United States Court of Appeals for the Federal Circuit

04-1470

XEROX CORPORATION,

Plaintiff-Appellant,

v.

3COM CORPORATION, U.S. ROBOTICS CORPORATION,
U.S. ROBOTICS ACCESS CORP., PALM COMPUTING, INC.,
PALM, INC., PALMSOURCE, INC., and PALMONE, INC.,

Defendants-Appellees.

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Appealed from: United States District Court for the Western District of New York

Judge Michael A. Telesca

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DECIDED: June 8, 2006

Before NEWMAN, RADER, and BRYSON, Circuit Judges.

BRYSON, Circuit Judge.

Xerox Corporation appeals from a summary judgment entered by the United States District Court for the Western District of New York, in which the court held invalid claims 1-3 and 7-16 of Xerox's U.S. Patent No. 5,596,656 ("the '656 patent"). Because we conclude that there are genuine issues of material fact remaining in dispute with regard to whether the prior art discloses all of the relevant claim limitations, we reverse the grant of summary judgment of invalidity for anticipation and obviousness and we remand the case to the district court for further proceedings on those issues. Because we conclude that claims 9 and 11 are not insolubly ambiguous, we reverse the district court's grant of summary judgment holding those claims invalid for indefiniteness.

I

The ’656 patent discloses a system and method for “computerized interpretation of handwritten text.” ’656 patent, col. 2, ll. 36-37. The system employs an alphabet of “unistroke symbols” that correspond to alphanumeric characters such as Arabic numerals and the letters of the English alphabet. Each unistroke symbol consists of a single, unbroken pen stroke that can be recognized by a computer upon some delimiting operation, such as lifting the pen from a computer-connected, pressure-sensitive writing surface.

Claims 1-3 and 7-16 of the ’656 patent provide as follows:

1. A system for interpreting handwritten text comprising

> a user interface including a manually manipulable pointer for writing mutually independent unistroke symbols in sequential time order and a user controlled signaling mechanism for performing a predetermined, symbol independent, delimiting operation between successive unistroke symbols in said sequential order, some of said unistroke symbols being linear and others being arcuate, each of said unistroke symbols representing a predefined textual component said delimiting operation distinguishing said unistroke symbols from each other totally independent of without reference to their spatial relationship with respect to each other;
>
> a sensor mechanism coupled to said user interface for transforming said unistroke symbols into corresponding ordered lists of spatial coordinates in said sequential order;
>
> a recognition unit coupled to respond to said sensor mechanism for convening said ordered lists of coordinates into corresponding computer recognizable codes in said sequential order, each of said codes representing a corresponding textual component;
>
> a display; and
>
> a character generator coupled to said recognition unit and to said display for writing the textual components defined by said codes on said display in a spatial order that corresponds to the sequential order of said codes.

2. The system of claim 1 wherein

said user interface further includes a substantially planar writing surface;

said unistroke symbols are written on said writing surface; and

said sensor mechanism transforms each of said unistroke symbols into an ordered list of x,y coordinate pairs.

3. The system of claim 2 wherein

said pointer is a passive device that is manually engaged with, drawn across, and then disengaged from said writing surface to define the geometric shape and direction of each of said unistroke symbols; and

said writing surface is interfaced with said sensor mechanism for inputting the geometric shape and direction of each of said unistroke symbols to said sensor mechanism.

7. The system of any of claims 2-6 wherein

said pointer is a stylus.

8. The system of claim 2 wherein

said unistroke symbols are delimited from each other in said sequential time order by making and breaking contact between said pointer and said writing surface once for each unistroke symbol.

9. The system of claims 2, 3, 4, 5 or 6 wherein said unistroke symbols are well separated from each other in sloppiness space.

10. A machine implemented method for interpreting handwritten text comprising

writing said text in sequential time order using an alphabet of mutually independent unistroke symbols to spell out said text at an atomic level, each of said unistroke symbols conforming to a respective graphical specification that includes a stroke direction parameter, some of said unistroke symbols having graphical specifications that differ from each other essentially only on the basis of their respective stroke direction parameters, some of said unistroke symbols being linear and others being arcuate;

entering a predetermined, symbol independent delimiter between successive ones of said unistroke symbols in said time order, said delimiter distinguishing successive unistroke symbols from each other without reference to and totally independently of their spatial relationship with respect to each other;

capturing the stroke direction of each of said unistroke symbols as an ordered list of coordinates;

disambiguating said unistroke symbols from each other based upon predetermined criteria, including the stroke directions of the respective symbols.

11. The method of claim 10 wherein said unistroke symbols are well separated from each other in sloppiness space.

12. A handwriting recognition process for pen computers, said process comprising the steps of

correlating unistroke symbols with natural language alphanumeric symbols, each of said unistroke symbols being fully defined by a single continuous stroke that conforms geometrically and directionally to a predetermined graphical specification, some of said unistroke symbols being linear and others being arcuate;

entering user written unistroke symbols into buffer memory in sequential time order, successive ones of said unistroke symbols being delimited from each other by a predetermined, symbol independent delimiting operation, said delimiting operation distinguishing successive unistroke symbols from each other without reference to and totally independently of their spatial relationship with respect to each other;

reading out said unistroke symbols from buffer memory in sequential time order to provide buffered unistroke symbols;

translating each buffered unistroke symbol that correlates with a natural language symbol into said natural language symbol; and

outputting any natural language symbols that are produced by such translating to a utilization device.

13. The handwriting recognition process of claim 12 wherein certain unistroke symbols correlate with natural language alphanumeric symbols, and other unistroke symbols correlate with user invokeable control functions.

14. The handwriting process of claim 13 wherein at least one of said other unistroke symbols correlates with a control function that shifts the correlation of at least some of said certain unistroke symbols from one

set of natural language alphanumeric symbols to another set of natural language alphanumeric symbols.

15. The handwriting recognition process of claim 14 wherein said control function shifts said correlation for just one following unistroke symbol and then restores said correlation to an initial state.

16. A machine implemented handwriting recognition process comprising the steps of

correlating natural language symbols with unistroke symbols, where each of said unistroke symbols is fully defined by a single continuous stroke that conforms geometrically and directionally to a predetermined graphical specification, at least certain of said unistroke symbols being arcuate;

writing user selected unistroke symbols in sequential time order while performing a predetermined, symbol independent delimiting operation for delimiting successive ones of said unistroke symbols from each other, said delimiting operation distinguishing successive unistroke symbols from each other without reference to and totally independently of the spatial relationship of said unistroke symbols with respect to each other;

detecting said selected unistroke symbols; and

translating the detected unistroke symbols that are written into said machine into a corresponding natural language representation.

In 1997, Xerox brought suit against 3Com Corporation and six other defendants (collectively, "3Com"). Xerox alleged that the '656 patent was infringed by 3Com's "Graffiti" system for handwriting recognition, which is used with 3Com's PalmPilot handheld digital devices. 3Com then requested that the U.S. Patent and Trademark Office reexamine the '656 patent. Following consideration of a number of prior art references, including a journal article written by D.J. Burr and a Japanese patent application by Tadahiro Nagayama, the Patent and Trademark Office confirmed the patentability of all 16 of the patent's claims.

The district court meanwhile construed the claims and granted summary judgment of noninfringement. On Xerox's appeal to this court, we agreed with the district court's construction of certain contested claim terms: We upheld the district court's ruling that the term "unistroke symbols" requires "sufficient graphical separation for the computer to definitively recognize a symbol immediately upon delimitation or pen lift." Xerox Corp. v. 3Com Corp., 267 F.3d 1361, 1366 (Fed. Cir. 2001) ("Xerox I"). We also agreed that "spatial independence" means that the invention must be "capable of properly distinguishing and recognizing symbols without reference to where a previous symbol was written on the writing surface." Id. at 1367.

Nonetheless, we concluded that the district court had erred in granting summary judgment of noninfringement. In particular, we disagreed with the court's conclusion that it was clear that the Graffiti symbols were not sufficiently "graphically separated" from each other to be unistroke symbols; that the Graffiti system did not allow for "definitive recognition" of symbols immediately upon pen lift by the user; and that the Graffiti system did not feature "spatial independence." First, we noted that a number of the claims recited symbols having graphical separation based on "geometric shape and direction," and that some of Graffiti's symbols, which are similar geometrically, are distinguishable based on stroke direction. We held that the district court had erred in "looking only to the geometry of the symbol and ignoring the direction the pen must travel to create the symbol." Id. at 1368. Second, we held that the district court "was incorrect that Graffiti does not allow for definitive recognition of all symbols immediately upon pen lift," since none of the Graffiti symbols are altered by subsequent strokes. Id. Third, we held that the court had erred in concluding that Graffiti "does not employ 'spatial independence.'" Id. The spatial independence limitation is met, we held, "if the computer recognizes the symbol without reference to where a previous symbol was written," which is a feature found in the Graffiti system. Id. at 1369 (emphasis in original). We therefore remanded the case to the district court for further proceedings on the issues of infringement and invalidity.

On remand, the district court granted summary judgment of infringement. In addition, the court held that the '656 patent was not invalid because it concluded that this court, in Xerox I, "presumably did not construe the claims in such a way as to be invalid." Xerox Corp. v. 3Com Corp., 198 F. Supp. 2d 283, 296 (W.D.N.Y. 2001). 3Com appealed from that judgment. On appeal, we affirmed the district court's claim construction and its grant of summary judgment of infringement. With respect to the issue of invalidity, however, we held that our prior decision on the issue of claim construction "did not obviate the need for a separate validity analysis," and we therefore reversed the district court on that issue. Xerox Corp v. 3Com Corp., 61 Fed. Appx. 680, 681 (Fed. Cir. 2003) ("Xerox II").

In doing so, we addressed a point raised on appeal "[i]n an effort to provide some guidance to the district court on remand." Xerox II, 61 Fed. Appx. at 684. Specifically, we explained that "definitive recognition" does "not require a permanent, unalterable choice of a symbol that cannot be changed if the recognition is later determined to be erroneous." Id. That is, "subsequent action by the user or subsequent processing by the computer to delete or replace [the] symbol does not negate . . . recognition." Id. In short, "definitive recognition" occurs when the "system completes the recognition of the unistroke symbol." Id.

On remand, the district court issued two orders. In its first order, the court granted summary judgment of invalidity. Xerox Corp. v. 3Com Corp., No. 97-CV-6182T, at 16 (W.D.N.Y. May 26, 2004). The court found that "[b]oth the Burr and Nagayama references teach the use of single-stroke symbols that are definitively recognized upon pen lift." Id. at 10. In response to Xerox's argument that both systems provide for additional actions following symbol recognition, the district court pointed to this court's decision in Xerox II and explained that "these additional manipulations of the entered data do not transform the definitive recognition of the symbol that has already occurred into tentative recognition." Id. at 11. Thus, the district court concluded that the evidence demonstrates that "each reference discloses the creation of unique symbols which are capable of being definitively recognized by the recognition device." Id. at 12.

Responding to Xerox's argument that Burr's symbol recognition system is sometimes inaccurate and thus the symbols of Burr cannot be said to have sufficient graphical separation to permit definitive recognition, the district court explained that "[w]hether or not the reader recognizes the symbol intended by the writer is irrelevant for purposes of determining whether or not symbols are graphically separate such that each symbol will be definitively recognized upon delimitation." Id. at 13-14 (emphasis in original). The district court explained that although some symbols may be "visually similar to the human eye, they will be considered graphically separate as long as each symbol is definitively recognized upon pen lift." Id. at 14.

The district court also rejected Xerox's argument that neither Burr nor Nagayama teaches a "set" of single-stroke symbols. The court explained that Burr "allows the user to define the stroke-set to be used" and therefore "discloses a set of 26 single-stroke curves which correspond to letters of the English alphabet." Id. at 12-13. The court noted that Nagayama expressly requires "a set of two or more characters or figures, each of which have a single stroke." Id. at 13.

The court further concluded that both Burr and Nagayama teach "spatial independence" because both "teach devices which allow symbols to be written anywhere on the recognition device surface." Id. at 14. In response to an argument raised by Xerox, the court explained that "even if spatial relationships are used to group words [in Burr], the symbols are distinguished and recognized without reference to where a previous symbol was written." Id. at 15. Based on that analysis, the court granted 3Com's motion for summary judgment of invalidity.

Both parties sought clarification because the district court's first order did not specifically address the asserted independent and dependent claims. The district court then issued a second order in which it granted summary judgment of invalidity based on specific findings as to each limitation of the asserted claims. Xerox Corp. v. 3Com Corp., No. 97-CV-6182T, at 3 (W.D.N.Y. Mar. 1, 2005). In particular, the court ruled that Burr and Nagayama disclose the limitation that "some of the single-stroke symbols [are] linear and others arcuate." Id. at 9. In that regard, the district court noted that a figure contained in Burr depicted the "t" symbol as "made of two intersecting lines each of which are essentially straight" and that Nagayama "discusses how a linear symbol created by the user may be recognized by the reader and used to generate a graphical depiction of two lines." Id.

The court next rejected Xerox's argument that Nagayama does not disclose a system for text entry. It explained that "[w]hile it is true that Nagayama discloses a method for inputting commands, that method relies on the inputting of single-stroke symbols that correspond to textual characters, and the display of those characters to confirm the correct input." Id. at 10.

The court also concluded that "Burr incorporates single-stroke symbols that differ from each other essentially only on the basis of stroke direction." Id. at 14. The court reasoned that "the Burr symbols for 'o' and 'a' differ essentially only on the basis of the vertical line extending downward from the middle of the left [sic] side of the oval of the 'a.'" Id. The court added that the "stroke direction" claim limitation "is further invalidated as anticipated [because] Burr teaches the use of a time-warp algorithm, which takes into account stroke direction by considering the temporal relationship between the points making up the single-stroke symbol." Id. at 15.

Addressing claims 14 and 15, which recite at least one unistroke symbol that correlates with a control function that shifts the correlations of some of the unistroke signals from one set of natural language symbols to another, the court found those claims to be obvious in light of Nagayama as combined with the prior art system of Organek. The court explained that it would have been obvious to one skilled in the art of handwriting recognition to combine Organek's disclosure of single-stroke symbols to invoke control functions (such as "shift" or "caps lock") with Nagayama's teaching of single-stroke symbols to convert graphics displayed on a screen. Id. at 23.

Finally, the court held claims 9 and 11 invalid for indefiniteness. Those claims recite an additional limitation that the unistroke symbols must be "well separated from each other in sloppiness space." The court explained that the claim term "sloppiness space" is ambiguous and "is not clearly defined or explained in the patent to an extent that would allow one skilled in the art to understand how symbols can be well separated in sloppiness space." Id. at 21. Moreover, the court added that "sloppiness space" is "not a term of art used in the industry, and does not convey a concept that was known in the industry." Id. at 20. Thus, according to the district court, "there is no way to determine whether or not two symbols do achieve sufficient separation so as to be well separated in sloppiness space." Id. at 21. Consequently, the court found the term "sloppiness space" to be ambiguous and concluded that claims 9 and 11 are therefore invalid for indefiniteness under 35 U.S.C. § 112. The court further concluded that "[e]ven if claims 9 and 11 are not invalid as indefinite, . . . those claims are anticipated by Burr." Id. at 21. The district court explained that most of Burr's symbols are "vastly different from one another, thus practicing sufficient separation in sloppiness space." With respect to the Burr symbols that appear to have some overlap, such as the "i" and the "l," the court held that those symbols "practice sloppiness separation just as [much as] the Graffiti symbols" that had already been held to infringe. Id. at 22.

II

Xerox argues that the district court erred in granting summary judgment of invalidity for 3Com as to claims 1-3 and 7-16, and that the court should have granted Xerox's cross-motion for summary judgment on the issue of invalidity. In its brief, Xerox addresses four invalidity issues—anticipation by Burr (applicable to claims 1-3, 7-12, and 16; anticipation by Nagayama (applicable to claims 1-3, 7-8, 12-13, and 16); obviousness in light of Nagayama combined with Organek (applicable to claims 14 and 15); and indefiniteness (applicable to claims 9 and 11). We address Xerox's anticipation arguments together and the obviousness and indefiniteness arguments separately.

A. Anticipation by Burr and Nagayama

1. "Unistroke Symbols"

Xerox argues that the '656 patent is not anticipated because neither Burr nor Nagayama discloses "unistroke symbols," a limitation that is present in every claim of the '656 patent. The term "unistroke symbols" is defined to mean symbols having "sufficient graphical separation for the computer to definitively recognize a symbol immediately upon delimitation or pen lift." Citing our discussion of unistroke symbols in Xerox II, Xerox contends that the invention of Burr fails to "complete[] the recognition" of the symbols upon pen lift because Burr merely provides for creation of a set of 26 "dissimilarity" numbers representing the most probable symbol shape matches. According to Xerox, recognition in Burr is not complete until after "dictionary lookup" occurs. As we explained in Xerox II, however, "[d]efinitive recognition does not require a permanent, unalterable choice of a symbol that cannot be changed if the recognition is later determined to be erroneous." 61 Fed. Appx. at 684. In Burr, shape matching of each inputted symbol occurs independent of dictionary verification. In fact, Burr explicitly describes two distinct steps: "warp-based character matching" and "dictionary lookup." See D.J. Burr, Designing a Handwriting Reader, IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. PAMI-5, No. 5, at 554 (Sept. 1983) ("Burr"). Thus, dictionary lookup is not a step necessary for "recognition" of a character to occur; it simply serves as a means for later determining that a particular recognition may be erroneous.

Likewise, Nagayama's "confirmation" step does not preclude Nagayama's system from "complet[ing] the recognition" upon pen lift. As Nagayama explains, upon pen lift, "once [a centering] move has been completed, [the written character] is compared with reference standard patterns in the dictionary . . . , and if a high-correlation character is found in the dictionary, the character is deemed recognized." See Control Method Using Real-time Recognition of Handwritten Character Patterns, Japanese Patent Application Kokai No. SHO59-35277, at 5 (filed Aug. 23, 1982) ("Nagayama"). The character is then "displayed for visual confirmation." Id. As in Burr, the subsequent step in Nagayama serves only as a means to correct errors in the recognition that has already occurred. In the words used by the district court in its construction of the term "unistroke symbols," which we upheld in Xerox I, both Burr and Nagayama "definitively recognize a symbol immediately upon delimitation or pen lift."

Xerox contends that Burr does not disclose a system in which the symbols have "sufficient graphical separation to permit the computer to definitively recognize the symbol" upon pen lift, and thus Burr does not disclose the use of "unistroke symbols." "Sufficient graphical separation," however, is not a quality that exists in a vacuum. As is clear from the district court's claim construction, which Xerox accepts, "graphical separation" among the symbols is "sufficient" if it permits the computer to distinguish the symbols upon pen lift. Thus, if the computer is capable of differentiating among symbols upon pen lift, there is "sufficient graphical separation" among them, and if the computer does not have that capability, there is not "sufficient graphical separation," despite the similarities or differences that may appear to a casual observer of the symbols. Because Burr discloses a system in which definitive recognition occurs upon pen lift, as discussed above, there is necessarily sufficient graphical separation among those symbols to permit the computer to achieve definitive recognition.

Xerox makes the related argument that definitive recognition "requires accurate recognition." It contends that Burr fails to disclose symbols that are "accurately recognized on pen lift" because Burr does not teach "specific reference symbols, . . . provides no guidance for choosing symbols that are graphically separate, and . . . places no restrictions on the user's choice of symbols." Xerox makes a similar argument with regard to the Nagayama reference. Yet nothing in the language of the claims or in the specification supports Xerox's proposal that a particular degree of accuracy is necessary for a system to qualify as producing "definitive recognition." Moreover, even if some degree of accuracy were required, an expert for the defendants, in a journal article published prior to this litigation, reported that Burr's invention achieves 90 percent character recognition accuracy without dictionary lookup. See Charles C. Tappert et al., The State of the Art in On-Line Handwriting Recognition, IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 12, No. 1, at 797 (Aug. 1990). Although Xerox suggests that a system must be "over 95%" accurate in order for it to qualify for "definitive recognition" under the '656 patent, nothing in the patent indicates that 95 percent accuracy constitutes "definitive recognition" but 90 percent accuracy does not. Xerox's arguments regarding "accurate recognition" are therefore unavailing.

Xerox further argues that Burr and Nagayama do not anticipate the '656 patent claims, because neither reference discloses "a set of reference symbols that a user would emulate." Yet there is no indication in the claim language that any such prototype symbols are required, and Xerox certainly does not suggest that its claims should be confined to the particular set of symbols illustrated in Figure 2 of the '656 patent. Even if we were to read the claims as requiring that the system provide some set of symbols for the user to employ, Burr supplies a set of representative single stroke symbols that can be emulated by the user, even though it also permits the user to define his own stroke set. Similarly, Nagayama provides "examples of single-stroke characters that could be used with the present invention." Xerox's argument regarding unistroke symbols is therefore without merit.

2. "Distinguishing said unistroke symbols from each other totally independent of and without reference to their spatial relationship"

Xerox contends that there is a material factual dispute between the parties as to whether Burr discloses symbols that have "spatial independence." Xerox asserts that Burr requires its users to "segregate and group written strokes into words," thus "suggesting that to properly distinguish and recognize at least the first input symbol of a word, Burr's computer must reference where the last symbol of the previous word was written on a writing surface." As explained by the district court on remand, however, "even if Burr does rely on spatial relationships to group words, that function has no effect on . . . the system['s ability] to distinguish and recognize symbols without reference to where a previous symbol was written." In other words, even if Burr's dictionary lookup relies upon the location of a previously inputted symbol, Burr's shape-matching algorithm works without regard to where a previous symbol was written. The spatial independence feature in Burr is evidenced by the fact that, as the Burr article explains, "[b]efore any correlation is done between two curves, each is independently normalized in three steps": centering, re-sizing, and detilting. Such positional adjustments preclude recognition that is dependent upon the locations where successive symbols are written. Consequently, there is no material factual dispute with regard to the "spatial independence" limitation.

3. "Some of said unistroke symbols being linear"

Xerox argues that Burr fails to disclose the claim limitation that recites "some of said unistroke symbols being linear," which is present in all of the asserted claims except for claim 16. In particular, Xerox contends that the district court erred in concluding that the symbol , depicted in Fig. 5(b) of the Burr article, is linear. According to Xerox, "two lines intersecting at substantially right angles do not yield a linear symbol." Yet this argument overlooks the fact that the term "linear" can be defined as "of or pertaining to a line or lines." See 8 Oxford English Dictionary 983 (2d ed. 1989); Random House Unabridged Dictionary 1117 (2d ed. 1993) ("of, consisting of, or using lines"); Encarta World English Dictionary 1048 (1999) ("relating to, consisting of, or using lines"). Moreover, each time the term "linear" is used in the claims, it is used in contrast to the term "arcuate," as in claim 1, which recites "some of said unistroke symbols being linear and others being arcuate." '656 patent, col. 7, ll. 16-17; see also id. col. 8, ll. 41-42 (claim 10); id. col. 8, ll. 64-65 (claim 12). The reference to "some" symbols being arcuate and "others" being linear indicates that the term "linear" was used in the patent to denote consisting of a straight line or lines, as opposed to consisting of curves.

We agree with the district court that Burr's symbol for the letter "t," represented by the figure  and drawn with a single stroke, discloses a "linear" symbol as that term is used in the '656 patent. Burr states that all of the symbols used in the Burr system consist of a single stroke created without "pen lift," and Figures 5 and 6 of the Burr article demonstrate that the symbol  is readily recognized as a "t," even without dictionary lookup. Xerox's argument regarding the "linear" claim limitation is thus unpersuasive.

4. Text Entry

Xerox asserts that all claims require "text entry" and that the Nagayama reference fails to anticipate because "each symbol is 'mapped to commands and functions' and not 'text.'" For support, Xerox points to the term "natural language" contained in claims 12 and 16. See '656 patent, col. 9, ll. 17-18; col. 10, ll. 24-25. Although Xerox is correct that those claims recite outputting natural language symbols as a result of inputting unistroke symbols, Nagayama nonetheless discloses this claim limitation. Nagayama explains that the memory in its invention "contain[s] a dictionary of reference standard characters, signals for commands, functions, etc." In this manner, Nagayama distinguishes "characters" from "commands" or "functions." Nagayama then states that after a single-stroke character is written, it is compared with the reference standard patterns in the dictionary; if a "high-correlation character" is found in the dictionary, the character is deemed recognized and is displayed. Only after such character display (and subsequent user confirmation) is a "signal corresponding to the recognized character . . . read from the memory 14 (Step 15), and sent to the computational control circuit." See Nagayama at 5; see also id. at 9-10, Figs. 3 and 4. In other words, command entry and function selection occur as independent steps following character display. Nagayama is thus directed not only to command entry and function selection by recognition of handwritten characters, figures, and symbols; it recites output of text as well. As a result, Xerox's argument that Nagayama fails to disclose "text entry" is unavailing.

5. Stroke Direction

Xerox contends that Burr does not disclose unistroke symbols in which graphical separation is based on both geometric shape distinctions and differences in stroke direction. Xerox argues that Burr does not rely on stroke direction to identify symbols, but instead "discusses identifying symbols by 'shape-matching,' 'difference[s] in shape,' and dissimilarity of a drawn character to 'each of the set of reference shapes.'"

The patent uses "stroke direction" in two ways that are pertinent to the anticipation issue. Claim 10 recites a system having some symbols with "graphical specifications that differ from each other essentially only on the basis of their respective stroke direction parameters." That is, the claimed system has "several pairs of symbols that are geometrically identical; but for direction, the computer could not discern between them." See Xerox I, 267 F.3d at 1368. Such pairs of symbols include, for example, Xerox's symbols for "c" and "d" ( and ). Other claims, such as claims 12-16, refer to strokes that "conform[] geometrically and directionally to a predetermined graphical specification" to indicate that the recited system captures and employs both the shape and the direction of the strokes as a means of differentiating symbols. An example of a pair of symbols distinguishable based on a combination of shape and stroke direction would be Xerox's symbols for "v" and "w" ( and ). It was in this sense that we referred in Xerox I to Graffiti's symbols for "O" and "Q" (and ) as illustrating the use of stroke direction as well as shape to distinguish symbols. In so doing, we distinguished Graffiti from the Whitaker prior art. We explained that Whitaker cannot "discern" unistrokes by stroke direction because in the Whitaker system symbols are "written . . . on a sheet of paper" and then "scanned all at once into a computer," so that the system is "unable to discern the direction in which a symbol is drawn." Id.

The district court compared the pair of Graffiti symbols for "O" and "Q" ( and ) with the pair of Burr symbols for "o" and "a" ( and ). The court found that "[l]ike the Graffiti symbols for 'O' and 'Q' that differ only on the basis of the horizontal line extending from the top of the oval, the Burr symbols for 'o' and 'a' differ essentially only on the basis of the vertical line extending downward from the middle of the left [sic] side of the oval of the 'a'." Based on that comparison, the court concluded that if Graffiti uses stroke direction as an element of graphical separation, Burr necessarily does as well. Despite the visual similarities between the two pairs of symbols, however, that conclusion does not necessarily follow. The two pairs of symbols would be parallel for purposes of anticipation only if it were determined that Burr captures and uses stroke direction in distinguishing among symbols. Absent the use of stroke direction, a system such as that disclosed in Burr would rely only on the geometric shape of the symbols to distinguish them, which would not be sufficient to anticipate the invention's use of stroke direction as a distinguishing mechanism.

3Com argues that, based on this court's discussion of the term "stroke direction" in Xerox I, it is clear that the Burr article discloses that limitation. We do not agree. In Xerox I, we held that although some of the Graffiti symbols look much alike, the element of stroke direction serves to distinguish them. Because Graffiti captures and uses stroke direction in differentiating symbols, we held that the district court was wrong to disregard that aspect of graphical separation in the Graffiti system. The question before us now is whether Burr discloses the use of stroke direction in differentiating symbols and thus anticipates that limitation.

3Com argues that Burr's shape-matching algorithm "considers . . . stroke direction information in finding a 'best match' with stored reference shapes." In particular, 3Com argues that Burr necessarily relies on stroke direction because it teaches "dynamic programming," which involves "serially connecting sampled coordinates" to form 2-D vectors, "with orientation in the direction of time flow." Additionally, at oral argument 3Com's counsel pointed to the use of the term "antiparallel" in the text accompanying Figure 2 of the Burr article as evidence that stroke direction is a component of Burr's shape-matching algorithm.

A close reading of the Burr article, however, suggests that although Burr's invention undoubtedly captures stroke direction data, it may not use that data to distinguish one symbol from another. In its discussion of "dynamic programming," Burr explains that shape-matching is conducted by representing each character as a string of 2-D vectors "formed by serially connecting sampled coordinates from the digitizer, taken at constant sampling rate," with each 2-D vector "orient[ed] in the direction of time flow." Burr, at 555. Inputted symbols are then compared to reference shapes by determining the "element-to-element distance measure between two vectors [one from each curve] . . . based on their relative positions and orientations." Id. This calculation factors in the angle between the inputted vector ($\vec{B}$) and the reference vector ($\vec{A}$), the angle of a constructed vector ($\vec{C}$) from the tail of $\vec{A}$ to the midpoint of $\vec{B}$, as well as two correction terms γ and ε. Burr explains that ε is a correction term that "inhibits positional misalignment" while γ is a correction term that is "used to weight against vector orientation misalignment." The value referred to as γ is added only "[i]f $\vec{B}$ is antiparallel to $\vec{A}$." Id. at 556. It thus appears that Burr's shape-matching algorithm is designed to remove the effects of diametric variations in stroke direction. That would make sense if the objective is only to compare the resultant shapes. If that is indeed the case, then Burr merely captures data regarding stroke direction, and not only fails to distinguish symbols on the basis of stroke direction, but expressly teaches away from that limitation by "correct[ing]" for "vector orientation misalignment."

Similar conclusions may be drawn from the Nagayama application. Although Nagayama describes "a coordinates signal generator [that] generates signals corresponding to the coordinates of the points being pressed by the pen," its discussion on symbol distinction is limited to "compar[ing] the pattern of the character stored in the image memory . . . with the reference standard patterns in the dictionary." See Nagayama at 4. In this manner, Nagayama appears to disclose only the capture of directional data and subsequent shape matching; it is not clear that it distinguishes symbols based on both geometric shape and stroke direction, or "essentially only on the basis of . . . stroke direction."[1]

Consequently, a genuine issue of material fact remains as to whether the Burr and Nagayama references disclose the various "stroke direction" limitations of the asserted claims of the '656 patent. Because "invalidity by anticipation requires that the four corners of a single, prior art document describe every element of the claimed

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[1] As for 3Com's Graffiti system, the geometrically identical symbols for "space" and "backspace" and for the letter "U" and one variant of the letter "V" indicate that directional data is employed in distinguishing among symbols, as shape matching of those two pairs of symbols would not by itself disclose any distinction between them.

invention," Advanced Display Sys., Inc. v. Kent State Univ., 212 F.3d 1272, 1282 (Fed. Cir. 2000), we vacate the district court's grant of summary judgment of invalidity for anticipation and remand the case to the district court for further proceedings with particular focus on whether Burr or Nagayama discloses the use of stroke direction in distinguishing symbols as that term is used in the patent.

B. Obviousness in Light of Nagayama and Organek

The district court held that dependent claims 14 and 15 would have been obvious in light of Nagayama and Organek. In particular, the court held that it would have been obvious "to one skilled in the art of handwriting recognition to combine the teachings of Organek with Nagayama to utilize the known features of both in assigning a control function to a single-stroke symbol." Xerox's arguments on obviousness rely entirely on its assertion that Nagayama "lacks both [the] 'text entry' and 'stroke direction'" limitations. We have rejected Xerox's argument that Nagayama fails to disclose text entry. However, in light of our conclusions with respect to the stroke direction limitation, we cannot sustain the district court's judgment on the ground invoked by the court. Accordingly, we remand to the district court to reconsider its judgment as to obviousness based on our analysis of the stroke direction limitation and to determine, in light of its reconsideration of the stroke direction issue, whether the invention of claims 14 and 15 would have been obvious in light of Nagayama and Organek.

C. Indefiniteness or Anticipation of Claims 9 and 11

Addressing the issue of the indefiniteness of dependent claims 9 and 11, the district court concluded that the term "sloppiness space" is ambiguous and is not adequately defined in the patent. The district court observed that "the patent does not explain how one would determine whether or not symbols are sufficiently distinct so as to be well separated in sloppiness space." Yet, as Xerox asserts, the specification explicitly defines symbols that are "well separated from each other in sloppiness space" as those distinguished by "substantial angular offset (e.g., at least 45° and preferably 90°) or directional distinction (opposing directions)." See '656 patent, col. 3, ll. 28-31. The specification also contrasts symbols that are well separated from each other in sloppiness space from the characters of the ordinary Roman alphabets, "which are not reliably distinguishable from each other in the face of rapid or otherwise sloppy writing." '656 patent, col. 1, ll. 54-56. While those descriptions are not rigorously precise, they provide adequate guidance as to the types of symbols that are "well separated from each other in sloppiness space," particularly in light of the difficulty of articulating a more exact standard for the concept. See In re Marosi, 710 F.2d 799, 803 (Fed. Cir. 1983) (finding claims not indefinite when specification provided "a general guideline and examples sufficient to enable a person of ordinary skill in the art to determine whether" claim limitation is satisfied). Thus, in light of the criteria provided in the specification, we hold that claims 9 and 11 are "subject to construction" and are not "insolubly ambiguous." For that reason, those claims are not invalid for indefiniteness. See Bancorp Servs., L.L.C. v. Hartford Life Ins. Co., 359 F.3d 1367, 1371 (Fed. Cir. 2004) (holding that a claim will not be held invalid if the "meaning of the claim is discernible, even though the task may be formidable and the conclusion may be one over which reasonable persons will disagree"). We therefore reverse the district court's grant of summary judgment that claims 9 and 11 are invalid for indefiniteness.

In the alternative, the district court found that "[e]ven if claims 9 and 11 are not invalid as indefinite, . . . those claims are anticipated by Burr." The district court explained that "Burr teaches the use of symbols that are well defined in terms of sloppiness space." The court, however, did not explain how it interpreted the term "sloppiness space." To be sure, that is not surprising, considering that the court in its indefiniteness ruling had just found that term insolubly ambiguous. As a consequence, however, the district court's analysis provides little insight into how Burr discloses the limitation of sloppiness separation, other than to suggest that if the Graffiti symbols are well separated in sloppiness space then the Burr symbols must be as well.[2] Moreover, and more importantly, claims 9 and 11 incorporate the stroke direction limitations from claims 2-6 and 10. Accordingly, claims 9 and 11 cannot be held invalid for anticipation if the stroke direction limitations in those claims are not anticipated by Burr. We therefore vacate the portion of the district court's judgment holding, in the alternative, that claims 9 and 11 are invalid for anticipation.

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[2] The district court's analysis seems to be predicated in part on its belief that this court ruled in Xerox II that Graffiti infringes claims 9 and 11 of the '656 patent. In dueling footnotes, the parties debate whether this court resolved that issue in Xerox II. In the proceedings leading to Xerox II, the district court characterized Xerox's argument as being that "every Graffiti symbol practices every limitation of the independent claims [claims 1, 10, 12, and 16] of the '656 patent." The district court did not address the issue of infringement of the dependent claims at that time, and the parties did not present the infringement issue on a claim-by-claim basis in Xerox II. We therefore did not address the question whether the Graffiti system infringed the dependent claims. Accordingly, to the extent that it may be relevant to future proceedings in this case, we hold that the previous adjudication upholding the district court's summary judgment of infringement did not extend to dependent claims 9 and 11.

III

In summary, while we agree with the district court's analysis in many respects, we disagree with the court with regard to the "stroke direction" limitation, and we disagree with the court's indefiniteness and anticipation analysis as applied to claims 9 and 11. Our determination with respect to the stroke direction limitation requires that we vacate the judgment and remand for further consideration of both the anticipation and obviousness rulings. Our determination with respect to the court's indefiniteness analysis requires that we reverse the judgment that claims 9 and 11 are invalid on that ground.

Each party shall bear its own costs for this appeal.

REVERSED IN PART, VACATED IN PART, and REMANDED.