

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA

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NANCY MAYER WHITTINGTON, CLERK
U.S. DISTRICT COURT

UNITED STATES OF AMERICA,)
)
)
 v.)
)
 I. LEWIS LIBBY,)
)
 Defendant.)

Criminal No. 05-394 (RBW)

MEMORANDUM OPINION

On October 26, 2006, this Court heard extensive testimony and argument on the defendant's motion to admit the expert testimony of Dr. Robert A. Bjork.¹ Specifically, the defendant opines that he should be permitted to introduce the testimony of Dr. Bjork "regarding [what he characterizes as] the widely-accepted findings from the science of memory." Def.'s Mot. at 1. Having carefully considered the papers filed in connection with this motion, the exhibits, and the testimony presented during the hearing on the motion, the Court must conclude that Dr. Bjork's testimony is not admissible. Accordingly, for the reasons that follow, the defendant's motion to introduce Dr. Bjork's testimony will be denied.

I. Background

This Court has, on several occasions, set forth the facts underlying the charges lodged against the defendant. See, e.g., United States v. Libby, 432 F. Supp. 2d 81, 82 (D.D.C. 2006);

¹ The following papers have been submitted to the Court in connection with this motion: (1) Motion of I. Lewis Libby to Admit Expert Testimony Under Federal Rule of Evidence 702 ("Def.'s Mot."); (2) the Government's Memorandum in Opposition to Defendant's Motion to Admit Expert Testimony ("Gov't's Opp'n"); and (3) the Reply of I. Lewis Libby in Support of his Motion to Admit Expert Testimony Under Federal Rule of Evidence 702 ("Def.'s Reply").

United States v. Libby, 432 F. Supp. 2d 26, 28 (D.D.C. 2006); United States v. Libby, 429 F. Supp. 2d 27, 28-29 (D.D.C. 2006); United States v. Libby, 429 F. Supp. 2d 1, 4 (D.D.C. 2006). Thus, the Court need not engage in an extensive review of the facts as they are well-known to all involved. It is helpful, nonetheless, to briefly review the facts as they relate to the motion currently before the Court.

The defendant is charged in a five-count indictment with obstruction of justice in violation of 18 U.S.C. § 1503 (2000), two counts of false statements in violation of 18 U.S.C. § 1001(a)(2) (2000), and two counts of perjury in violation of 18 U.S.C. § 1623 (2000). Indictment at 1. All of these charges arise from a criminal investigation into the possible unauthorized disclosure of classified information—Valerie Plame Wilson’s affiliation with the Central Intelligence Agency (“CIA”)—to several journalists. Indictment at 8, ¶ 25. Specifically, the charges against the defendant are predicated upon statements that the defendant allegedly made to Special Agents of the Federal Bureau of Investigation (“FBI”) in October and November, 2003, id. at 9, ¶ 26, and testimony he provided to a grand jury in March 2004, id. at 11, ¶ 30. The alleged false statements occurred when the defendant recounted conversations he had in June and July 2003, with news reporters Tim Russert, Judith Miller, and Matthew Cooper to the FBI Agents and to the grand jury. See generally Indictment at 11-22.

The defendant has made clear that in his effort to rebut these charges he will argue, in part, (1) that it is the government’s witnesses, and not him, who misremembered the facts and the substance of the various conversations detailed in the indictment and (2) that any errors he may have made in describing the events were occasioned by confusion or faulty memory, not any wilful intent to misrepresent the truth. Def.’s Mot. at 1-2; see Libby, 429 F. Supp. 2d at 12

(noting that the defendant may assert as his defense that any false statements were the result of confusion, mistake, or a faulty memory). This Court has acknowledged that this “faulty memory defense” is a viable defense to the charges. Libby, 429 F. Supp. 2d at 12 (recognizing that “the charges could possibly be defeated by the defendant demonstrating that the alleged misstatements were not made intentionally, but were merely the result of confusion, mistake, faulty memory, or another innocent reason.”). Accordingly, the memory and recollection of the principal players will undoubtedly play a substantial role in the assessment of the defendant’s culpability in the upcoming trial.

To support his faulty memory defense, the defendant seeks to introduce at trial the testimony of Dr. Bjork “to show that it is entirely plausible, given how memory has been found to function, that Mr. Libby or the government witnesses—or both—have innocently confused or misremembered the conversations on which this case turns.” Def.’s Mot. at 2. Specifically, Dr. Bjork would testify about thirteen scientific principles concerning human memory, including the process by which memory is encoded, stored, retained, and retrieved and various scientific bases for memory errors including “content borrowing,” source misattribution, subsequent recall, divided attention, and “retroactive interference.” Def.’s Mot., Ex. A (listing thirteen opinions Dr. Bjork’s testimony would encompass). According to the defendant, Dr. Bjork’s expert testimony “will assist the jury by providing information about the findings of memory research that are not already known to the jurors.” Def.’s Mot. at 2. It is the admissibility of Dr. Bjork’s testimony under Federal Rule of Evidence 702 that is the subject of this opinion.

II. Federal Rule of Evidence 702

The admissibility of expert testimony is governed by Federal Rule of Evidence 702.² Central to the court's determination of whether expert testimony is admissible under Rule 702, and consistent with the Rule's purpose, is the two-prong test enunciated by the Supreme Court in Daubert v. Merrell Dow Pharm., 509 U.S. 579 (1993).³ Under this test, a court determining the admissibility of purported expert testimony must first determine "[1] whether the reasoning or methodology underlying the testimony is scientifically valid and [2] whether that reasoning or methodology properly can be applied to the facts in issue." Id. at 592-93.⁴ When analyzing whether expert testimony is admissible under this test, the Court plays the role of a "gatekeeper" with the responsibility to ensure that the proposed testimony is both reliable and relevant. Ambrosini v. Labarraque, 101 F.3d 129, 133 (D.C. Cir. 1996); see Daubert, 509 U.S. at 589. The burden is on the proponent of the testimony to establish its admissibility by a "preponderance of proof." Meister v. Med. Eng'g Corp., 267 F.3d 1123, 1127 n.9 (D.C. Cir. 2001) (citing Daubert, 509 U.S. at 592 n.10).

² Under Rule 702,

[i]f scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise, if (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case.

Fed. R. Evid. 702.

³ The Supreme Court most recently discussed the admissibility of expert testimony under Rule 702 and Daubert in Kumho Tire Co. v. Carmichael, 526 U.S. 137, 141 (1999) and in General Electric Co. v. Joiner, 522 U.S. 136, 142 (1997). Both opinions confirm that courts are guided by Daubert's two-prong test when determining whether expert testimony is admissible at trial.

⁴ Federal Rules of Evidence 703, 704, 705, and 706, among others, also govern the admissibility of expert testimony. These provisions, however, are not the subject of the defendant's motion.

This first prong of the Daubert test “establishes a standard of evidentiary reliability.” Daubert, 509 U.S. at 590. Although the subject of the scientific testimony need not be “known to a certainty,” it must be “ground[ed] in the methods and procedures of science.” Id. at 590. When examining this part of the test, the “court must focus ‘solely on principles and methodology, not on the conclusions that they generate.’” Ambrosini, 101 F.3d at 133 (citing Daubert, 509 U.S. at 595). The Supreme Court has provided a non-exhaustive, flexible list of factors to help courts determine whether the proffered testimony satisfies the first prong of the Daubert test. This list includes: (1) whether the subject of the expert’s testimony “can be (and has been) tested”; (2) whether it has been “subjected to peer review and publication”; (3) “the known or potential rate of error” of the relevant scientific technique; (4) “the existence and maintenance of standards controlling the technique’s operation”; and (5) whether it is “generally accepted” in the relevant scientific community. Daubert, 509 U.S. at 593-94. It is important to note, however, that

nothing in either Daubert or the Federal Rules of Evidence requires a district court to admit opinion evidence that is connected to existing data only by the ipse dixit of the expert. A court may conclude that there is simply too great an analytical gap between the data and the opinion proffered.

Gen. Elec. Co. v. Joiner, 522 U.S. 136, 146 (1997).

Even if the Court concludes that the proponent of expert testimony has satisfied the first prong of the Daubert test, the testimony will only be admissible if it “will assist the trier of fact to understand the evidence or to determine a fact in issue.” Fed. R. Evid. 702. This prong of the Daubert test “goes primarily to relevance.” Daubert, 509 U.S. at 591. Thus, “[e]xpert testimony which does not relate to any issue in the case is not relevant and, ergo, non-helpful.” Id. (citation

and internal quotation marks omitted). As the Supreme Court in Daubert explained, the proposed testimony must be a “fit” to assist the jury in resolving an issue relevant to a case, id., which “entails a preliminary assessment of whether . . . scientifically valid . . . reasoning or methodology properly can be applied to the facts in issue,” id. at 593. An expert need not offer an opinion on a specific issue to satisfy this “fit” requirement; rather, the expert can testify about general scientific principles. See, e.g., United States v. Mulder, 273 F.3d 91, 101-02 (2d Cir. 2001).⁵ The Supreme Court has cautioned, however, that “[f]it is not always obvious, and scientific validity for one purpose is not necessarily scientific validity for other, unrelated purposes.” Daubert, 509 U.S. at 591.

In determining whether proposed scientific evidence has a proper fit, courts have looked to a variety of factors, including: “(1) whether the testimony is relevant; (2) whether it is within the juror’s common knowledge and experience; and (3) whether it will usurp the juror’s role of evaluating a witness’s credibility.” United States v. Rodriguez-Felix, 450 F.3d 1117, 1123 (10th Cir. 2006) (internal footnotes and citations omitted). Thus, expert testimony concerning matters beyond the understanding of the average juror is often admissible, while expert testimony concerning knowledge within the province of the average juror is not. Compare United States v. Long, 328 F.3d 655, 666 (D.C. Cir. 2003) (concluding that “experts may testify regarding the modus operandi of a certain category of criminals where those criminals’ behavior is not ordinarily familiar to the average layperson”) and United States v. Moore, 104 F.3d 377, 384 (D.C. Cir. 1997) (holding that expert testimony concerning practices of persons involved in drug

⁵ In fact, the Federal Rules of Evidence encourage expert testimony in non-opinion form. See Fed. R. Evid. 702, advisory committee’s notes (noting that parties should be “encourage[d] [to] . . . use . . . expert testimony in non-opinion form when counsel believes the trier can itself draw the requisite inference.”).

dealing in using duct tape assisted jury in determining whether the defendant intended to distribute drugs), with Stromback v. New Line Cinema, 384 F.3d 283, 295 (6th Cir. 2004) (holding that expert testimony was not necessary in a copyright infringement case, as a jury could compare two works to determine if they were substantially similar) and United States v. Mitchell, 49 F.3d 769, 780 (D.C. Cir. 1995) (concluding that the district court did not err in preventing a linguistics expert from testifying about taped conversations, as the tapes were before the jury and they could be properly evaluated by the jury). Expert testimony will also be precluded if would usurp the jury's role as the final arbiter of the facts, such as testimony on witness credibility and state of mind. See, e.g., Nimely v. City of New York, 414 F.3d 381, 398 (2d Cir. 2005) (holding "that expert opinions that constitute evaluations of witness credibility, even when such evaluations are rooted in scientific or technical expertise, are inadmissible under Rule 702"); United States v. Boney, 977 F.2d 624, 630 (D.C. Cir. 1992) (concluding that expert testimony on the guilt or innocence of a defendant in a criminal case invaded the province of the jury and was improper under Rule 702); Salas v. Carpenter, 980 F.2d 299, 305 (5th Cir. 1992) (excluding expert testimony on whether the defendant had the requisite state of mind to commit the charged offense).

Admittedly, there is no bright line that separates issues that are considered within the comprehension of juries and those that are not. 4 J. McLaughlin, J. Weinstein, & M. Berger, Federal Evidence § 702.03[2][b] (2d ed. 2006). And some courts have concluded that when a court is presented with a close question of whether an expert's proposed testimony falls within the competence of the jury's apprehension, the court should resolve the question in favor of admitting the testimony. See, e.g., United States v. Jakobetz, 955 F.2d 786, 796-97 (2d Cir.

1992) (concluding that courts should resolve doubts about the admissibility of expert testimony in favor of the proponent of the testimony); Larabee v. M M & L Int'l Corp., 896 F.2d 1112, 1116 n.6 (8th Cir. 1990) (noting that while “the district court ordinarily has broad discretion to admit or exclude expert testimony, . . . doubts about whether an expert’s testimony will be useful should generally be resolved in favor of admissibility.”) (citation and internal quotation marks omitted). These courts have reasoned that since the Federal Rules of Evidence adopt a liberal approach to the admissibility of expert testimony, close questions should be resolved in favor of admissibility. Jakobetz, 955 F.2d at 797. However, although the Federal Rules of Evidence embody a “general approach of relaxing the traditional barriers to ‘opinion’ testimony,” Daubert, 509 U.S. at 588, before expert testimony may be admitted at trial, the Court must first conclude that the proponent of the expert testimony satisfies the two-prong Daubert test, id. at 589. And even if this Daubert test is satisfied, expert testimony can still be precluded under Rule 403 “if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury, or by considerations of undue delay, waste of time, or needless presentation of cumulative evidence.” United States v. Gatling, 96 F.3d 1511, 1523 (D.C. Cir. 1996) (“If a court determines that expert testimony might be helpful to the jury, it should allow the testimony unless it finds that under Rule 403 the unfair prejudice caused by the testimony outweighs its probative value.”); see Daubert, 509 U.S. at 594. In discussing the interplay between Rule 403 and Rule 702, the Supreme Court recognized that “[e]xpert evidence can be both powerful and quite misleading because of the difficulty in evaluating it. Because of this risk, the judge in weighing possible prejudice against probative force under Rule 403 of the present rules exercises more control over experts than over lay witnesses.” Daubert, 509 U.S. at

595 (quoting Jack B. Weinstein, Rule 702 of the Federal Rules of Evidence is Sound: It Should Not Be Amended, 138 F.R.D. 631, 632 (1991)).

III. Legal Analysis

A. Daubert Analysis

The government does not challenge the proposed testimony of Dr. Bjork on the grounds that his testimony fails to satisfy the first prong of Daubert, noting that it “does not quibble with Dr. Bjork’s expertise concerning research into memory, particularly with respect to the reliability of eyewitness identification.”⁶ Gov’t’s Opp’n at 1. Rather, the government contends that the defendant “cannot meet his burden as the proponent of the evidence of establishing that the testimony will assist the jury in understanding or determining any of the facts at issue in this case.” Id. Thus, this is the only question the Court must resolve. For the reasons that follow,

⁶ Although a former member of this Court concluded almost twenty years ago that the “psychodynamics of memory and perception” are not sufficiently scientifically reliable to permit an expert to testify on the subject, Robertson v. McCloskey, 676 F. Supp. 351, 355 (D.D.C. 1988), this conclusion hardly remains good law. First, the court in Robertson applied the principles set forth in Frye v. United States, 293 F. 1013 (D.C. Cir. 1923), the then-leading authority on the introduction of expert testimony. Frye, of course, has now been supplanted by the Supreme Court’s pronouncement in Daubert. Daubert, 509 U.S. at 586 (noting that the Frye test has been superseded by the Federal Rules of Evidence). And, based upon a review of the scientific literature provided to the Court, there can be little doubt that today (as opposed to twenty years ago) the science of memory is well established and accepted in the scientific community, and the subject of Dr. Bjork’s testimony has been well tested and subjected to peer review. See, e.g., S. Hannigan & M. Reinitz, Migration of Objects and Inferences Across Episodes, 31 *Memory & Cognition* 434-444 (2003); M. Arnold & D.S. Lindsay, Remembering Remembering, 28 *J. of Experimental Psychology* 521-529 (2002); A. Troyer, G. Winocur, F. Craik, & M. Moscovitch, Sources Memory and Divided Attention: Reciprocal Costs to Primary and Secondary Tasks, 13 *Neuropsychology* 467-474 (1999); L. Jacoby, V. Woloshyn, & C. Kelley, Becoming Famous Without Being Recognized: Unconscious Influences of Memory Produced by Dividing Attention, 118 *J. of Experimental Psychology: General*, 115-125 (1989). Moreover, Dr. Bjork’s curriculum vitae and a review of his research demonstrates that he is eminently qualified to testify on the subject of memory and perception. Def.’s Mem., Ex. B; see A. Benjamin, R. Bjork, & B. Schwartz, The Mismeasure of Memory: When Retrieval Fluency is Misleading as a Metamnemonic Index, 127 *J. of Experimental Psychology: General*, 55-68 (1998); J. Shaw, R. Bjork, & A. Handal, Retrieval-Induced Forgetting in an Eyewitness-Memory Paradigm, 2 *Psychonomics Bulletin & Review*, 249-253 (1995); M. Anderson, R. Bjork, & E. Bjork, Remembering Can Cause Forgetting: Retrieval Dynamics in Long-Term Memory, 20 *J. of Experimental Psychology: Learning, Memory, and Cognition* 1063-1087 (1994); S. Smith, A. Glenberg, & R. Bjork, Environmental context and human memory, 6 *Memory & Cognition*, 342-353 (1978). Thus, even if the government had raised an objection on this point, it could not be sustained.

this Court agrees with the government. Therefore, Dr. Bjork will not be permitted to testify at trial.

In support of his position that Dr. Bjork's testimony will be helpful to the jury, the defendant asserts that "[r]esearch has shown that jurors are generally unaware of the frequency and causes of honest errors of recollection, and they underestimate the fallibility of memory." Def.'s Mem. at 8. Thus, the defendant claims that Dr. Bjork's testimony about general principles concerning the field of memory research will assist the jurors in understanding the memory issues that will be presented to them in the case. *Id.* In opposing Dr. Bjork's testimony, the government contends that (1) expert testimony on memory issues is permissible only under special circumstances not at issue here, Gov't's Opp'n at 7-11, (2) the proposed testimony is within the knowledge and experience of an average juror, *id.* at 12-17, (3) the testimony cannot be applied to the facts of this case, *id.* at 17-18, and (4) under Rule 403, the proposed testimony is likely to confuse, mislead, or unduly influence the jury, *id.* at 18-20.

There is no clear case authority, or absolute rule, on when an expert should be permitted to testify on issues regarding memory and perception. Courts have permitted such testimony when the testimony related to eyewitness identifications, repressed memory, and medical conditions that may affect memory. *See, e.g., Rock v. Arkansas*, 483 U.S. 44, 57-62 (1987) (concluding that Arkansas Supreme Court's conclusion that expert testimony on repressed memory was *per se* inadmissible was in error); *United States v. Brownlee*, 454 F.3d 131, 140-44 (3d Cir. 2006) (district court erred in excluding expert testimony on memory errors of eyewitnesses related to cross-racial identifications and identifications made under stress in the absence of other inculpatory evidence); *United States v. Shay*, 57 F.3d 126, 131-34 (1st Cir.

1995) (district court erred in excluding expert testimony concerning defendant's mental disorder that may have impacted his inculpatory statements). And other courts have excluded such testimony when it related to eyewitness identifications and recollection of past events. See, e.g., United States v. Carter, 410 F.3d 942, 950-51 (7th Cir. 2005) (excluding expert testimony concerning the reliability of eyewitness identifications); Robertson v. McCloskey, 676 F. Supp. 351, 354-55 (D.D.C. 1988) (excluding testimony of an expert in the field of "psychodynamics of memory and perception."). In addition, expert testimony relating to memory and perception has been excluded when, for example, effective cross-examination was employed to challenge the credibility and memory of the witnesses. Carter, 410 F.3d at 950-51; Rodriguez-Felix, 450 F.3d at 1125. Contrary to the government's position, these cases do not demonstrate that expert testimony on memory and perception is only admissible in certain "special circumstances." Gov't's Opp'n at 7-11. Rather, these cases simply stand for the proposition that there is no per se rule for or against the admissibility of such testimony. And a court presented with a proffer of expert testimony must determine its admissibility on a case-by-case basis. See, e.g., Brownlee, 454 F.3d at 144 (examining the facts of the case to determine whether the trial court erred in precluding the expert testimony); Shay, 57 F.3d at 133-34 (same). Accordingly, this Court must apply the second prong of the Daubert test to determine whether the proffered testimony will be helpful to the jury. For the reasons that follow, it will not be helpful.

To support his argument that Dr. Bjork's testimony will be helpful to the jury, the defendant relies on various studies, which he avers stand for the proposition that "jurors are generally unaware of the frequency and causes of honest errors of recollection, and that they underestimate the fallibility of memory." Def.'s Mem. at 8. As further support for his position,

the defendant offered the testimony of Dr. Elizabeth Loftus, who detailed her belief, based upon her research and the research of others, that many⁷ of the principles which Dr. Bjork would testify to are not commonly understood by jurors.⁸ After carefully reviewing the studies provided by the defendant and the testimony of Dr. Loftus, this Court must conclude that those studies are inapposite to what the jurors will have to decide in this case because: (1) the studies examine issues of memory and cognition under substantially different factual situations than the situation here; (2) the research does not demonstrate that jurors will underestimate the fallibility of memory when the matter is addressed in the trial setting though voir dire, cross-examination, closing arguments, and jury instructions; and (3) insofar as the studies relied on by Dr. Loftus purport to demonstrate the failure of jurors to sufficiently understand factors that impact the accuracy of memory, the scientific value of the studies themselves is suspect.

The studies relied upon by the defendant were based upon research that examined prospective juror understanding of factors that could impact the reliability of eyewitness identifications. See, e.g., R. Schmechel, T. O'Toole, C. Easterly, & E. Loftus, *Beyond the Ken? Testing Jurors' Understanding of Eyewitness Reliability Evidence*, 46 *Jurimetrics J.* 177-214

⁷ Dr. Loftus acknowledged that Dr. Bjork's proposed testimony that "a person is more likely to encode accurately and retrieve accurately information that is important to him than information that is unimportant to him" is a matter of common sense. Def.'s Mot., Ex. A.

⁸ To support her conclusions, Dr. Loftus relied on principally on six studies. R. Schmechel, T. O'Toole, C. Easterly, & E. Loftus, *Beyond the Ken? Testing Jurors' Understanding of Eyewitness Reliability Evidence*, 46 *Jurimetrics J.* 177-214 (2006); K. Deffenbacher & E. Loftus, *Do Jurors Share a Common Understanding Concerning Eyewitness Behavior*, 6 *Law & Human Behavior* 15 (1982); T. Rapus Benton, D. Ross, E. Bradshaw, W.N. Thomas, & G. Bradshaw, *Eyewitness Memory is Still Not Common Sense: Comparing Jurors, Judges and Law Enforcement to Eyewitness Experts*, 10 *Appl. Cognit. Psychol.* 115 (2006); S. Kassin, V.A. Tubb, H. Hosch, & A. Memon, *On the "General Acceptance" of Eyewitness Testimony Research*, 56 *Am. Psychologist* 405 (May 2001); R. Wise and M. Safer, *A Survey of Judges' Knowledge and Beliefs About Eyewitness Testimony*, *Court Review* 6 (Spring 2003); and A. Daniel Yarmey and H.P Tressillian Jones, *Is the Psychology of Eyewitness Identification a Matter of Common Sense?* in *Evaluating Witness Evidence* 13 (Lloyd-Bostock and Clifford eds. 1983).

(2006) (“Beyond the Ken”) (noting that this survey “would discern what potential District of Columbia jurors understood about memory in general and the reliability of eyewitness identification evidence in particular.”) (emphasis added); R. Wise & M. Safer, A Survey of Judges’ Knowledge and Beliefs About Eyewitness Testimony, 40 Court Review, Spring 2003, at 6-16 (“A Survey of Judges’ Knowledge”); K. Deffenbacher & E. Loftus, Do Jurors Share a Common Understanding Concerning Eyewitness Behavior?, 6 L. and Human Behavior 15-30 (1982) (“Do Jurors Share a Common Understanding”). This Court cannot accept the proposition that the research findings concerning juror knowledge of factors impacting the reliability of eyewitness identification applies equally to juror knowledge of the factors that impact memory and cognition in other contexts, such as the memory and recall of conversations. Thus, while the defendant has proffered numerous scientific studies describing how memory functions, the research showing that jurors do not understand these concepts is limited to the application of the concepts in the discrete area of eyewitness identification and its findings have limited, if any, applicability in other respects. See Robertson, 676 F. Supp. at 353.

First, the design of these surveys demonstrates their limited value. For example, in Beyond the Ken, the survey design was based primarily on hypothetical situations involving eyewitness identification and the credibility of eyewitnesses. Beyond the Ken at 207-11.⁹ Other

⁹ In addition, this Court has difficulty placing significant weight on this study because it is quite clear from reading this article that it is more an article of advocacy than a piece of scientific literature. First, the principal authors of Beyond the Ken are attorneys (public defenders), not psychologists. Beyond the Ken at 1, n.*. And, Dr. Loftus noted during her testimony that these attorneys contacted her to participate in this research, thereby acknowledging that the attorneys (as opposed to the researcher) were the driving force behind this study. Moreover, the first half of the article is dedicated to challenging the legal basis that judges have used for excluding the testimony of experts on eyewitness identifications. Id. at 177-93. And, while the article clearly relays the results of a scientific study, id. at 193-214, the authors stretch the results and reach conclusions that are neither supported by the data or even the questions asked of prospective jurors. For example, the paper notes that “46% of potential jurors

(continued...)

studies have been similarly designed. For example, in one study, participants were shown a video of a mock criminal trial to examine what factors might impact a potential juror's verdict. Different groups were shown different versions of the trial where various witness and identification factors were altered such as the disguise of the robber, the visibility of a weapon, and the amount of violence committed. See B. Cutler, S. Penrod, & H. Dexter, Juror Sensitivity to Eyewitness Identification Evidence, 14 L. & Human Behavior, 185-191 (1990) ("Juror Sensitivity"); B. Cutler, S. Penrod, & T. Stuve, Juror Decision Making In Eyewitness Identification Cases, 12 L. & Human Behavior, 41-55 (1988) ("Juror Decision Making"). Other studies have examined the effect of cross-racial identification on an eyewitness's ability to identify an alleged perpetrator, the effect of extreme stress on an eyewitness's ability to identify the alleged perpetrator, and the effect the length of time an eyewitness viewed a criminal act had on his or her ability to identify the alleged perpetrator. In addition, these studies have examined

⁹(...continued)

believe that the witness on the stand is effectively narrating a video recording of events that she can see in her 'mind's eye' for jurors." Id. at 196. However, the question posed in the survey was whether "[t]he act of remembering a traumatic event is like a video recording in that one can recall details as if they had been imprinted or burned into one's brain." Id. at 211 (emphasis added). Thus, the conclusion overstates the research findings, and does not appreciate that the survey participants were responding to the question in the context of a traumatic event, which might produce very different results if the question had asked about a non-traumatic event. Moreover, the study found that 66% of respondents believed the statement, "I never forget a face," applied "very well" or "fairly well" to them and that 77% thought the statement, "I have an excellent memory," applied "very well" or "fairly well" to them. Id. at 196, 207. From these results, the authors conclude that "[t]he fact that such large majorities of people tend to believe their memories are above average suggests that potential jurors may begin each trial with unwarranted confidence in memory and the ability to identify faces generally." Id. at 196. First, these two questions themselves are ambiguous and call for vague and unclear responses, which are virtually impossible to quantify, *i.e.*, the standard used in assessing what the respondents intended to convey when they indicated that they had excellent memories and the qualitative distinction between what the respondents were conveying when they responded "fairly well" as opposed to "just somewhat." Moreover, the conclusion the authors draw from the responses is not supported by the question that was asked. The authors conclude that the responses demonstrate that the majority of respondents believe they have above-average memories. But this was not the question the respondents were asked, and the authors cite no support for the proposition that an individual who believes the statement, "I never forget a face," applied "very well" implies that the respondent believes he or she has an above-average memory. See, e.g., United States v. Hernandez, 106 F. Supp. 2d 1317, 1323-24 (S.D. Fla. 2000) (noting that a poorly designed survey has little value to a Court).

the reliability of show-ups and lineups, and the effect of alcohol intoxication and age on eyewitness identification. See Do Jurors Share a Common Understanding at 26-28; T. Rapus Benton et al., Eyewitness Memory is Still Not Common Sense: Comparing Jurors, Judges and Law Enforcement to Eyewitness Experts, 10 Appl. Congit. Psychol. 115, 128-29 (2006) (“Eyewitness Memory is Still Not Common Sense”); S. Kassin, et al., On the “General Acceptance’ of Eyewitness Testimony Research, 56 Am. Psychologist 405, 408 (May 2001) (“On the “General Acceptance’ of Eyewitness Testimony”). Thus, it is clear that based on the design of these studies, the research was focused solely on the impact of various factors on eyewitness identifications. This Court, therefore, has difficulty concluding that the studies provided by the defendant are applicable in any meaningful way to the case at hand, because they do not focus on the precise issues before the Court. Cf. Loctite Corp. v Nat’l Starch & Chem. Corp., 516 F. Supp. 190, 206 (S.D.N.Y. 1981) (concluding that prelitigation survey provided no assistance to the Court as it did not investigate the precise issue before the Court).

Moreover, the value of these studies is further diminished by the factual basis that would underscore an expert’s testimony on eyewitness identification issues and the expert testimony on the principles of memory and cognition that the defendant seeks to introduce. Under the former category, there can be little doubt that the average juror is not regularly, if at all, presented with issues of eyewitness identification of an alleged perpetrator of a criminal offense. Thus, it is highly probable that the average juror would be less familiar with concepts that may impact a witness’s identification such as weapons focus, mug-shot-induced bias, or lineup format. See, e.g., A Survey of Judges’ Knowledge at 12. However, on a daily basis the average juror is personally faced with innumerable questions of memory and cognition, as everyone in their daily

lives is called upon to store, encode, and retrieve information he or she has been subjected to. Although the average juror may not understand the scientific basis and labels attached to causes for memory errors, jurors inevitably encounter the frailties of memory as a commonplace matter of course. See, e.g., United States v. Welch, 368 F.3d 970, 973-75 (7th Cir. 2004) (“[a]lthough the average person may not know what the term ‘clothing bias’ means, it is common knowledge that one may mistake a person for someone else who is similarly dressed. Moreover, the typical juror would know that two people who are structurally similar are more likely to be confused for each other than are dissimilar individuals. Finally, it does not require an expert witness to point out that memory decreases over time.”); United States v. Labansat, 94 F.3d 527, 530 (9th Cir. 1996) (“[i]t is common knowledge that memory fades with time”). Thus, this Court has no doubt that the average juror understands that if, for example, A learns from B that B had been on vacation in Hawaii and then later learns from C that she spent her vacation in Jamaica, that A could later misremember where each spent their vacations because he was consumed with pressing matters, either when he acquired this information, when he was asked to recall it, and possibly at any time in between. Accordingly, the jury does not need a tutorial on the science of “content borrowing,” “memory conjunction,” or “source misattribution” errors to appreciate that people sometimes experience mistaken memories. The same applies for each of the thirteen areas upon which Dr. Bjork would testify, as the defendant has not established that the principles are either so complex or counter-intuitive that jurors do not understand them. Def.’s Reply at 12. And just as a jury can comprehend the memory errors in the hypothetical above, the defendant here will be able to present to the jury the high pressured and sensitive nature of his work and the volume of information he received daily, to demonstrate that any error he may have made was

the product of confusion, mistake or a faulty memory. Similarly, the defendant has an arsenal of litigation tools at his disposal to challenge the recollection of the government witnesses. And the utility of one of these tools was vividly illustrated by government counsel's skillful cross-examination of Dr. Loftus, which demonstrated the fundamental impermanence of both short-term and long-term memory. With this and other trial practice tools, the jury, for themselves, can assess whether a witness's recollection of an earlier conversation is accurate. As a former member of this Court has found, "[i]t is no secret that memory decreases over time, that individuals can selectively remember or even [unintentionally] fabricate events, or that stress can have an impact on memory or perception." Robertson, 676 F. Supp. at 354.

And even if the Court could conclude that these research findings establish that jurors do not understand the fallibility of memory in situations like the one currently before the Court, the authors of Beyond the Ken concede that "surveys are subject to the critique that they cannot assess how jurors are actually able to apply their knowledge about eyewitness identifications in the courtroom—a question to which postdiction and judgment studies may be better suited." Beyond the Ken at 194 n.72. In fact, none of the studies provided to the Court show whether the rigors of the normal trial process provides jurors with the knowledge they need to critically assess the merits of the positions presented to them concerning the accuracy of one's memory, even if it is true that the average juror lacks an understanding of the frailties of memory at the outset of a trial. And, Dr. Loftus testified that she knows of no such studies. One example of the studies that have been conducted is Beyond the Ken, where the survey was designed to ask respondents hypothetical questions, presented in multiple choice format over the telephone, to ascertain how the respondents would interpret a particular piece of evidence. Beyond the Ken at 207; see Do

Jurors Share a Common Understanding at 15-30. These hypothetical situations make no assessment of whether the respondent's answers might change if exposed to, for example, probing voir dire questions, vigorous cross-examination and closing arguments, and instructions that advise the jury of the factors that may impact on the accuracy of memory. Nor do these studies account for the effect of the deliberation process. Thus, the questions asked in these surveys were posed in a vacuum and did not provide a valid assessment of whether any perceived failure to understand memory errors can be rectified by the normal trial process. Therefore, because these studies examined responses to questions posed in the abstract, and not through the lens of the actual trial process, their usefulness in establishing that jurors need assistance from an expert witness to understand the fallibility of memory is extremely limited, at best.

Admittedly, one of the studies provided to the Court states, in conclusory fashion, that "expert testimony is the only safeguard that has been shown to be effective in increasing jurors' sensitivity to eyewitness factors." A Survey of Judges' Knowledge at 11. As support for this proposition, the article relies on several other studies. Id. at 11 n.44. These other studies, however, do not support the proposition. First, all of the studies again focus on factors related to eyewitness testimony. Juror Sensitivity at 185-191 (1990) (relying upon Juror Decision Making at 41-55); see also G. Ramirez, D. Zemba, & E. Geiselman, Judges' Cautionary Instructions on Eyewitness Testimony, 14 Am. J. of Forensic Psychol. 31-66 (1996) ("Judges' Cautionary Instructions"); S. Penrod & B. Cutler, Preventing Mistaken Convictions in Eyewitness Identification Trials, in Psychology and Law: The State of Discipline 89-118 (Roesch et al. ed.,

1999).¹⁰ Moreover, the lead study cited for this proposition does not itself support the proportion. Rather, it simply concludes, without any empirical support, that “[t]he effectiveness of traditional safeguards designed to protect the defendant from mistaken identification remains in question.” See Juror Sensitivity at 190 (citing Christopher Walters, Comment, Admission of Expert Testimony on Eyewitness Identification, 73 Cal. L. Rev. 1402 (1985)). And this conclusion is drawn not from scientific evidence, but from a Comment written by a law student in a 1985 law review article, also largely void of any empirical support. See Christopher Walters, Comment, Admission of Expert Testimony on Eyewitness Identification, 73 Cal. L. Rev. 1402 (1985).

The only literature this Court has located that discusses in any detail whether the normal trial processes will sufficiently elucidate the points the defendant desires to impress upon the jury is a chapter in the book Psychology and Law: The States of Discipline. S. Penrod & B. Cutler, Preventing Mistaken Convictions in Eyewitness Identification Trials, in Psychology and Law: The State of Discipline 89-118 (Roesch et al. ed., 1999). As noted above, the chapter focuses on eyewitness identification, so its usefulness here is limited. The chapter does, however, have an insightful discussion about whether cross-examination is a sufficient safeguard against mistaken identifications, id. at 94-95, setting forth three conditions that the authors believe must be satisfied if cross-examination is to be effective: (1) the “[a]ttorneys must have a full opportunity to identify the factors that are likely to have influenced an eyewitness’s identification

¹⁰ There was one additional study cited in support of this proposition. This Court, however, was unable to locate this article as it appears the citation is incorrect. The title of the article, however, nonetheless confirms that it too is focused on eyewitness identification research. See E. Greene, Judge’s Instructions on Eyewitness Testimony: Evaluation and Revision, 18 J. Applied Psychol. 252 (1988).

performance in a particular case”; (2) “[a]ttorneys must be aware of the factors that influence eyewitness identification performance”; and (3) “[j]udges and juries must be aware during trial, and consider during deliberations, the factors that influence an eyewitness identification performance.” Id. at 95. Although this test is premised on cross-examining a witness who has made an eyewitness identification, its principles have application here too.

Here, regarding the first factor, there can be no doubt that the defendant and his attorneys have had a full the opportunity to identify the factors that may impact the credibility of his memory defense. He has already been provided a substantial amount of documentation, including topic overviews of the intelligence briefings he received, all of his personal notes, and his daily schedules. Moreover, the defendant himself has undoubtedly apprised his highly skilled attorneys of the work that was consuming his attention during the times relevant to this prosecution. As to the second prong of the test, the substance of the defendant’s current motion and his consultations with both Drs. Bjork and Loftus demonstrate that the defense team is well aware of the factors that influence the accuracy of memory and thus will be in a capable position to effectively raise during cross-examination of the government’s witnesses, the direct examination of the defendant himself (if he chooses to testify), and through closing arguments, the factors that impact the accuracy of memory. Id. at 97-98. Thus, satisfaction of the first two factors identified by Penrod and Cutler would suggest that effective cross-examination will provide a sufficient safeguard.

As to the final requirement, this Court has already noted that there is a substantial difference between eyewitness identification factors and the factors relevant to the defendant’s memory defense. Thus, while jurors may not understand some of the memory and cognition

principles underlying eyewitness identification, it can be assumed that they have a firm grasp of the memory and cognition issues about which Dr. Bjork would testify. And as the Court has already indicated, it is prepared to provide the jury with an instruction that will remind them of the factors they may consider in accessing the accuracy of memory. Moreover, Penrod and Cutler's chapter noted that "leading questions—typically used in cross-examination—may have a salutary effect on juror assessments of eyewitness performance." *Id.* at 103. The same clearly holds true for elucidating the factors that will be relevant to evaluating the testimony that will be presented in this case. And despite the chapter's ultimate conclusion that expert testimony on eyewitness identification "can serve as a safeguard against mistaken identification," the article opines that "a significant problem is that jurors simply do not make use of the knowledge they do possess." *Id.* at 114. Thus, even with expert testimony, the authors seemingly conclude that there is no guarantee that the jurors would apply the information provided to them. Accordingly, based upon these considerations, the Court must conclude that cross-examination, along with other trial procedures, will provide sufficient safeguards (if safeguards are needed at all) to ensure that the defendant's memory defense is properly evaluated by the jury. See Rodriguez-Felix, 450 F.3d at 1125 ("Jurors, assisted by skillful cross-examination, are quite capable of using their common-sense and faculties of observation" to determine the reliability of a witness's identification.) (citing Smith, 156 F.3d at 1053; United States v. Hall, 165 F.3d 1095, 1107 (7th Cir. 1999)); see also United States v. Carter, 410 F.3d 942, 950-51 (7th Cir. 2005); United States v. Thevis, 665 F.2d 616, 641 (5th Cir. 1982).¹¹

¹¹ In fact, in this case, the Court believes that cross-examination will be a powerful tool for the defense to challenge the confidence of the government's witnesses about their memories, just as it was for the government in its
(continued...)

Finally, even if this Court could accept the proposition that these research studies support the defendant's proposition that jurors do not have an understanding of memory errors such as the errors that allegedly occurred in this case, which it cannot do, the Court declines to accept the findings of these studies for a more basic reason—the reliability of these studies as applied to this case is questionable. As the government effectively demonstrated during the October 26, 2006 hearing, and about which Dr. Loftus reluctantly agreed in part, the application of these studies to establish that jurors do not understand the fallibility of memory is questionable for several reasons. First, some of the studies are, at least in part, structurally flawed. For example, in Dr. Loftus's 2006 paper, Beyond the Ken, respondents were asked whether “[a]n eyewitnesses’ level of confidence in his or her identification is an excellent indicator of that eyewitnesses’ reliability.” Beyond the Ken at 211. However, Dr. Loftus agreed that this question was unclear because there are two distinct types of confidence-accuracy relationships,¹² and that there was no way to know which type of relationship respondents thought they were being asked about. In addition, Dr. Loftus acknowledged during her testimony that the study entitled On the “General Acceptance” of Eyewitness Testimony Research, which examined the degree to which various experts believed that jurors understood common memory errors in the field of eyewitness

¹¹(...continued)

cross-examination of Dr. Loftus. For example, the Court has no doubt that the defendant, during the cross-examination of Tim Russert, will challenge the confidence he presumably will ascribe to the accuracy of his recollection of the conversation he had with the defendant, especially since there are no notes (either taken by Mr. Russert or the defendant) memorializing their conversation. Thus, even if there is some value to be derived from Dr. Bjork's testimony, effective cross-examination of the principal players will be far more valuable to the defendant's case than testimony on abstract principles of memory and cognition.

¹² As noted during the hearing, there are two different confidence-accuracy relationships. One is when the researcher studies the confidence-accuracy relationship across subjects, and the other is the study of the confidence-accuracy relationship within subjects.

identification as matters of common sense, was not the best approach for actually assessing juror knowledge. This is especially true in light of an earlier study by the same researcher, which actually examined non-expert responses to such questions and came out with substantially different results on some points. Compare S. Kassin et al., On the “General Acceptance” of Eyewitness Testimony Research, 56 Am. Psychologist 405 (May 2001), with S. Kassin & K. Barndollar, The Psychology of Eyewitness Testimony: A Comparison of Experts and Prospective Jurors, 22 J. of Applied Social Psychol. 1241 (1992). In addition, the study entitled Eyewitness Memory is Still Not Common Sense: Comparing Jurors, Judges and Law Enforcement to Eyewitness Experts, also has structural problems. For example, this study, which compared the survey responses of experts and non-experts, such as judges and jurors, assumed that the experts are always right. However, as demonstrated in the study, the expert responses were not always correct. See Eyewitness is Still Not Common Sense at 122.

Not only are the studies relied upon by the defendant structurally problematic, but they do not, in fact, support the proposition that jurors do not understand the principles about which Dr. Bjork would testify. For example, the defendant seeks to have Dr. Bjork testify that “[h]uman memory does not function like a tape recorder.” Def.’s Mem., Ex. A. To support his proposition that jurors do not understand this principle, the defendant relies on a study where respondents were asked whether “[t]he act of remembering a traumatic event is like a video recording in that one can recall details as if they had been imprinted or burned into ones’ brain.” Beyond the Ken at 211. This reliance is misplaced, as the focus of the question centers on traumatic events and the impression the respondents believed such events had on memory, and Dr. Bjork’s testimony

would not address this phenomenon.¹³ And as noted above, Dr. Bjork's proposed testimony that "[a] person's confidence in the accuracy of his memory may correlate weakly, if at all with the accuracy of the memory," is not supported by the question in Beyond the Ken that asked about eyewitness confidence, because that question fails to account for the two distinct types of confidence-accuracy relationships. Moreover, Dr. Loftus noted in her testimony that she was not aware of any empirical research that would support the conclusion that jurors would not understand four of the principles¹⁴ that Dr. Bjork would testify about, and she agreed that at least one of the principles was a matter of common sense.¹⁵ And, as noted earlier, Dr. Loftus has no knowledge of any studies that examined whether the rigors of the trial process would be sufficient to allow jurors to effectively and accurately evaluate the credibility of the witnesses and the validity of the defendant's memory defense. Thus, as demonstrated above, many of the studies relied upon by the defendant to show that jurors do not understand the principles of

¹³ This question also demonstrates a further flaw in Beyond the Ken. Forty-six percent of the respondents believed that the statement, "[t]he act of remembering a traumatic event is like a video recording in that one can recall details as if they had been imprinted or burned into one's brain" was true. Beyond the Ken at 211. However, 80% of respondents believed that "[e]yewitnesses can believe they remember details about a crime that they actually learned about later from someone else, such as the police." Id. Thus, while a wide majority of the respondents believed that eyewitnesses may inaccurately remember the sources of information that they may rely upon in conveying the details of a crime, this is seemingly inconsistent with the response of 46% of the respondents who believed that "[t]he act of remembering a traumatic event is like a video recording," even though one question was asking about a traumatic event and the other was not.

¹⁴ Dr. Loftus noted that she was not aware of any scientific research that shows that jurors do not understand (or that they do understand) the following principles: (1) "[d]ivided attention at the time of retrieval has relatively little effect on recall of information obtained earlier, but it does have a negative effect on recall for the sources of the information and thus may create source misattribution errors;" (2) "[m]emory research has shown that people can forget that they once remembered something, much as they forget other experiences"; (3) "[v]erbatim recall and 'gist' recall of conversations have shown to drop significantly after a delay of even a few days, with the loss of verbatim recall especially significant"; and (4) "[f]orgetting, rather than being simply a weakness of memory, is also an essential component in the efficient use of memory." Def.'s Mem., Ex. A.

¹⁵ Dr. Loftus agrees that the principle "[a] person is more likely to encode accurately and to retrieve accurately information that is important to him than information that is unimportant to him" is a matter of common sense.

memory Dr. Bjork would testify about are either themselves structurally unsound or do not support the proposition that the defendant seeks to establish. Nevertheless, despite the lack of scientific evidence to support her position that the principles Dr. Bjork would testify about are not commonly understood by jurors or could not be understood after going through the process of a trial, Dr. Loftus insisted that expert testimony concerning memory is necessary. This Court does not agree.

Based on the foregoing, the Court cannot conclude that the defendant has satisfied his burden of establishing that the expert testimony of Dr. Bjork will be helpful to the jury. Not only are the studies offered by the defendant inapposite to the situation here, but the theories upon which Dr. Bjork would testify are not beyond the ken of the average juror. And as the facts of this case unfold during the trial, the Court has no doubt that aided by the normal trial processes, and the assistance of very capable legal counsel, the jurors will have the ability to collectively draw upon their common-sense understanding of memory and render a fair and just verdict.

B. Federal Rule of Evidence 403

Even if this Court could conclude that Dr. Bjork's testimony satisfied the requirements of Rule 702, which it cannot, the Court would still exclude the evidence under Rule 403 for several reasons. First, as already discussed, it is reasonable to assume that the jurors selected in this case already have an understanding of the principles about which Dr. Bjork would testify. And, if by chance that is not the case for some of the jurors, there is no reason to believe that by the time the jury commences its deliberations (or during the course of deliberations) the entire jury panel will not appreciate the frailties of memory, and properly factor this into their evaluation of the evidence. Therefore, the probative value of Dr. Bjork's testimony is limited to merely drawing

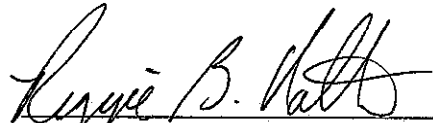
more attention to those principles about which the jury will already have an appreciation. Accordingly, the probative value of the testimony is substantially outweighed by considerations of undue delay and waste of time. Fed. R. Evid. 403. Cf. United States v. Shorter, 809 F.2d 54, 61 (D.C. Cir. 1987). In addition, the value of the evidence is also outweighed by the “danger of unfair prejudice, confusion of the issues, or misleading the jury.” Fed. R. Evid. 403. The jurors will be the ultimate arbiter of the facts, and in this role, they must weigh the credibility of each witness. United States v. Thornton, 746 F.2d 39, 49 (D.C. Cir. 1984). Permitting Dr. Bjork to testify on even the general principles of memory and cognition “may cause jur[ors] to surrender their own common sense in weighing [the] testimony,” Bastow v. Gen. Motors Corp., 844 F.2d 506, 510-11 (8th Cir. 1988), and instead cause them to rely too heavily upon Dr. Bjork’s testimony. This would amount to an invasion of the jury’s province, as the collective wisdom of the jurors, aided by the trial process itself, will more than adequately provide the jury with the means to assess the credibility and veracity of the witnesses, and testimony concerning scientific principles regarding memory and cognition would only serve to confuse those determinations. United States v. Edelman, 873 F.2d 792, 795 (5th Cir. 1989) (affirming district court’s exclusion of expert testimony under Rule 403 on the grounds that it would confuse the jury).

IV. Conclusion

In Daubert, the Supreme Court designated the trial judge as a gatekeeper on the question of the admissibility of expert testimony. Daubert, 509 U.S. at 589. To permit the introduction of the testimony proposed by the defendant would be an abdication of that responsibility and would therefore leave the gate this Court is obligated to protect unguarded and without a sentry. This the Court cannot do, in light of the mandate given to it by the highest Court in the land. As noted

above, this Court has concluded that the defendant has failed to satisfy his burden of establishing that the testimony of Dr. Bjork would be helpful to the jury and thus, he has failed to satisfy the second prong of Daubert. Moreover, even if this Court could conclude that the defendant satisfied his burden under Daubert, Dr. Bjork's testimony would nonetheless have to be excluded under Federal Rule of Evidence 403, as the probative value of the proposed testimony is outweighed not only by the delay and waste of time that would be occasioned by the introduction of the testimony, but also by the risk that the jury will be misled and confused by the testimony. The defendant's motion to present the testimony of Dr. Bjork must therefore be denied.

SO ORDERED this 2nd day of November, 2006.¹⁶



REGGIE B. WALTON
United States District Judge

¹⁶ An Order consistent with this Court's ruling accompanies this Memorandum Opinion.