

# MEETING OF THE MINDS

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## Building a Better Mousetrap: If It's Virtual, Can Its Patent Be Infringed?

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If a tree falls in a virtual forest, and there is no avatar to hear it, does it make a sound? The real-world version of this question has generated philosophical discussion dating back to at least the early 1700s,<sup>1</sup> generally centering around the difference between the physical manifestation of sound, as vibrations in air, and the human perception of those vibrations. For the virtual world version, however, the answer is simply “No,” as there is not even a physical manifestation of sound, unless there is a nearby avatar. Discussion of this question does, however, give us the opportunity to provide a brief introduction to some issues regarding virtual worlds that are relevant to the question that forms the real basis for this article: “If a mouse is caught in a virtual mousetrap, and the mousetrap is patented, is there infringement?”

An inventor or a patent attorney may reasonably wonder why she should care. However, virtual worlds such as Second Life have thriving economies, which include the purchase and sale of potentially patented inventions. And besides environments such as these that have primarily entertainment uses, there are instances where a virtual version of a mechanical invention may have a very practical, economic, and business purpose. For example, consider a patented mechanism that forms part of a complex aircraft. Simulations of aircraft are commonplace for a range of purposes, including pilot training and predicting maintenance issues. An inventor may find that there is substantial economic value in the use of her invention in such a virtual environment.

### Virtual Worlds

“A virtual world is a genre of online community that often takes the form of a computer-based simulated environment, through which users can interact with one another and use and create objects.”<sup>2</sup> Unfortunately, this definition,

like any other, does little to capture the essence of what a virtual world is, and the reader is encouraged to explore some of the virtual worlds currently available online, such as Second Life,<sup>3</sup> World of Warcraft,<sup>4</sup> and Eve Online.<sup>5</sup> We will discuss here a few technical issues that will be helpful in considering the questions posed at the outset of this article, and in understanding the remainder thereof.

In essence, a virtual world is an attempt to simulate the real world using computers. In the real world, the behaviors of objects are governed by the laws of physics. In a virtual world, the behaviors of virtual objects are governed by computer software, this software being designed to simulate the laws of physics as accurately as is practical. For example, when a ball is dropped in the real world, it will fall because of the force of gravity. That fall will be resisted by friction and aerodynamic forces, and eventually by the collision of the ball with the ground. Other physical forces will cause the ball to bounce, or perhaps to break, depending on the properties of materials it is made of. In a virtual world, an object like a ball is represented by information stored in a computer. That information will include the ball's location, its speed and direction of motion, if it is moving, and other attributes relating to its appearance. Depending on how detailed the simulation is, it may also include information about the materials the ball is made

of, how much it weighs, etc.<sup>6</sup> When a virtual ball is dropped, the computer calculates, for successive small intervals of time, how a real ball, having the same properties as the virtual ball, would behave, and then applies that behavior to the virtual ball, changing its location, speed, etc. When the virtual ball hits the ground, likewise the virtual world software will compute what would happen to an equivalent real ball in those circumstances, and appropriate changes will be made to the attributes of the virtual ball, and, potentially, also to the properties of the ground. For example, the ball may change shape, break into pieces, change speed and direction of movement, etc. Coming back to our initial question, depending on the level of detail of the virtual world, when the ball hits the ground, it may also calculate any sound that would be made by a real ball in such circumstances.

Up to this point all of this is just numbers and calculations inside the computer—a purely mathematical simulation. We perceive the state of a virtual world through the eyes (and ears) of avatars. Avatars are representations of individuals that exist in and interact with the virtual world, under control of real people. When an avatar is looking in a particular direction, the objects that would be within its field of view are displayed on the computer of the person controlling the avatar. Similarly, if the virtual world simulates any sounds,

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these would be played through the speakers of the computer used by the person controlling any avatar that was within range of the sound. As successive computations are made, the images seen by, and any sounds heard by, the avatars are updated, giving the appearance of a dynamic virtual world.

Returning to our initial question, if there are no avatars nearby the falling tree, then no sound is made. At most, all that is done is that a computer representation of the sound is computed, but that representation is never played through any speakers, so no sound is ever produced, not even under the strictly physical interpretation of sound as vibrations in air. In fact, the virtual world would likely optimize its calculations so that it did not even calculate a representation of a sound unless it was within range of an avatar.

### Virtual Mousetraps

With a basic understanding of virtual worlds, we now turn to the question forming the basis of this article: “If a mouse is caught in a virtual mousetrap, and the mousetrap is patented, is there infringement?” In addressing this question, for the remainder of this article, we will consider the situation where a patented mousetrap has been directly copied within a virtual world. Our discussions will focus primarily on machine patents, but we will address process patents briefly when appropriate. We will use a particular patented mousetrap for illustrative purposes, “A trap

for capturing mice or other rodents,” U.S. Patent No. 5,471,781 (December 5, 1995), illustrated in the figure below.

### Building a Virtual Mousetrap

We will first consider what it means to build a virtual copy of the patented mousetrap. In the real world, we all know what it means to build a mousetrap—the various parts are formed from appropriate materials, through techniques such as molding, machining, etc., and then are combined with appropriate fasteners and other hardware. In a virtual world, however, an object is constructed by creating a description of the object in a form that can be manipulated by the virtual world software, in order to simulate the behavior of the object. Properties of parts are specified, as well as their relative positions and orientations. Interactions between parts are defined (such as the pivoting action of the door at point 52), and this information is stored within the virtual world software. At this point, what has been constructed can be thought of as a template, from which many virtual mousetraps can be created. The person who built this template can provide it for use by other users of the virtual world (either for free, or for a price), or simply use it herself. Each of the mousetraps thus created would have its own properties (e.g., its location in the virtual world, the current position of the trap door, whether there is virtual bait inside, etc.). For the purposes of determining patent infringement, it is necessary to consider when a virtual mousetrap is actually “made”—is it when the template is constructed or when that template is used to place a particular instance based on the template within the virtual world? If it is not until the instance is created, then it becomes much more difficult to tie infringement to the person who actually copied the patented trap.

### Making, Using, or Selling

Infringement is found when a patented article is made, used, or sold.<sup>7</sup> We will return later to the question of whether or not the virtual mousetrap would be considered a patented article, and we will first consider when such an article is made, used, or sold. “Use” is the easiest of these to deal with, so we will address it first.

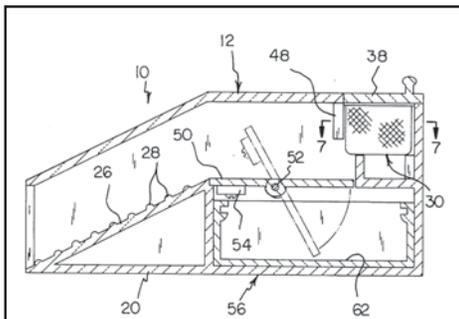
It is clear that a virtual mousetrap is used when an instance of it is placed in

a position where it has the potential to catch (virtual) mice. The problem with using this as the basis for infringement, however, is that this activity is carried out by the end-user of the mousetrap, and the patent holder would have to individually sue these users. In order to be able to keep infringing articles out of the marketplace, the patent holder will want to be able to enforce the patent against those who manufacture or sell the infringing traps—that is, the person who created the copy of the mousetrap, as discussed in the previous section.

When this alleged infringer created a copy of the patented mousetrap, what was created bears more resemblance to computer programs and data structures than any physical object. The specification is really a set of instructions for the virtual world, used to simulate the behavior and appearance of a mousetrap when the end user places an instance of it in the virtual world. Until the end-user places such an instance in the virtual world, it is nothing more than an abstract computer representation.

To complicate matters further, it is not entirely clear what constitutes a sale in a virtual world, and what is it that is sold. Virtual objects certainly are bought and sold,<sup>8</sup> but no personal property exchanges hands in these transactions. In fact, what the purchaser acquires for his or her money is a license to use the abstract representation of the virtual mousetrap to create an instance of this trap in the virtual world.<sup>9</sup> Of course, licensing an infringing article still constitutes infringement insofar as the licensee is *using* the invention without authorization of the patentee,<sup>10</sup> but what is it that is licensed? It is the set of computer instructions that the virtual world can use to create a representation of the mousetrap, and it is undecided whether or not courts would consider this to be the sale (or licensing) of the virtual object itself. We will discuss below options available to the patent holder if the court finds that a patented article is created only when the virtual mousetrap is instantiated by the end user.

Recall that, as mentioned at the outset, we are considering specifically machine patents. If the inventor of our mousetrap patent had also claimed the process used to catch the mouse, then the question would be whether or not



It would be straightforward for someone to build a virtual copy of this mousetrap, and, if the virtual world were detailed enough and contained virtual mice, and if such a mouse were to climb up the ramp (26) and onto the trap door, the door would pivot (at point 52) under the weight of the mouse, and the mouse would be trapped in the compartment underneath (62).

catching a virtual mouse in the virtual mousetrap would constitute carrying out the patented process using a computer. This would involve many similar concerns to those addressed in this article, but also others that are beyond the scope of this article.

### **Direct Infringement**

In order for the patent holder to have any hope of enforcing her patent against the virtual copier, at some point direct infringement must be found. “Determining whether a patent claim has been infringed requires a two-step analysis: ‘First, the claim must be properly construed to determine its scope and meaning. Second, the claim as properly construed must be compared to the accused device or process.’”<sup>11</sup> For illustrative purposes we will consider one component of one element of claim 1 in our mousetrap patent: “a trap door pivotally mounted within said main body.” In construing claim 1, the court will have to consider, among other things, whether or not a virtual representation of a trap door is a trap door for the purpose of this claim. If the patentee had provided support for the inclusion of virtual representations of trap doors in the specification of the patent, then the court’s decision would likely be that the virtual trap door is included; however, that is not the case with our mousetrap patent. Without such support in the specification, it is difficult to predict whether or not the court would consider virtual trap doors to fall within the ordinary meaning of a trap door. Similarly, it is uncertain whether the court would consider the virtual trap door to be pivotally mounted, and whether or not it is mounted within the main body. However, it does seem more likely that, at least in some circumstances, the court would not consider a claim to be directly satisfied by a virtual element, when the patent describes only physical things. Thus, we must consider other options for the inventor.

### **The Doctrine of Equivalents**

Judge Learned Hand characterized the doctrine of equivalents as follows: “[A]fter all aids to interpretation have been exhausted, and the scope of the claims has been enlarged as far as the words can be stretched, on proper occasions courts make them cover more

than their meaning will bear.”<sup>12</sup> As discussed above, it seems likely that our mousetrap inventor will have to rely on the application of this principle in order to find direct infringement by a virtual mousetrap when the patent’s specification does not discuss virtual representations of the invention. Returning to our trap door example, the court will need to decide if a virtual trap door does “the same work in substantially the same way, and accomplish[es] substantially the same result”<sup>13</sup> as a physical trap door as described in the patent. If the court so finds, then it must find that “they are the same, even though they differ in name, form or shape.”<sup>14</sup>

The first question to be asked is: What is the work performed by the trap door in the patented invention? The answer is that the trap door provides a surface onto which a mouse may walk in search of the bait, only to then drop away from under the unsuspecting creature’s feet. The virtual trap door does appear to perform the same work. The form or shape is different, as is the form or shape of the mouse, but the work performed is the same. The next question, then, is whether or not they perform that work in substantially the same way. The patented trap door performs its work by rotating out of the way around a pivot point due to the force of gravity acting on the mouse. The virtual trap door does not, of course, respond to any physical forces, but it does respond to an accurate simulation of these forces. This seems to be the weakest point in the argument for infringement, and is likely to be the point on which the court’s decisions will rest, but there is at least a strong argument that mathematical simulations of physical forces are substantially similar to the actual forces. These questions all relate to the issue of equivalence between a physical thing and a simulation of that thing. Although we have found no case law dealing with this topic directly, some courts have suggested an openness to such considerations, indicating that a simulation may be considered a reduction to practice in certain circumstances.<sup>15</sup>

Supposing then that the court does find that a virtual world simulation is equivalent to a physical object, then the next consideration will be whether or not the result accomplished by the patented

trap (i.e., catching a real mouse) is substantially similar to the result of the virtual trap (i.e., catching a virtual mouse). It seems likely that, if the court has found that the way is similar, then the court will find that the result is also similar. However, a contrary argument that a real mouse is not the same as a virtual mouse is also somewhat persuasive. These questions will be determined based on the court’s determination of similarity between a virtual world and the real world. For the purposes of the remainder of this article, we will assume that the patentee has been successful in convincing the court that a virtual world is substantially similar to the real world.

### **Indirect Infringement**

Supposing, as described above, that direct infringement is found on the part of the end user of the virtual mousetrap—but not on the part of the creator of the virtual mousetrap—we now consider other options for the patentee to enforce the patent against the virtual mousetrap creator, other than direct infringement. The inventor also could pursue a claim of indirect infringement. Indirect infringement comes in two forms: contributory infringement and inducing infringement. In both cases, knowledge of the patent is required on the part of the alleged indirect infringer.<sup>16</sup> In our example, where the virtual mousetrap was copied directly from the patent, this can easily be established, but, of course, this may not always be the case in other situations.

Presuming knowledge of the patent, in order for the court to make a finding of inducing infringement “there must first be an act of direct infringement and proof that the defendant knowingly induced infringement with the intent to encourage the infringement. The defendant must have intended to cause the acts that constitute the direct infringement and must have known or should have known [that] its action would cause the direct infringement.”<sup>17</sup> This is a high bar, but, given that the virtual mousetrap has no other purpose than to catch virtual mice, it seems at least possible that the court would find in the patentee’s favor. The situation with respect to contributory infringement is similar but more straightforward: “All that is required for a finding of contributory

infringement is (1) knowledge of the activity that is alleged to be infringing . . . and (2) knowledge of the patent.”<sup>18</sup> Given that it is difficult to imagine any noninfringing use of the virtual mousetrap, much less any such substantial use, it seems possible that the court could find that the virtual mousetrap copier is a contributory infringer.

### Use by the Virtual Copier

The previous argument against the creator of the virtual mousetrap relies on knowledge of the patent on the part of the copier. In our particular hypothetical, this is the case, but this will certainly not always be so. In instances where the alleged infringer is not aware of the patent, there is still one option left for the patentee to recover damages with respect to past infringements.<sup>19</sup> Our inventor can argue that the virtual copier created instantiations of the virtual mousetrap during development and testing, and that, but for these uses of the virtual mousetrap, the alleged infringer would not have been able to develop and sell the virtual mousetrap, and the patentee would have been able to realize these sales herself. This last aspect may turn out to be troublesome. If our inventor is only selling real mousetraps, then the virtual copier can argue that these sales would not have gone to the patentee (and, presumably, the virtual world would simply have been overrun with mice), and the patentee would not be able to recover lost profits. However, even in this case, the inventor still would be entitled to a reasonable royalty.<sup>20</sup>

### Conclusions

In order to avoid the uncertainties discussed above regarding enforcement of machine patents against virtual representations of those machines, there are steps that inventors may want to take, particularly if they anticipate that their inventions may have uses in virtual environments. First of all, when preparing the patent application, inventors may want to specifically include virtual representations of their inventions, including abstract representations of such, so as to capture the model, and not just the instances created by the end users. One difficulty here would be in ensuring that the claims remain patentable subject matter. A virtual model is simply a

complex data structure, and might not, in itself, be patentable.<sup>21</sup> Furthermore, inventors of mechanical devices may want to include process claims that cover the functionality of their inventions, which could then be applied to the performance of these processes by computer, in a virtual environment.

In light of the analysis above, the only thing that can be said with any certainty is that it would be very difficult to predict how a court would rule if presented with a scenario as we have outlined in this article. Any such decision, however, would necessarily depend on the level of detail in the patent’s specification and the level of knowledge of someone of ordinary skill in the art. This raises another question: does the level of knowledge of someone of ordinary skill in the art for, say, a complex machine include knowledge about virtual representations and/or simulations of that complex machine in a virtual world? That, however, is a question for another day. ■

### Endnotes

1. *If a Tree Falls in a Forest*, WIKIPEDIA, [http://en.wikipedia.org/wiki/If\\_a\\_tree\\_falls\\_in\\_a\\_forest](http://en.wikipedia.org/wiki/If_a_tree_falls_in_a_forest).

2. *Virtual World*, WIKIPEDIA, [http://en.wikipedia.org/wiki/Virtual\\_world](http://en.wikipedia.org/wiki/Virtual_world) (citing J. Bishop, *Enhancing the Understanding of Genres of Web-Based Communities: The Role of the Ecological Cognition Framework*, 5:1 INT’L J. WEB-BASED COMMUNITIES 4 (2009)).

3. SECOND LIFE, <http://www.secondlife.com>.

4. WORLD OF WARCRAFT, <http://www.worldofwarcraft.com>.

5. EVE ONLINE, <http://www.eveonline.com>.

6. We refer here, and throughout the article, to physical properties of a virtual object, such as the material the virtual ball is made of. Of course, a virtual ball isn’t made of anything—it is not a physical object, but just a computer representation intended to simulate a physical object. When we refer to physical properties of virtual objects, we are referring to the simulations of those properties. For example, if our virtual ball has been specified as being made of rubber, then the simulation will attempt to mimic the behavior of a rubber ball as closely as possible.

7. 35 U.S.C. § 271(a).

8. *See, e.g.,* Nelson Linden, *The Second Life Economy in Q3 2010*, SECOND LIFE BLOGS (Oct. 28, 2010, 2:04:35 PM), <http://blogs.secondlife.com/community/features/blog/2010/10/28/the-second-life-economy-in-q3-2010>.

9. This license aspect is made quite clear by the restrictions that come with these sales. They

may or may not include, for example, permission to copy and/or modify the object.

10. 35 U.S.C. § 271(a).

11. *Ekchian v. The Home Depot, Inc.*, 104 F.3d 1299, 1302 (Fed. Cir. 1997) (quoting *Carrol Touch, Inc. v. Electro Mech. Sys., Inc.*, 15 F.3d 1573, 1576 (Fed. Cir. 1993)); *see also* *K-2 Corp. v. Salomon S.A.*, 191 F.3d 1356, 1362 (Fed. Cir. 1999).

12. *Royal Typewriter Co. v. Remington Rand, Inc.*, 168 F.2d 691, 692 (2d Cir. 1948).

13. *Graver Tank & Mfg. Co. v. Linde Air Prods. Co.*, 339 U.S. 605 (1950).

14. *Id.*

15. *Mosaid Techs. v. Samsung Elecs. Co.*, 362 F. Supp. 2d 526, 547 (D.N.J. 2005) (citing *McDonnell Douglas Corp. v. U.S.*, 229 Ct. Cl. 323, 670 F.2d 156, 161 (1982)).

16. For contributory infringement, the knowledge requirement is statutory, under 35 U.S.C. § 271(c). For inducing infringement it is well established in case law; *see, e.g.,* *Water Techs. Corp. v. Calco, Ltd.*, 850 F.2d 660, 668 (Fed. Cir. 1988).

17. *DSU Med. Corp. v. JMS Co., Ltd.*, 471 F.3d 1293, 1305 (Fed. Cir. 2006).

18. *Sandisk Corp. v. Lexar Media, Inc.*, 91 F. Supp. 2d 1327, 1335 (N.D. Cal. 2000).

19. Once the patentee provides notice to the alleged infringer, then the arguments based on knowledge of the patent will, of course, apply.

20. *Rite-Hite Corp. v. Kelley Co. Inc.*, 56 F.3d 1538 (Fed. Cir. 1995) (en banc) (“A patentee is entitled to no less than a reasonable royalty on an infringer’s sales for which the patentee has not established entitlement for lost profits.”).

21. U.S. PATENT & TRADEMARK OFFICE, MANUAL OF PATENTING EXAMINING PROCEDURE § 2106.01 (Sept. 2007). For a thorough discussion of data structures and patentability, *see, for example,* Andrew J. Hollander, *Patenting Computer Data Structures: The Ghost, the Machine and the Federal Circuit*, 2003 DUKE L. & TECH. REV. 33.