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**Objects**

The World of Objects, *cont'd {romp. 47* code in Listing 4, and meetOther­ Dog, using the algorithm of your choice.

6. Youth groups are allowed to

have help with the coding, but you must promise that they developed the algorithms on their own.

7. One entry per e-mail address. If a youth group is involved, it must be identified.

8. No cheating by overriding methods you shouldn't override or updating private data you shouldn't

be accessing.

So? Are you in?

Your first stop is the SOMobjects

Home Page where I will maintain a

full set of the official rules and a *.zip* file containing·all the files you need to· compile and test this framework using VisualAge C++. I will include several sample dog types. On the SOMobjects Home Page, look for a link to the *OS/2 Magazine* Dog Meets Dog Contest. The URL for the SOM­ objects Home Page is *http://www.fc. net/-roger/owatch.htm.*

Good luck. You'll need it. My

Girl Scouts are bad. Dim

***Acknowledgements***

I am grateful to Girl Scout Troop

161 (Amy, Emily, Meg, Catie, Erin,

Zer, and Chandra) and its intrepid leader (and my wife) Alice Sessions for their inspiration for this article.

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**REXX**

The REXX Column, *cont'd from p. 56*

By using a trace instruction that gets its settings from your own envi­ ronment variable, you can eliminate this hassle. I use an environment vari­ able of TRACE in my own programs and have a group of instructions, all written as a single line with the instructions separated with semi­ colons, which I move around in the program as I need it. When I want it out of the way, I move the entire line to a position in the program where program flow will never reach it. I call this instruction my "magic" trace instruction, and it lies dormant in *skeleton.cmd* until I need it. I can then move it to the point where I want it and run the program with an envi­ ronment variable of SET TRACE=?R to cause interactive tracing. I then reset the environment variable with

SET TRACE= to negate the trace. Dim

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