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UNITED STATES v. FIELD: INFRARED SCANS; CURBING POTENTIAL PRIVACY INVASIONS

The Fourth Amendment of the United States Constitution prohibits “unreasonable searches and seizures.”¹ While the Supreme Court initially construed this amendment liberally,² subsequent case law narrowed the definition of a “search”³ to physical intrusions.⁴ In *Katz v. United*

¹ U.S. CONST. amend. IV. The Fourth Amendment states:

The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no Warrants shall issue, but upon probable cause, supported by Oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized.

Id.

² See *Boyd v. United States*, 116 U.S. 616 (1886). In *Boyd*, the federal government claimed that the defendant had fraudulently avoided paying duty taxes on imported plate glass. *Id.* at 617-18. To prove these allegations, the prosecution needed to establish the quantity and value of the glass in a previous shipment. *Id.* at 618. The district attorney received a court order directing the defendant to produce a shipment invoice. *Id.* The Court held that the “compulsory production of a man’s private papers to establish a criminal charge against him, or to forfeit his property,” *id.* at 622, violates the Fourth Amendment. *Boyd*, 116 U.S. at 630. After quoting *Entick v. Carrington*, 19 Howell’s St. Tr. 1029 (1765), the Court stated:

The principles laid down in [*Entick*] affect the very essence of constitutional liberty and security. They reach farther than the concrete form of the case then before the court, with its adventitious circumstances; they apply to all invasions on the part of the government and its employees [sic] of the sanctity of a man’s home and the privacies of life. It is not the breaking of his doors, and the rummaging of his drawers, that constitutes the essence of the offense; but it is the invasion of his indefeasible right of personal security, personal liberty and private property, where that right has never been forfeited by his conviction of some public offense

Boyd, 116 U.S. at 630. Although the court order may not have constituted a traditional search and seizure, *Boyd* recognized that it is not the way in which the government obtains information that implicates our Fourth Amendment rights; instead, it is the actual invasion of a privacy interest. See Melvin Gutterman, *A Formulation of the Value and Means Models of the Fourth Amendment in the Age of Technologically Enhanced Surveillance*, 39 SYRACUSE L. REV. 647, 654 (1988) (stating that Supreme Court recognized that Fourth Amendment protects citizens from invasions to “indefeasible right of personal security, liberty and private property” (quoting *Boyd*, 116 U.S. at 630)).

³ The Fourth Amendment’s language requires a two-part analysis to determine whether a government act or search is unconstitutional. Richard G. Wilkins, *Defining the “Reasonable Expectation of Privacy”: An Emerging Tripartite Analysis*, 40 VAND. L. REV. 1077, 1078 n.3 (1987).

First, a court must decide if a “search” occurred. *Id.* “A ‘search’ occurs ‘when an expectation of privacy that society is prepared to consider reasonable is infringed.’” *United States v. Karo*, 468 U.S. 705, 712 (1984) (quoting *United States v. Jacobsen*, 466 U.S. 109, 113

States,⁵ however, the Court revised its Fourth Amendment analysis⁶ after technological advances eroded the practicality of this rigid approach.⁷

(1984)). Second, the search must be examined to see if it is unreasonable. *Wilkins*, *supra* at 1078 n.3. Normally, a search is unreasonable unless a search warrant is first obtained. *See, e.g., Karo*, 468 U.S. at 717 (“Warrantless searches are presumptively unreasonable . . .”). The Supreme Court, however, has permitted warrantless searches under certain circumstances. *See, e.g., United States v. Ross*, 456 U.S. 798, 807-09 (1982) (holding that when there is probable cause to believe that automobile contains contraband, warrantless search is permissible); *Schneekloth v. Bustamonte*, 412 U.S. 218, 219 (1973) (“[O]ne of the specifically established exceptions to the requirements of both a warrant and probable cause is a search that is conducted pursuant to consent.”) (citations omitted); *Coolidge v. New Hampshire*, 403 U.S. 443, 465 (1971) (“It is well established that under certain circumstances the police may seize evidence in plain view without a warrant.”); *Warden v. Hayden*, 387 U.S. 294, 298 (1967) (holding that “exigencies of the situation” permitted warrantless search). This Comment focuses only on whether a “search” has occurred. It does not examine the second part of the Fourth Amendment analysis — whether a search is unreasonable because the government failed to obtain a search warrant where one was required.

⁴ *See Olmstead v. United States*, 277 U.S. 438, 466 (1928). In *Olmstead*, the government gathered evidence of a conspiracy by tapping the defendant’s telephones. *Id.* at 456-57. Wires were inserted into the telephone lines without any trespass to the defendant’s property. *Id.* at 457. The evidence gathered from the overheard conversations led to convictions. *Id.* The Court held that the government did not violate the Fourth Amendment because there was no physical invasion. *Id.* at 466. In attempting to balance the rights of individual citizens with the interests of society, *Olmstead* provided the guidance lacking in *Boyd* by requiring a physical trespass to constitute a “search.” *Olmstead*, 277 U.S. at 465; *see also Silverman v. United States*, 365 U.S. 505, 509 (1961) (holding that, since “spike mike” physically penetrated defendant’s heating duct, eavesdropping violated Fourth Amendment).

⁵ 389 U.S. 347 (1967). In *Katz*, the government attached an electronic listening device to the outside of a public telephone booth where the defendant was suspected of transmitting illegal wagering information. *Id.* at 348. The defendant was convicted on the basis of this evidence. *Id.* and the Court found that the information received from the listening device constituted a search and seizure within the meaning of the Fourth Amendment. *Id.* at 353.

⁶ *Katz*, 389 U.S. at 353. In finding an unreasonable search and seizure, the Court explained that “the Fourth Amendment protects people—and not simply ‘areas’—against unreasonable searches and seizures [T]he reach of that Amendment cannot turn upon the presence or absence of a physical intrusion into any given enclosure.” *Id.*

⁷ *See Wilkins*, *supra* note 3, at 1087-88 (“The Court’s abandonment of a rigid, property-based construction of the fourth amendment . . . laid to rest most of the criticism that the law had become stilted and anachronistic in its attempt to accommodate modern investigative technology . . .”). As technology advances, a police officer’s physical location becomes less important. David E. Steinberg, *Making Sense of Sense-Enhanced Searches*, 74 MINN. L. REV. 563, 588 (1990). Steinberg explains:

[A] suspect will not care how police examine an object located in the suspect’s backyard: police may view the object with their unaided vision from one foot away [or] use a high-powered telescope stationed a mile away In each case, the police gain the same information about the suspect. Residents no longer receive significant protection simply because police cannot enter onto their property without a warrant. *Id.*; *see also Olmstead*, 277 U.S. at 473 (Brandeis, J., dissenting) (stating that Constitution must be interpreted to prevent “[s]ubtler and more far-reaching means of invading privacy”); *Dow Chem. Co. v. United States*, 476 U.S. 227, 240 (1986) (Powell, J., dissenting) (“[T]his Court

Under the *Katz* standard, Fourth Amendment protections extend to situations where a person's subjective expectation of privacy is reasonable.⁸ While the flexible nature of this test⁹ accommodates technological advancements,¹⁰ its application has led to haphazard results.¹¹ For instance, courts have struggled to determine whether the government's use of a Forward Looking Infrared Device ("FLIR"),¹² which is employed to

has adhered to a standard that ensured that Fourth Amendment rights would retain their vitality as technology expanded the Government's capacity to commit unsuspected intrusions into private areas and activities.").

⁸ See *Katz*, 389 U.S. at 361 (Harlan, J., concurring). Justice Harlan created the applicable Fourth Amendment test. Harvey Wingo, *A 2020 Vision of Visual Surveillance and the Fourth Amendment*, 71 OR. L. REV. 1, 2 n.5 (1992); see, e.g., *California v. Ciraolo*, 476 U.S. 207, 211 (1986) (quoting language of Justice Harlan's concurrence); *Smith v. Maryland*, 442 U.S. 735, 740 (1979) (citing Justice Harlan in articulating Fourth Amendment test). Harlan stated that in order for a person to receive Fourth Amendment protection, one must satisfy "a twofold requirement, first that a person have exhibited an actual (subjective) expectation of privacy and, second, that the expectation be one that society is prepared to recognize as 'reasonable.'" *Katz*, 389 U.S. at 361 (Harlan, J., concurring). At first, it seemed that the subjective portion of the *Katz* test required that the government determine a person's actual state of mind. *United States v. Taborda*, 635 F.2d 131, 137 (2d Cir. 1980). The test, however, only requires that a subjective expectation be exhibited. *Id.* "We take this first factor to mean in essence that the defendant must have acted in such a way that it would have been reasonable for him to expect that he would not be observed." *Id.*

This Comment focuses on the "reasonable" element of the *Katz* test rather than the subjective element.

⁹ Wilkins, *supra* note 3, at 1079-80.

¹⁰ *Id.* at 1087-88 (discussing how *Katz* revolutionized Fourth Amendment search analysis by equipping courts with standard flexible enough to deal with emerging police investigatory techniques).

¹¹ *Id.* The *Katz* test is difficult to apply. *Id.* at 1107; Steinberg, *supra* note 7, at 583 (stating that Supreme Court found test "too ephemeral to provide a workable framework"). Although the "reasonable expectation of privacy" language is broad enough to encompass technological advances, its limits are vague. Wilkins, *supra* note 3, at 1079-80, 1088. The *Katz* approach "often embodies more 'flex' than 'analysis'" and "the judiciary has floundered in its attempt to delineate which expectations of privacy are 'reasonable.'" *Id.* at 1079-80. In applying the *Katz* test, reference must be made to what society deems acceptable either through law or through implicit understandings. See *Rakas v. Illinois*, 439 U.S. 128, 144 n.12 (1978) ("Legitimation of expectations of privacy by law must have a source outside of the Fourth Amendment, either by reference to concepts of real or personal property law or to understandings that are recognized and permitted by society."). For example, after the war on drugs was declared during Ronald Reagan's presidency, courts have condoned illegal searches under a "drug exception" to the Fourth Amendment. Lynne M. Pochurek, Note, *From the Battlefield to the Homefront: Infrared Surveillance and the War on Drugs Place Privacy Under Siege*, 7 ST. THOMAS L. REV. 137, 144 (1994). The Court's reasonable expectation of privacy test seemed to be affected by the nation's desire to eliminate drugs.

¹² The FLIR (also known as a thermal imager) is a passive, nonintrusive instrument which operates in the thermal infrared spectrum to detect differences in surface temperatures. *United States v. Porco*, 842 F. Supp. 1393, 1396 (D. Wyo. 1994), *aff'd sub nom.*, *United States v. Cusumano*, 67 F.3d 1497 (10th Cir. 1995). While it does not measure actual temperatures, it

detect excess heat emanating from indoor marijuana growing operations, constitutes a "search."¹³ Recently, in *United States v. Field*,¹⁴ the United States District Court for the Western District of Wisconsin held that a FLIR's scan constituted a "search."¹⁵

In *Field*, the government received information from two informants that the defendant was growing marijuana in his home.¹⁶ To investigate this tip, a thermal imagery expert used a FLIR from a public road approximately thirty to forty meters away to scan the defendant's home.¹⁷ Although the FLIR displayed an isolated heat source, the expert could not

compares the amount of heat radiated from different objects. *United States v. Pinson*, 24 F.3d 1056, 1057 (8th Cir.), *cert. denied*, 115 S. Ct. 664 (1994). In order to detect temperature differences, an object's solar heat must dissipate. *United States v. Field*, 855 F. Supp. 1518, 1522 (W.D. Wis. 1994). Therefore, the FLIR can only scan effectively in the night or early morning. *Id.* "The device is a hand held unit which looks like a 35 mm camera." *Porco*, 842 F. Supp. at 1396, and has a range from two feet to one quarter of a mile. *Id.* Objects scanned for temperature differences are seen on a screen and can be videotaped. *Id.* A cool area will appear grey and a relatively hotter area will appear bright white. *Id.* This device is among the most advanced and effective law enforcement tools used to fight the current drug problem in the United States. Pochurek, *supra* note 11, at 139.

After the Supreme Court concluded that it is permissible for the government to view a person's property from an aircraft, marijuana growers were forced to grow their illegal plants indoors. Lisa J. Steele, *Waste Heat and Garbage: The Legalization of Warrantless Infrared Searches*, 29 CRIM. L. BULL. 19, 19-20 (1993). The high-intensity discharge bulbs needed to grow marijuana indoors generate heat of approximately 150 degrees or more. *Pinson*, 24 F.3d at 1057. The excessive heat generated by grow lamps can be detected by comparing the heat of neighboring structures with a FLIR. *State v. Young*, 867 P.2d 593, 600 (Wash. 1994).

¹³ Courts are currently split on this issue. Courts that have expressly upheld a warrantless infrared scan include: *United States v. Robinson*, 62 F.3d 1325, 1328 (10th Cir. 1995) (holding no subjective or reasonable expectation of privacy in heat emitted from home); *United States v. Ishmael*, 48 F.3d 850, 853 (5th Cir.) (holding no reasonable expectation of privacy), *cert. denied*, 116 S. Ct. 74 (1995); *United States v. Myers*, 46 F.3d 668, 669-70 (7th Cir.) (finding no subjective or reasonable expectation of privacy), *cert. denied*, 116 S. Ct. 213 (1995); *Pinson*, 24 F.3d at 1059 (finding no reasonable expectation of privacy in heat emanations); *United States v. Ford*, 34 F.3d 992, 996 (11th Cir. 1994) (noting no subjective or reasonable expectation of privacy); *United States v. Penny-Feeney*, 773 F. Supp. 220, 225 (D. Haw. 1991), *aff'd on other grounds sub nom.*, *United States v. Feeney*, 984 F.2d 1053 (9th Cir. 1993). Courts that have held the scan to be a "search" include: *Cusumano*, 67 F.3d at 1509; *Field*, 855 F. Supp. at 1522; *Young*, 867 P.2d at 595.

¹⁴ 855 F. Supp. 1518 (W.D. Wis. 1994).

¹⁵ *Id.* at 1519.

¹⁶ *Field*, 855 F. Supp. at 1524. Two informants notified an officer of activity evincing a marijuana growing operation. *Id.* One informant stated that, while inside the defendant's home, he smelled a very strong odor of marijuana and saw loaded handguns and \$5000 in cash. *Id.* Another informant, while driving past defendant's residence, noticed indoor lamps that are generally used to help grow marijuana plants. *Id.* at 1524.

¹⁷ *Field*, 855 F. Supp. at 1522. The expert testified that the FLIR was capable of showing actual objects at a distance of 20 to 200 meters "with somewhat less detail than a television picture." *Id.*; *see supra* note 12.

identify its cause.¹⁸ The government then issued a *subpoena duces tecum* which allowed authorities to obtain the defendant's electricity bills.¹⁹ The bills showed unusually high electrical use.²⁰ Based on the information from the two informants, the FLIR, and the defendant's electricity bills, a search warrant was issued.²¹ Authorities entered the premises and found a marijuana growing operation in certain sheds.²²

The district court held that the facts upon which the warrant was issued were insufficient and, therefore, the court suppressed the evidence.²³ In so doing, the court adopted the magistrate judge's findings in full.²⁴ Chief Judge Crabb agreed with the magistrate judge's finding that the FLIR scan was a "search."²⁵ The court rejected the government's argument that a homeowner "abandons" heat when it escapes from his home and found that a FLIR, because it can detect objects through a home's walls, is more intrusive than analogous technology.²⁶ The court reasoned that, unlike the privacy expectation one has in one's car or in

¹⁸ *Field*, 855 F. Supp. at 1523. The expert testified he did not know what was inside Field's house; he only knew that there was an isolated heat source within the area indicated by the FLIR white spot. *Id.* Afterwards, he scanned two similar nearby structures not located on Field's property in order to establish a control group. *Id.* These structures did not contain any hotspots. *Id.*

¹⁹ *Field*, 855 F. Supp. at 1523. The bills were subpoenaed to determine whether Field used excessive electricity. *Id.*

²⁰ *Field*, 855 F. Supp. at 1523. Field's electricity bill averaged \$200 per month — a typical single-family residential customer's bills averaged \$80 per month. *Id.* Large-scale farming operations consume more electricity than solely residential use. *Id.* Field's property contained three sheds or barns, a chicken coop, an unattached garage, and a two-story house. Although about 20 head of cattle and other animals were on the property when it was subsequently searched, the sheriff was unaware of the animals' existence when the warrant was issued. *Id.* at 1520, 1524-25.

²¹ *Id.* at 1524-25.

²² *Field*, 855 F. Supp. at 1525. "From outside the pole shed, an observer would be unable to see anything suspicious, even if the door were open. Once inside, however, a person could go down a side walkway and discover a marijuana grow operation hidden under piles of hay." *Id.* A household dehumidifier was located in the area of the hotspot inside the defendant's home. *Id.* The FLIR expert stated that this may have been the heat source. *Id.*

²³ *Field*, 855 F. Supp. at 1520. Chief Judge Crabb agreed with the magistrate judge and held that "obtaining a thermal image of a residence is a search . . . requiring a warrant." *Id.* at 1519. She rejected the magistrate judge's finding that the sheriff acted with reckless disregard by intentionally omitting or misstating facts when he obtained the warrant. *Id.* at 1520. Chief Judge Crabb concluded that the observation that Field's electricity use was significantly higher than average was not, without more, enough to sustain the issuance of a search warrant. *Id.*

²⁴ *Id.* at 1518.

²⁵ *Field*, 855 F. Supp. at 1519.

²⁶ *Id.* at 1519 (comparing FLIR, which detects lawful and unlawful activity, to dogs trained to detect contraband).

public,²⁷ a person does not expect high technology surveillance to detect activities within one's home.²⁸ Concluding that the use of a thermal imager was a "search" within the meaning of the Fourth Amendment, the court held that the evidence gathered when executing the warrant must be suppressed.²⁹

This Comment suggests that the court's analysis is unduly expansive given the wide range of information that a FLIR can reveal.³⁰ Depending on its use in a particular case, an imager's scan may or may not be a "search."³¹ It is submitted that the *Field* court focused on a FLIR's possible abuses³² to the exclusion of its permissible uses. This Comment will present the proper constitutional analysis of the facts underlying *Field* and will suggest to future courts alternative solutions to the FLIR issue. Part One presents the factor approach implicitly found in the relevant case law following *Katz*. This approach is then applied to *Field*. Part Two advocates the proper balance between law enforcement and Fourth

²⁷ *Id.*

²⁸ *Id.*

²⁹ *Field*, 855 F. Supp. at 1518-20. The court held that since the evidence gathered by a thermal imager must be excluded from a probable cause determination, and the remaining evidence did not meet the probable cause requirement, the search warrant was invalid. *Id.* at 1520.

³⁰ *United States v. Robinson*, 62 F.3d 1325, 1330 (11th Cir. 1995) (noting that defendant's home was hotter than surrounding objects); *United States v. Ishmael*, 48 F.3d 850, 856 (5th Cir.) (agreeing with Eighth Circuit that no intimate details of home are revealed), *cert. denied*, 116 S. Ct. 74 (1995); *United States v. Myers*, 46 F.3d 668, 669 (7th Cir.) (acknowledging that scan revealed inordinate amounts of heat), *cert. denied*, 116 S. Ct. 213 (1995). *Compare* *United States v. Ford*, 34 F.3d 992, 996 (11th Cir. 1994) (stating that low resolution of FLIR rendered it incapable of revealing intimate details); *United States v. Pinson*, 24 F.3d 1056, 1059 (8th Cir.) (noting that FLIR revealed no intimate details of home), *cert. denied*, 115 S. Ct. 664 (1994); *United States v. Olson*, 21 F.3d 847, 848 n.5 (8th Cir.) (stating that FLIR revealed rafters and trailer divided into two rooms), *cert. denied*, 115 S. Ct. 230 (1994) and *United States v. Penny-Feeney*, 773 F. Supp. 220, 228 (D. Haw. 1991) (finding use of FLIR to detect heat on exterior of house was nonintrusive), *aff'd on other grounds sub nom.*, *United States v. Feeney*, 984 F.2d 1053 (9th Cir. 1993) (declining to address use of FLIR because independent grounds for probable cause established) *with* *United States v. Cusumano*, 67 F.3d 1497, 1504 (10th Cir. 1995) (noting that thermal imager might be able to detect two people in bedroom engaged in sexual activity); *Field*, 855 F. Supp. at 1531 n.7 (finding that properly trained FLIR operator could detect whether guest room radiated heat, presence of visitors, television in use, or presence of hot water from bathroom) and *State v. Young*, 867 P.2d 593, 595 (Wash. 1994) (finding infrared device capable of detecting human form near open window or leaning against thin barrier).

³¹ *See* *United States v. Kyllo*, 37 F.3d 526, 530-31 (9th Cir. 1994) (finding that quality of image and degree of detail obtained by specific thermal imaging device is determinative of whether scan is "search" within Fourth Amendment).

³² *See Field*, 855 F. Supp. at 1531. Chief Judge Crabb, however, appeared less concerned than the magistrate judge about the capabilities of a FLIR in police surveillance. She objected to the intrusiveness of the device irrespective of the degree of detail obtained. *Id.* at 1519.

Amendment privacy. It suggests protective measures available to a court for limiting the possibility of FLIR abuse.

I. HOW COURTS APPLY *KATZ*

In determining which expectations of privacy are reasonable, courts seem to focus their inquiry on two broad criteria: (1) the location of a surveillance; and (2) its degree of intrusiveness.³³

A. *The Significance of Place*

Although *Katz* placed little emphasis on the location of a surveillance,³⁴ subsequent case law has found this factor to be important in determining whether a “search” has occurred.³⁵ For example, in *Oliver v. United States*,³⁶ after receiving reports that the defendant was growing marijuana on his farm, two narcotics agents went to the property to investigate.³⁷ Ignoring a “No Trespassing” sign, the officers walked around a locked gate onto a footpath and found marijuana in an open field one mile from the defendant’s home.³⁸ The Court held that the police intrusion was permissible under the Fourth Amendment since activities conducted in an open field do not give rise to a privacy expectation that

³³ See Wilkins, *supra* note 3, at 1080 (advocating tripartite analysis of location, degree of intrusiveness, and surveillance goal). Courts have developed factors with which to analyze the Fourth Amendment concern in this area because, without such an approach, the *Katz* test is difficult to apply. See *supra* note 11.

³⁴ See *Katz*, 389 U.S. at 351. “For the Fourth Amendment protects people, not places. What a person knowingly exposes to the public, even in his own home or office, is not a subject of Fourth Amendment protection.” *Id.*; Wilkins, *supra* note 3, at 1109 (stating that dictum in *Katz* appears to reject significance of “place” in Fourth Amendment analysis); Elizabeth Schutz, Note, *The Fourth Amendment Rights of the Homeless*, 60 *FORDHAM L. REV.* 1003, 1011 (1992) (reporting common belief that *Katz* eradicated significance of “place”).

³⁵ See, e.g., *California v. Ciraolo*, 476 U.S. 207, 212-13 (1986) (recognizing heightened privacy expectations in curtilage); *Dow Chem. Co. v. United States*, 476 U.S. 227, 235 (1986) (“The curtilage area immediately surrounding a private house has long been given protection as a place where the occupants have a reasonable and legitimate expectation of privacy that society is prepared to accept.”); *Oliver v. United States*, 466 U.S. 170, 178 (1984) (stating that certain areas deserve heightened protection from government invasion); *Payton v. New York*, 445 U.S. 573, 589 (1980) (stating that “[t]he Fourth Amendment protects the individual’s privacy in a variety of settings” but privacy is most clearly defined in home). Compare *United States v. Knotts*, 460 U.S. 276, 285 (1983) (holding that use of tracking beeper where car’s movement was readily observable by naked eye did not violate any legitimate expectation of privacy) with *United States v. Karo*, 468 U.S. 705, 714-21 (1984) (refusing to suppress evidence, but holding that monitoring of beeper in private residence violates Fourth Amendment).

³⁶ 466 U.S. 170 (1984).

³⁷ *Id.* at 173.

³⁸ *Id.*

society is prepared to recognize as reasonable.³⁹

B. *The Intrusion Factor*

In determining whether a Fourth Amendment violation has occurred, courts also consider the degree of intrusiveness which results from a surveillance.⁴⁰ A variety of factors assist courts in deciding whether an impermissible intrusion has actually occurred. These factors include local custom,⁴¹ violation of law,⁴² the use of technologically advanced equipment,⁴³ and most importantly, the intimacy of the information revealed from surveillance.⁴⁴ In *United States v. Place*,⁴⁵ Drug Enforcement

³⁹ *Id.* at 178-79. Surprisingly, however, the Court gave little consideration to the fact that the officers trespassed upon the defendant's property, ignoring a locked gate and a "No Trespass" sign. *Id.* at 175. Additionally, the Court stated that the correct test was not whether private activity was concealed, but rather whether "the government's intrusion infringes upon the personal and societal values protected by the Fourth Amendment." *Oliver*, 466 U.S. at 182-83.

⁴⁰ See *California v. Ciraolo*, 476 U.S. 207, 213 (1986) (noting that observational method was not physically intrusive); Wilkins, *supra* note 3, at 1103-04.

⁴¹ See *Schutz*, *supra* note 34, at 1020 (suggesting that "Court places great emphasis on societal customs—rather than mere legality—in determining whether an expectation of privacy is one society would regard as reasonable"); see also *Florida v. Riley*, 488 U.S. 445, 450-51 (1989) (discussing frequency of public air travel as important factor in determining that no reasonable expectation of privacy existed for observations obtained from navigable air space); *California v. Greenwood*, 486 U.S. 35, 40 (1988) (holding that no reasonable expectation existed in discarded garbage since it is common knowledge that garbage is readily accessible to public).

⁴² See *Riley*, 488 U.S. at 445. In *Riley*, an officer flew over the defendant's house after receiving a tip that he was growing marijuana. *Id.* at 448. The Court found it significant that the helicopter flew at a height of 400 feet — well within public navigable airspace. *Id.* at 451 (stating that "it is of . . . importance that the helicopter in this case was *not* violating the law") (emphasis in original); see also *Rakas v. Illinois*, 439 U.S. 128, 144 n.12 (1978) (stating that Court has not abandoned property concepts in determining Fourth Amendment violation); *United States v. Tabor*, 635 F.2d 131, 138 n.9 (2d Cir. 1980) (stating that "[w]hether unenhanced viewing would implicate the Fourth Amendment would depend on whether the viewer properly occupies his vantage point" and that "[a] trespass ordinarily would make the viewing unlawful"); *Steinberg*, *supra* note 7, at 585-86 (stating that courts remain likely to invalidate warrantless searches that involve physical trespass into constitutionally protected areas). *But see Oliver*, 466 U.S. at 176-77 (distinguishing open fields from houses protected by Fourth Amendment).

⁴³ See *Dow Chem. Co. v. United States*, 476 U.S. 227, 238 (1986) (explaining, in dictum, warrantless use of highly sophisticated technology may be constitutionally proscribed); *United States v. Agapito*, 620 F.2d 324, 330 (2d Cir.) (distinguishing natural hearing from electronically enhanced hearing), *cert. denied*, 449 U.S. 834 (1980); *Taborda*, 635 F.2d at 139 (holding that observation of defendant's apartment through use of high powered telescope 190 feet away required search warrant).

⁴⁴ See *United States v. Ford*, 34 F.3d 992, 996 (11th Cir. 1994) (describing intimacy of detail and activity revealed by surveillance as significant factor); see also *Dow Chem. Co.*, 476 U.S. at 238 (noting that photographs were "not so revealing of intimate details as to raise constitutional concerns"); *Ciraolo*, 476 U.S. at 215 n.3 (acknowledging that technology revealing intimate associations, objects, or activities may be unduly invasive); *Taborda*, 635 F.2d at 139 (noting that telescopes may reveal "intimate details of a person's private life, which he legitimately expects

Agents subjected the defendant's bags to a canine sniff.⁴⁶ The Supreme Court found that the agents had reasonable suspicion to believe the defendant was involved in drug trafficking.⁴⁷ In holding that the sniff was not a "search," the Court reasoned that the investigative technique was "much less intrusive than a typical search" because the quantum of obtainable information was limited.⁴⁸

C. Application to Field

A home is worthy of stringent privacy protections.⁴⁹ To be constitutional, therefore, a FLIR scan must be minimally intrusive when the previously mentioned two-prong test is applied. The cases seem to indicate that the two factors of intrusiveness which may make a FLIR scan unduly invasive are: (1) the intimacy of detail relayed; and (2) the sophistication of the technology used. A FLIR is a highly advanced machine whose scan can detect heat from virtually any object.⁵⁰ Some have suggested that society fears this type of technology more than any other type.⁵¹ Since the Fourth Amendment protects a person's privacy, however, a technologically enhanced surveillance is only unconstitutional if it reveals intimate information.⁵² Under the facts of existing thermal imagery case law,⁵³

will not be observed"); Wilkins, *supra* note 3, at 1104-07 (discussing importance of intimacy in determining whether constitutional search occurred).

⁴⁵ 462 U.S. 696 (1983).

⁴⁶ *Id.* at 699.

⁴⁷ *Id.* at 698-99.

⁴⁸ *Id.* at 707.

⁴⁹ *E.g.*, Wilkins, *supra* note 3, at 1112 ("[H]ome is sacred in Fourth Amendment terms" (citing *Segura v. United States*, 468 U.S. 796, 810 (1984))).

⁵⁰ See *United States v. Field*, 855 F. Supp. 1518, 1522 (W.D. Wis. 1994) (reporting expert's testimony that "all objects radiate some thermal energy") (emphasis in original).

⁵¹ See Lisa S. Morris, Note, *Photo Radar: Friend or Foe*, 61 UMKC L. REV. 805, 808 (1993) (stating that many consider use of photoradar "sneaky" and Orwellian); see also *Field*, 855 F. Supp. at 1533 (suggesting that public would have expectation of privacy if it was aware of potential use of FLIR technology).

⁵² See *United States v. Ishmael*, 48 F.3d 850, 855 (5th Cir.) ("The crucial inquiry, as in any search and seizure analysis, is whether the technology reveals 'intimate details.'"), *cert. denied*, 116 S. Ct. 74 (1995); see also *United States v. Jacobsen*, 466 U.S. 109, 122-23 (1984). In *Jacobsen*, members of an Airport Federal Express office opened a damaged package pursuant to company policy regarding insurance claims. *Id.* at 111. After employees discovered four plastic bags containing white powder, they called the Drug Enforcement Agency ("DEA"). *Id.* A DEA agent then removed specimens from the bags and tested them, finding the substance to be cocaine. *Id.* at 111-12. The Court held the field test was not a "search" or "seizure" because the test could only reveal whether the previously suspicious powder was cocaine. *Id.* at 122. Although the defendant had some expectation of privacy, it was not one which society would regard as reasonable. *Jacobsen*, 466 U.S. at 122-23 ("A chemical test that merely discloses whether or not a particular substance is cocaine does not compromise any legitimate interest in privacy."); see

constitutional concerns do not seem to arise when using the intrusion factors mentioned above.⁵⁴ Even if one was to dismiss the factor approach advocated by scholars,⁵⁵ it seems that the Supreme Court has already upheld warrantless acts that were far more invasive than FLIR searches.⁵⁶

also supra notes 45-48 and accompanying text. The use of police radar guns is analogous to a FLIR scan. Police use radar guns to detect speeding motorists. The gun's scan is virtually impossible to prevent once an automobile passes through the detectable zone. Fourth Amendment issues do not arise, however, since the scan does not invade the motorist's privacy. *Cf. United States v. Knotts*, 460 U.S. 276, 281 (1983) (asserting reduced expectation of privacy in car on public highway); *Morris, supra* note 51, at 817 (arguing that photograph taken by photo radar device would probably not be invasion of privacy because automobile is exposed to public view and motorists do not possess expectation of privacy when committing crime in public). It seems that the privacy interest is something more than an intent to hide criminal activity. *See Jacobsen*, 466 U.S. at 137 (Brennan, J., dissenting) (stating that Court's reasoning implies that possession of contraband reduces individuals' reasonable expectation of privacy).

⁵³ *United States v. Cusumano*, 67 F.3d 1497, 1499 (10th Cir. 1995) (finding that imager revealed "hot spots" along walls, roof, and areas near front door); *Ishmael*, 48 F.3d at 852 (observing that water exiting building was hotter than when it entered and ground next to building was warmer than ground further away); *United States v. Robinson*, 62 F.3d 1325, 1327 (11th Cir. 1995) (finding that home was considerably warmer than surrounding houses); *see, e.g., United States v. Robertson*, 39 F.3d 891, 894 (8th Cir. 1994) (stating that observations of readings showed high amount of heat emanating from two or three areas of trailer), *cert. denied*, 115 S. Ct. 1812 (1995); *United States v. Ford*, 34 F.3d 992, 993 (11th Cir. 1994) (observing that mobile home emitted inordinate amount of heat through its floors and walls); *United States v. Pinson*, 24 F.3d 1056, 1057 (8th Cir.) (establishing through affidavit that excessive heat emitted from window, roof and skylight), *cert. denied*, 115 S. Ct. 664 (1994); *United States v. Olson*, 21 F.3d 847, 848 n.5 (8th Cir.) (due to extreme heat, photographs revealed rafters and that trailer was divided into two rooms), *cert. denied*, 115 S. Ct. 230 (1994).

⁵⁴ Although most of the FLIR searches previously discussed occurred in a home, it appears that in performing the search no laws were violated and no intimate details were observed. Thus, it is asserted that since the scans were minimally intrusive, they did not constitute a "search" within the meaning of the Fourth Amendment, even if they were within the confines of a highly protected home. *But see infra* note 61.

⁵⁵ Many scholars have advocated a Fourth Amendment analysis which implements the use of balancing factors. *See, e.g., Wilkins, supra* note 3, at 1080 (stating that Court implicitly focused on three interrelated inquires in determining whether government has violated reasonable expectation of privacy); Clifford S. Fishman, *Technologically Enhanced Visual Surveillance and the Fourth Amendment: Sophistication, Availability and the Expectation of Privacy*, 26 AM. CRIM. L. REV. 315, 317-18 (1988) (recognizing pattern of Court in considering three factors to determine if search has occurred); *see also Steinberg, supra* note 7, at 612 (observing that Supreme Court primarily considers four factors in Fourth Amendment analysis).

⁵⁶ *See, e.g., Florida v. Riley*, 488 U.S. 445, 445-46 (1989) (finding that government helicopter that flew over defendant's fence-enclosed property to peer into greenhouse with missing roof panels did not violate Fourth Amendment); *Dow Chem. Co. v. United States*, 476 U.S. 227, 228-29 (1986) (determining that aerial photographs taken by Environmental Protection Agency of heavily secured chemical plant with high precision mapping camera was not "search"); *California v. Ciraolo*, 476 U.S. 207, 215 (1986) (reiterating that it was not Fourth Amendment violation for police to fly over and take pictures of backyard enclosed by six-foot outer fence and ten-foot inner fence without warrant); *Oliver v. United States*, 466 U.S. 170, 184 (1984) (concluding that officers walking around locked gate containing "No Trespass" sign to trespass

Chief Judge Crabb may have put too much emphasis on the home as the place of the scan.⁵⁷ In one Supreme Court case, then Chief Judge Burger stated that “the home is sacred in Fourth Amendment terms . . . because of . . . the occupants’ *privacy* interests in the activities that take place within.”⁵⁸ Admittedly, an expectation of privacy is reasonable in a home because it is an area of intimate and personal activities.⁵⁹ In *Field*, however, the FLIR survey only revealed “a white area on Field’s house.”⁶⁰ Even the thermal imaging expert was unable to identify the hot spot’s origin.⁶¹ It is submitted that this was not the type of privacy interest which the Fourth Amendment was designed to protect.⁶²

II. BALANCING LAW ENFORCEMENT AND PRIVACY INTERESTS

It is probable that Chief Judge Crabb was concerned about possible

on defendant’s open field did not constitute “warrantless” search); *United States v. Knotts*, 460 U.S. 276, 277, 285 (1983) (holding that law enforcement agents’ insertion of electronic beeper into defendant’s chemical drum in order to trace him to secluded cabin was not “search”); *Smith v. Maryland*, 442 U.S. 735, 745-46 (1979) (holding that police officers’ installation and use of pen register to record phone numbers of defendant’s calls was not “search”).

Courts confronted with the thermal imagery issue tend to focus on privacy intrusions by comparing a FLIR to other types of surveillance equipment. *See United States v. Penny-Feeney*, 773 F. Supp. 220, 226 (D. Haw. 1991) (stating that FLIR scan is analogous to dog’s sniff), *aff’d on other grounds sub nom.*, *United States v. Feeney*, 984 F.2d 1053 (9th Cir. 1993); *United States v. Pinson*, 24 F.3d 1056, 1058 (8th Cir.) (same), *cert. denied*, 115 S. Ct. 664 (1994). Analogies to other types of technology are imperfect since a FLIR does not enhance senses but relays information that is qualitatively different. As a result, critics try to distinguish analogies. *See, e.g.*, *United States v. Field*, 855 F. Supp. 1518, 1519, 1532-33 (W.D. Wis. 1994) (refuting comparison that escaped heat is similar to garbage and that FLIR scan is analogous to dog’s sniff); *Steele*, *supra* note 12, at 30-39 (stating that canine is trained to detect only illicit narcotics while FLIR detects all heat); *Pochurek*, *supra* note 11, at 155-59 (refuting analogies).

⁵⁷ *See Field*, 855 F. Supp. at 1519 (“Thermal imaging can extract information from within a person’s home, the place most deserving of protection from government intrusion.”).

⁵⁸ *Segura v. United States*, 468 U.S. 796, 810 (1984) (emphasis in original).

⁵⁹ *Wilkins*, *supra* note 3, at 1112. *Katz* shifted the emphasis on the home from a literal Fourth Amendment analysis to an area associated with privacy. *Id.* at 1110-11.

⁶⁰ *Field*, 855 F. Supp. at 1523.

⁶¹ *Id.* The government argued that a thermal imager cannot detect activities within a home. *Id.* at 1531. In rejecting this argument, the court stated, “if the thermal imager doesn’t tell the government anything useful, then it has no value in determining whether there is probable cause to issue a search warrant.” *Id.* Instead of finding that the search warrant lacked probable cause, the court held that a FLIR scan constitutes a “search” since it reveals detailed information and “does not fit into any exception to the warrant requirement.” *Id.* at 1533.

⁶² *But see United States v. Cusumano*, 67 F.3d 1497, 1510 (10th Cir. 1995) (holding that because thermal imager revealed hot spots on garage wall, roof, and areas near front door, scan impermissibly intruded into defendant’s Fourth Amendment privacy); *State v. Young*, 867 P.2d 593, 594 (Wash. 1994) (finding that because FLIR displayed abnormal heating patterns unobtainable through unaided observation, its use was unconstitutional).

governmental abuses.⁶³ It is submitted, however, that the court should have attempted to strike a balance between the Fourth Amendment and law enforcement interests.⁶⁴ This can be accomplished by requiring that reasonable suspicion exist before permitting FLIR scans, and by requiring that the scan be videotaped.

In *People v. Dunn*,⁶⁵ New York police brought a narcotics detection dog to the common hallway outside the defendant's door after receiving information that his apartment contained drugs.⁶⁶ When the dog indicated the presence of drugs, a search warrant was obtained and executed.⁶⁷ The defendant moved to have the seized evidence suppressed based on his assertion that the warrant was improperly issued.⁶⁸ He claimed the warrant was based in part on a "canine sniff" which he contended constituted a warrantless search.⁶⁹ The New York Court of Appeals held

⁶³ The magistrate judge stated expressed concern about the public becoming aware of the FLIR's capabilities. *Field*, 855 F. Supp. at 1533. Society would develop a subjective expectation of privacy in certain heat sources and would accept this expectation as being reasonable. *Id.* But "[w]hen determining whether surveillance is unduly invasive, a court must focus on what actually occurred, not on what might occur in some future case." *United States v. Domitrovich*, 852 F. Supp. 1460, 1474 (E.D. Wash. 1994), *aff'd*, 57 F.3d 1078 (9th Cir. 1995); *see Dow Chem. Co. v. United States*, 476 U.S. 227, 238 n.5 (1986) ("Fourth Amendment cases must be decided on the facts of each case, not by extravagant generalizations. '[W]e have never held that potential, as opposed to actual, invasions of privacy constitute searches for purposes of the Fourth Amendment.'" (quoting *United States v. Karo*, 468 U.S. 705, 712 (1984))). Other courts have also been concerned about the possibility that the government may impermissibly use a FLIR. *Cusumano*, 67 F.3d at 1504 (stating that thermal imager is currently capable of revealing private activities, and that allowing it to use device would eviscerate Constitution). Even if the government exercises discretion by avoiding the viewing of personal activities, little would prevent it from using the FLIR in neighborhood surveillances to detect unusual heat patterns. *See United States v. Jacobsen*, 466 U.S. 109, 137-38 (1983) (Brennan, J., dissenting). Brennan stated:

[T]he Court adopts a general rule that a surveillance technique does not constitute a search if it reveals only whether or not an individual possesses contraband. . . . In fact, the Court's analysis is so unbounded that if a device were developed that could detect, from outside of a building, the presence of cocaine inside, there would be no constitutional obstacle to the police cruising through a residential neighborhood and using the device to identify all homes in which the drug is present.

Id. This problem can be solved by requiring a reasonable suspicion standard for FLIR use. *See infra* notes 64-75 and accompanying text.

⁶⁴ *See Carroll v. United States*, 267 U.S. 132, 149 (1925) (stating that Fourth Amendment should be construed to conserve public and private interests).

⁶⁵ 77 N.Y.2d 19 (1990), *cert. denied*, 501 U.S. 1219 (1991).

⁶⁶ *Id.* at 21.

⁶⁷ *Id.* (stating that, based on dogs' reaction and prior information, search warrant was obtained).

⁶⁸ *Id.* at 22.

⁶⁹ *Id.* (arguing that "canine sniff" conducted outside apartment was unsupported by probable cause and constituted "unlawful warrantless search").

that the sniff was a "search" under the New York State Constitution.⁷⁰ Noting that a canine's smell is less intrusive than a full-blown search, the court stated that, "[g]iven the uniquely discriminate and nonintrusive nature of such an investigative device, as well as its significant utility to law enforcement authorities, we conclude that it may be used without a warrant or probable cause, provided that the police have a reasonable suspicion that a residence contains illicit contraband."⁷¹ It is submitted that this reasoning is applicable to FLIR uses.⁷² For a scan to remain constitutional it may not reveal the details of a home.⁷³ Therefore, a scan cannot be the sole information used to establish the probability of marijuana growth.⁷⁴ Since an infrared scan can only be one factor in a probable cause determination, authorities must acquire more information to obtain a search warrant. If FLIR use was held to a reasonable suspicion standard, police officers would be forced to obtain this additional information prior to using a FLIR scan.⁷⁵ If the government could not establish reasonable suspicion, it would not be permitted to use the FLIR. If a reasonable suspicion did exist, a FLIR could be used to help establish the probable

⁷⁰ *Dunn*, 77 N.Y.2d at 25.

⁷¹ *Id.* at 26 (citations omitted).

⁷² Reasonable suspicion depends upon the content and reliability of information. *Alabama v. White*, 496 U.S. 325, 330 (1990). It is a lower standard than probable cause, requiring less evidence and less reliability. *Id.* In determining whether reasonable suspicion exists, however, the content and reliability of information are evaluated under the totality of circumstances. *Id.* Thus, a tip which has a low degree of reliability must be supported by more evidence. *Id.* For example, an anonymous tip corroborated by independent police work may provide the reasonable suspicion necessary to use a FLIR scan. *Id.* at 332. The additional evidence might include the defendant's electricity bills. *White*, 496 U.S. at 332.

⁷³ See *supra* notes 49-62 and accompanying text.

⁷⁴ "Probable cause for a search is established when there are reasonable grounds to believe that objects connected to criminal activity . . . are presently located in the particular place to be searched." *United States v. Porco*, 842 F. Supp. 1393, 1399 (D. Wyo. 1994), *aff'd sub nom.*, *United States v. Cusumano*, 67 F.3d 1497 (10th Cir. 1995). Probable cause exists when, given all the circumstances, there is a fair probability that evidence of a crime will be found. *Illinois v. Gates*, 462 U.S. 213, 238 (1983). Because the FLIR is imprecise, it cannot establish a fair probability of criminality without other supporting evidence.

⁷⁵ For example, in *Field*, the sheriff subpoenaed the defendant's electricity bills after conducting an infrared survey. *United States v. Field*, 855 F. Supp. 1518, 1523 (W.D. Wis. 1994). If the informants' information was insufficient to establish reasonable suspicion, the sheriff could have obtained the bills first to help meet this requirement. See *United States v. Dimitrovich*, 852 F. Supp. 1460, 1475 n.3 (E.D. Wash. 1994) (stating that law enforcer may obtain power consumption records without warrant) (citing *Smith v. Maryland*, 442 U.S. 735, 743 (1978) (holding that there is no expectation of privacy in information disclosed to third persons)), *aff'd*, 57 F.3d 1078 (9th Cir. 1995); *Porco*, 842 F. Supp. at 1398 (holding that sheriff permissibly obtained defendant's electric bills from power company without warrant because there is no legitimate expectation of privacy in information revealed to third party).

cause necessary to obtain a search warrant.

Furthermore, to avoid testimony "patently tailored to meet constitutional objections,"⁷⁶ law enforcement agents should be required to videotape a FLIR surveillance.⁷⁷ The court could then view the tape to see if impermissible details were relayed.⁷⁸

III. CONCLUSION

Supreme Court cases upholding technologically enhanced surveillances have been heavily and justifiably⁷⁹ criticized.⁸⁰ The capabilities of these devices may cause citizens to view their freedom differently.⁸¹ Reasonable expectations of privacy diminish when the Court permits governmental intrusions.⁸² Under the current state of the Fourth Amendment's pro-

⁷⁶ *People v. Smith*, 430 N.Y.S.2d 95, 97 (N.Y. App. Div. 1980).

⁷⁷ *See Porco*, 842 F. Supp. at 1396 (stating that FLIR scans can be videotaped).

⁷⁸ Police officers could take steps to prevent a FLIR from impermissibly infringing on the privacy of a homeowner while maintaining the machine's accuracy. One method of accomplishing this would be by calibrating the infrared device to pick up heat sources likely to be plant growth lamps. *See Field*, 855 F. Supp. at 1522 (stating that thermal imagery expert routinely set FLIR to only detect very hot objects). Secondly, officers could perform an aerial scan of a home. Since a roof is usually thicker than a wall, the possibility of seeing cooler objects is lessened. *See id.* at 1531 (stating that in *Washington v. Young*, 867 P.2d 593, 594 (Sup. Ct. Wash. 1994), parties stipulated that infrared device could detect human forms near windows or behind walls made of plywood or similar materials).

A more difficult thermal imagery problem would be limiting the ability of an officer to use a home as a control group. A FLIR operator might seek the permission of various homeowners in the neighborhood or establish the police department as the norm. Pochurek points out that an infinite amount of factors such as the home's age and insulation may cause differences in heat loss. Pochurek, *supra* note 11, at 158.

⁷⁹ *E.g.*, Pochurek, *supra* note 11, at 137 (concluding that such surveillances compromise fourth amendment); Steinberg, *supra* note 7, at 582 (noting that constitutional problems are caused by permitting sense enhanced surveillance); Gutterman, *supra* note 2, at 650 (stating that Court's Fourth Amendment approach fails to protect privacy rights).

⁸⁰ Traditionally, a person learned of a police investigation when authorities presented the search warrant. Steinberg, *supra* note 7, at 569. However, the secrecy of a technologically enhanced investigation provides no such notice. *Id.* Public knowledge of government action helps prevent arbitrary police behavior because the police will be made accountable for mistakes and unjustified searches. *Id.* at 572-73. The secrecy of technologically advanced surveillance, however, can encourage arbitrary government acts. *Id.* at 573-74.

⁸¹ Because citizens may be unaware of investigations, they may begin to live in fear. Steinberg, *supra* note 7, at 570. This may cause a 'chilling effect' on the exercise of First Amendment rights. *Id.* at 571 (quoting *Laird v. Tatum*, 408 U.S. 1, 11 (1972)).

⁸² *See Wingo*, *supra* note 8, at 21. Once it becomes common knowledge that police utilize a surveillance device, the court can conclude that "society" must realize it is no longer reasonable to expect privacy in something which the government can routinely detect. *Id.* "If reasonable expectations of privacy disappear whenever there is a possibility that unseen eyes may be observing one's activities, then such expectations may no longer exist at all." *Id.* *But see Smith v. Maryland*, 442 U.S. 735, 740-41 n.5 (1978) (noting that "where an individual's subjective

tections, however, the details revealed by thermal imagers such as that used in *Field* do not invade a reasonable expectation of privacy. The *Field* court's attempt to limit technological surveillance by finding thermal imaging unconstitutional is admirable but unwarranted. The court should have directed its concern toward containing the possibilities of future abuses. This can be accomplished by: (1) requiring the government to acquire a reasonable suspicion of indoor marijuana growth before using a FLIR; and (2) requiring the government to videotape its surveillance. These restrictions strike a fair balance between law enforcement and privacy interests.

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expectations had been 'conditioned' by influences alien to well-recognized Fourth Amendment freedoms . . . [i]n determining whether a 'legitimate expectation of privacy' existed . . . a normative inquiry would be proper").

