

Cigarette Design Technologies Reduce Smoke Yield and Expand Consumer Choices: The Role and Utility of the FTC Test Method

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BACKGROUND The Federal Trade Commission (FTC) test method for measuring tar and nicotine yields of cigarettes provides accurate and reliable information. Comparison of yields of various brands is a key factor consumers use to make objective choices in the marketplace. Another key factor is the taste of the cigarette, which in most cases is related to the tar and nicotine yield.

Calls for reduced tar yields from cigarettes came from the popular press, the scientific literature, and the public health community beginning in the late 1950's. Many of these included statements that tar reduction would reduce the relative risks for certain diseases.

The implementation of FTC testing for tar and nicotine in 1967 was an important step for cigarette manufacturers to communicate information on lower tar products to consumers for them to use to make informed decisions in the marketplace.

Even at that time, FTC understood the limitations of standardized machine smoking and recognized that no standard method would be able to take into account the wide range in human smoking behavior:

No two human smokers smoke in the same way. No individual smoker smokes in the same fashion. The speed at which one smokes varies both among smokers, and usually also varies with the same individual under different circumstances even within the same day. Some take long puffs (or draws); some take short puffs. That variation affects the "tar" and nicotine quantity in the smoke generated (Federal Trade Commission, 1967).

The FTC also recognized that the FTC method could not predict the absolute smoke yield any individual smoker might receive from a particular cigarette:

No test can precisely duplicate conditions of actual human smoking and, within fairly wide limits, no one method can be said to be either "right" or "wrong." The Commission considers it most important that the test results be based on a reasonable standardized method and that they be capable of being presented to the public in a manner that is readily understandable (Federal Trade Commission, 1967).

Daniel Oliver, chairman of FTC, confirmed FTC's position on cigarette testing in a statement before a congressional committee:

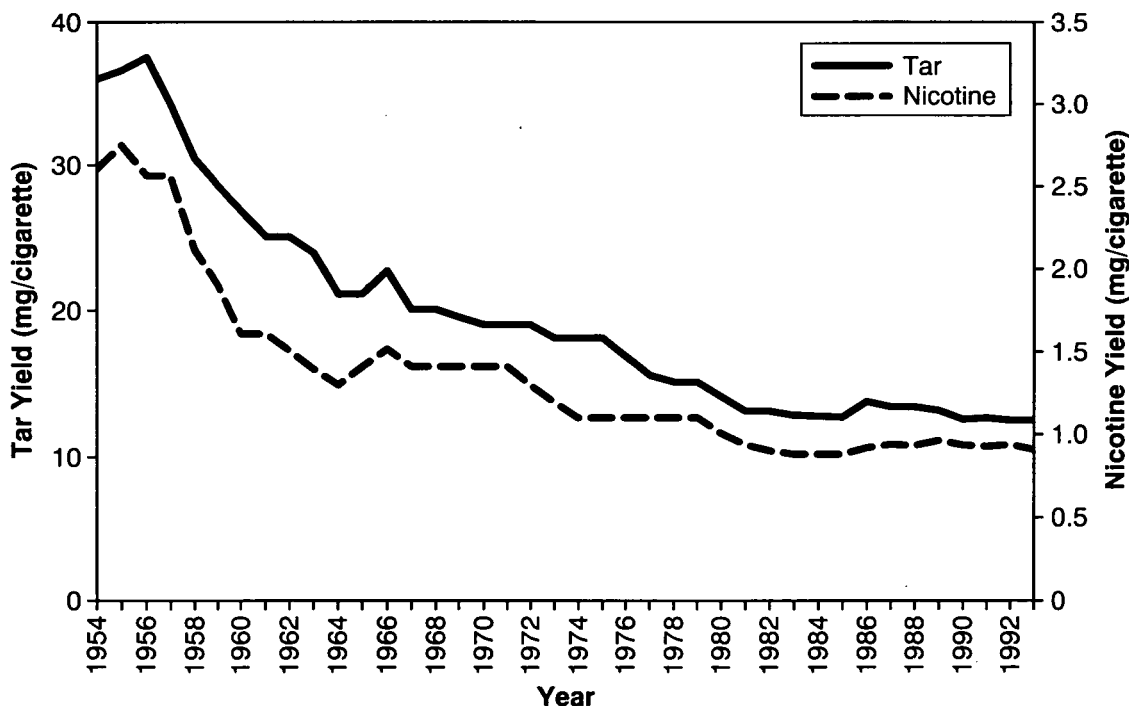
As a general matter, I believe that advertisements that accurately convey information on "tar" and nicotine content can be a valuable source of information to consumers. Advertising that provides comparative information on different "tar" and nicotine levels can be especially useful (Oliver, 1988).

CIGARETTE DESIGN AND CHANGES IN THE CIGARETTE MARKET

The cigarette industry response to the public demand for reduced tar and nicotine cigarettes is evident in the dramatic decline in sales-weighted average tar yields over the past 40 years (Figure 1). In the early 1950's the average tar yield of cigarettes was around 38 mg per cigarette. Today that average is about 12 mg per cigarette. Nicotine yields also have been reduced in a similar fashion, although to a slightly different degree because the available techniques reduce tar and nicotine yields with slightly different efficiencies.

The techniques to reduce tar over the years include filtration, more efficient filtration (through different filter materials, fiber type and density, and filter length), filter ventilation, expanded tobacco, tobacco weight reduction, increased paper porosity or permeability, reconstituted tobacco, faster burning cigarette papers, and reduction of cigarette circumference.

Figure 1
Sales-weighted average tar and nicotine yields, 1954-1993

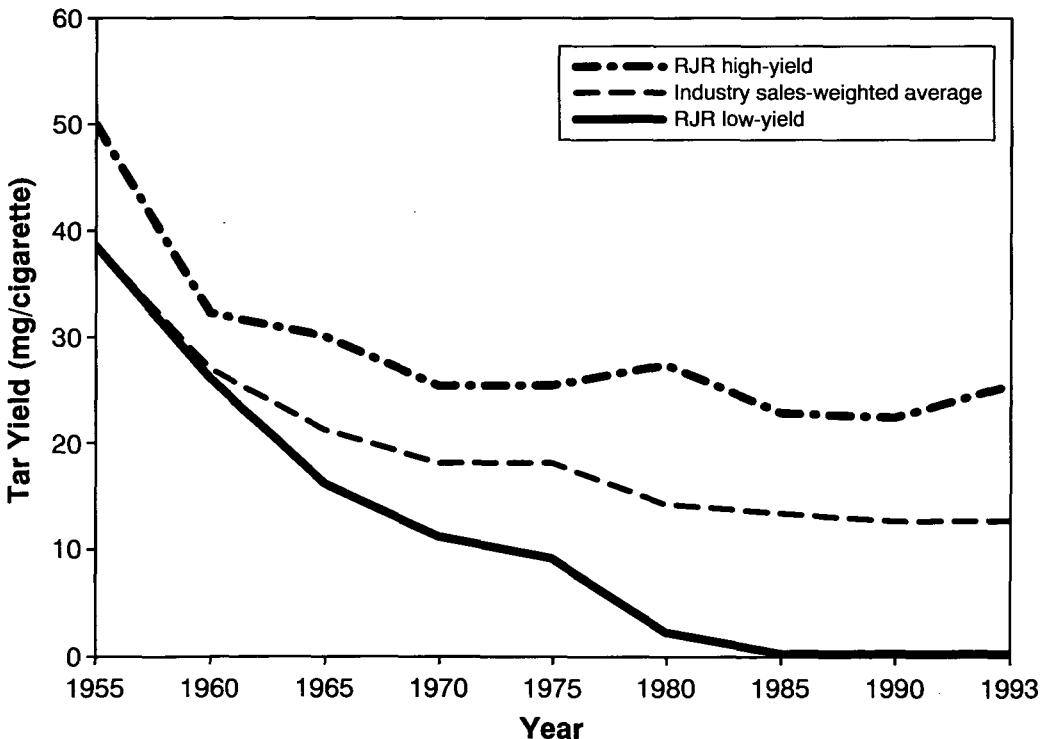


The physics and chemistry of a burning cigarette are exceedingly complex. For example, filter ventilation involves two mechanisms. In the first, fresh air from the outside is admitted to the filter and mixes with the smoke. As a result of this ventilation, a smaller effective puff is drawn on the burning end of the cigarette and less tobacco is then consumed during the puff. In addition, the smoke velocity in the cigarette is dramatically reduced, and the filter efficiency upstream of the ventilation holes increases. Similarly, in the second, a higher paper porosity also allows more outside air to enter the smokestream, also reducing the effective puff volume at the fire cone. The various cigarette design parameters result in many interactive effects on the performance of the cigarette.

The changes in cigarette design to reduce tar and nicotine yields have not been limited to low-tar and ultralow-tar products. Even today's nonfiltered cigarettes, the so-called high-tar brands, have about half the tar yield of their 1950's counterparts.

As a result, consumers today have a much wider range of choices in tar and nicotine than they did previously, and all cigarettes are substantially lower in tar yields than they were in past years (Figure 2). Cigarette design changes have resulted in an overall major reduction in smoke yields.

Figure 2
R.J. Reynolds Tobacco Company offers smokers a range of tar levels (1955-1993, in 5-year intervals)



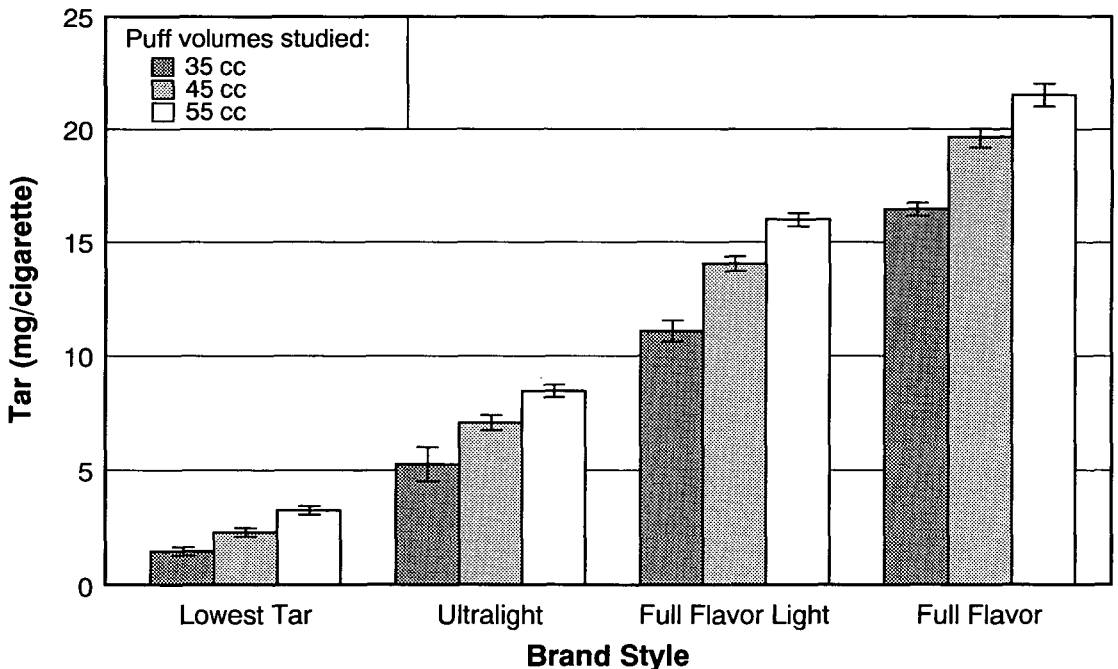
**UTILITY OF
THE FTC TEST
METHOD**

Although it has been clear that humans do not smoke like machines, it is also clear that changes in the FTC smoking conditions do not alter the relative ranking of cigarettes. The FTC conditions include a 35-cc puff of 2 seconds duration, taken once per minute. If the puffing conditions are changed, the relative ranking or yields of the cigarettes are preserved.

For example, Figure 3 shows tar yield as a function of puff volume. In this chapter, puff volumes of 35 cc, 45 cc, and 55 cc were chosen for comparison of four cigarette products, one each from the lowest tar, ultralight, full-flavor light, full-flavor categories. The 35-cc puff is the FTC condition and is not intended to represent the lowest smoker puff volume; the other two conditions were arbitrarily chosen. As the puff volume increases, tar yield of the product in each category increases. However, the ranking of the categories is preserved. For example, the tar yield of an ultralow-tar product at a 55-cc puff volume is lower than the tar yield of a low-tar product at the same puff volume.

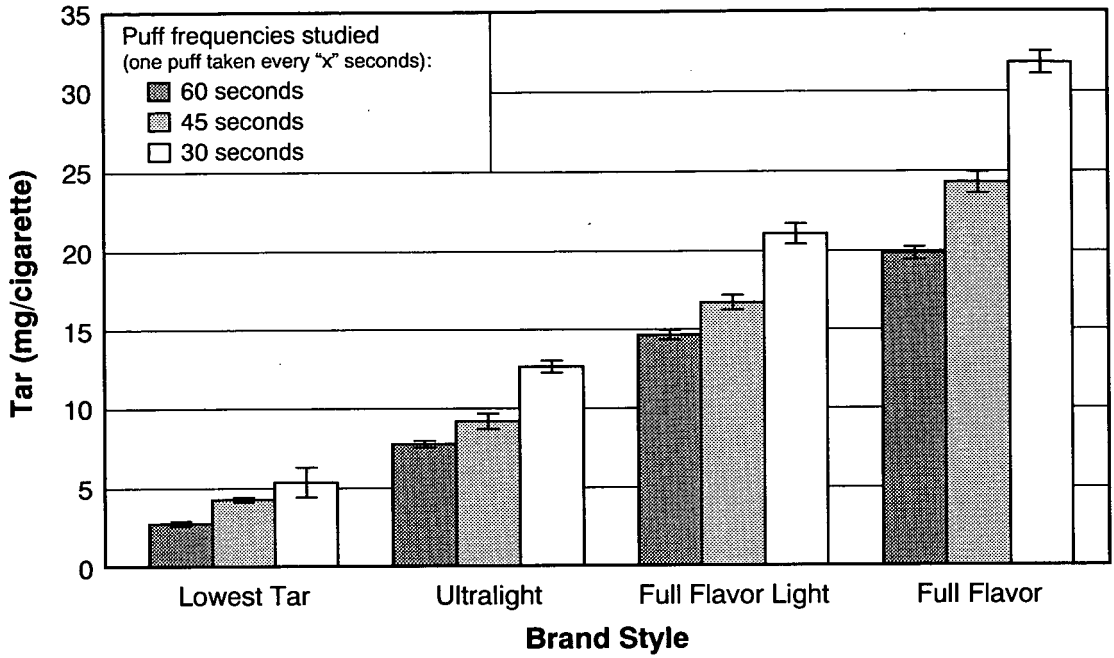
Changing the puff frequency from one puff per minute to one puff every 45 seconds or one puff every 30 seconds also increases the tar yield in each category, yet the ranking of the cigarettes is intact (Figure 4). Puff duration has little, if any, effect on the actual yields (Figure 5).

Figure 3
Effect of puff volume on observed tar yields



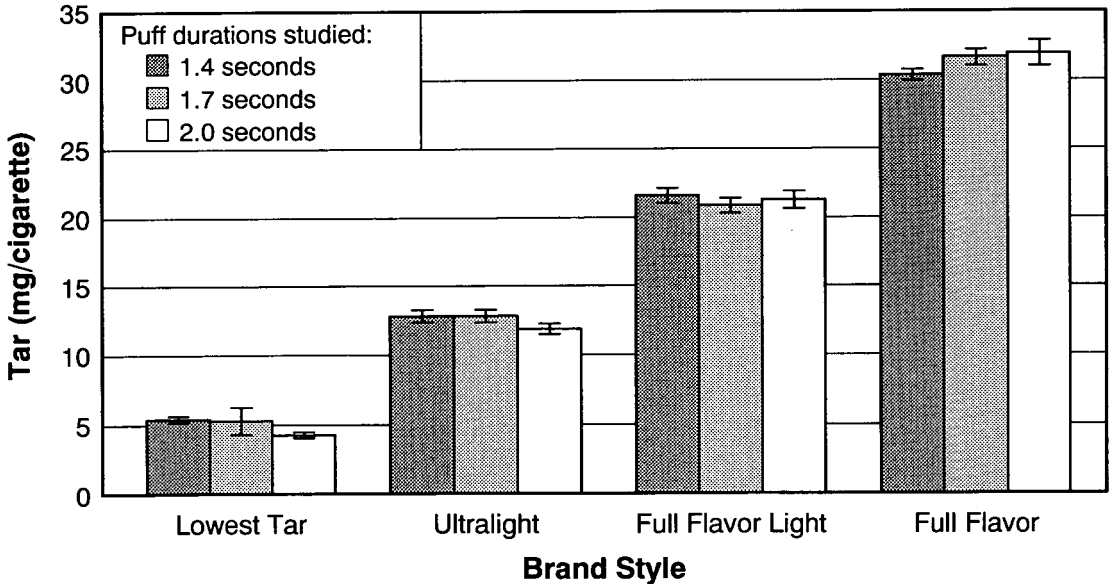
Note: The puff duration for this experiment was 2 seconds; the puff frequency was one every 60 seconds.

Figure 4
Effect of puff frequency on observed tar yields



Note: The puff volume for this experiment was 45 cc; the puff duration was 1.7 seconds.

Figure 5
Effect of puff duration on observed tar yields



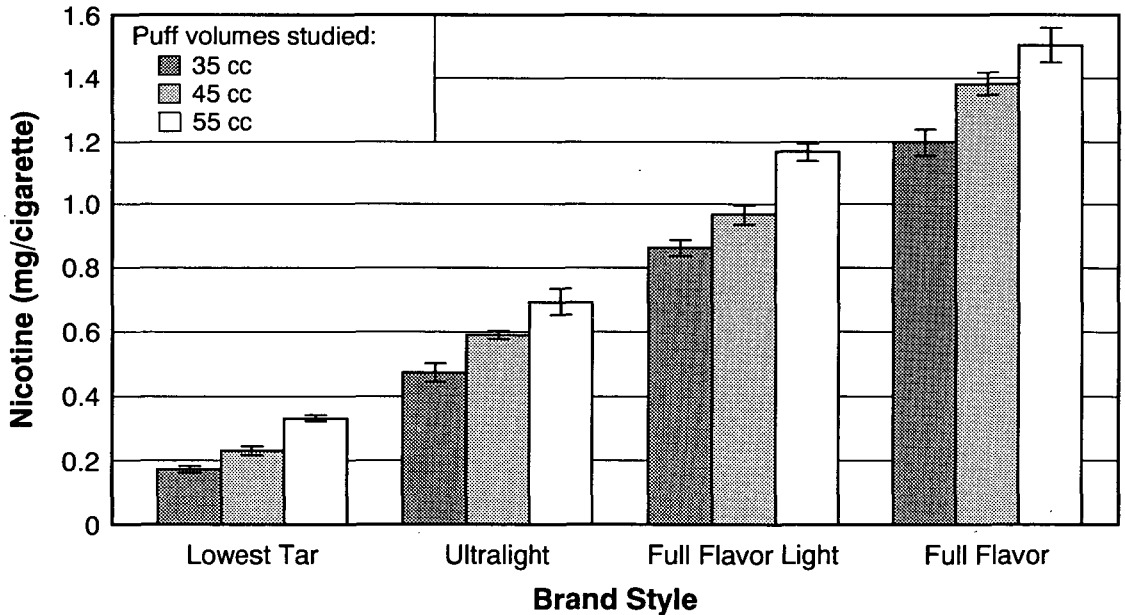
Note: The puff volume for this experiment was 45 cc; the puff frequency was one every 30 seconds.

Figures 6 through 8 show smoke nicotine yields for the same set of cigarettes; however, the smoking machine puffing conditions are different for each figure. Like tar yield, the nicotine yield goes up with increased puff volume and increased puff frequency, and the relative yields among the categories remain ordered. Puff duration also has little if any effect on nicotine yields.

Standard methods are used to provide information to consumers for products other than cigarettes. A classic example is the estimated Environmental Protection Agency (EPA) gas mileage ratings for vehicles. Depending on driving habits, conditions, maintenance, and fuel type, a vehicle may get more or less mileage than indicated by the EPA estimate. Although few drivers will achieve the actual mileage listed for a vehicle, the mileage ratings do provide a means of relative comparison among vehicles. A potential buyer can use the information to determine if a particular vehicle would fit into his or her particular transportation and economic needs.

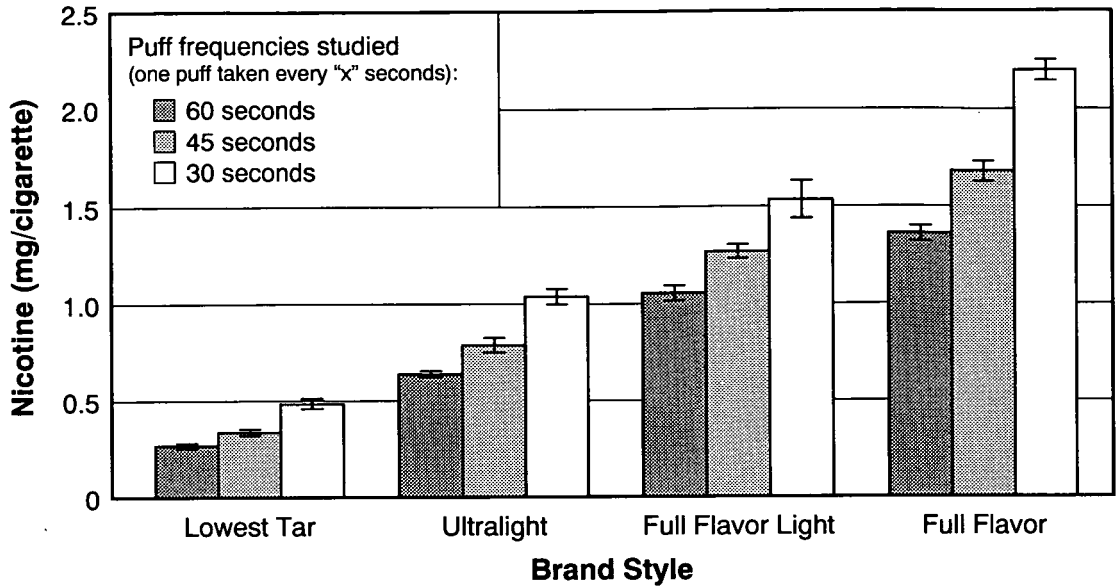
Similarly, smokers have two primary considerations in making their choices in the cigarette marketplace. The FTC method provides comparative smoke yield information that is an essential part of that process. The second factor of taste is an individual preference that is made with the comparative information in mind.

Figure 6
Effect of puff volume on observed nicotine yields



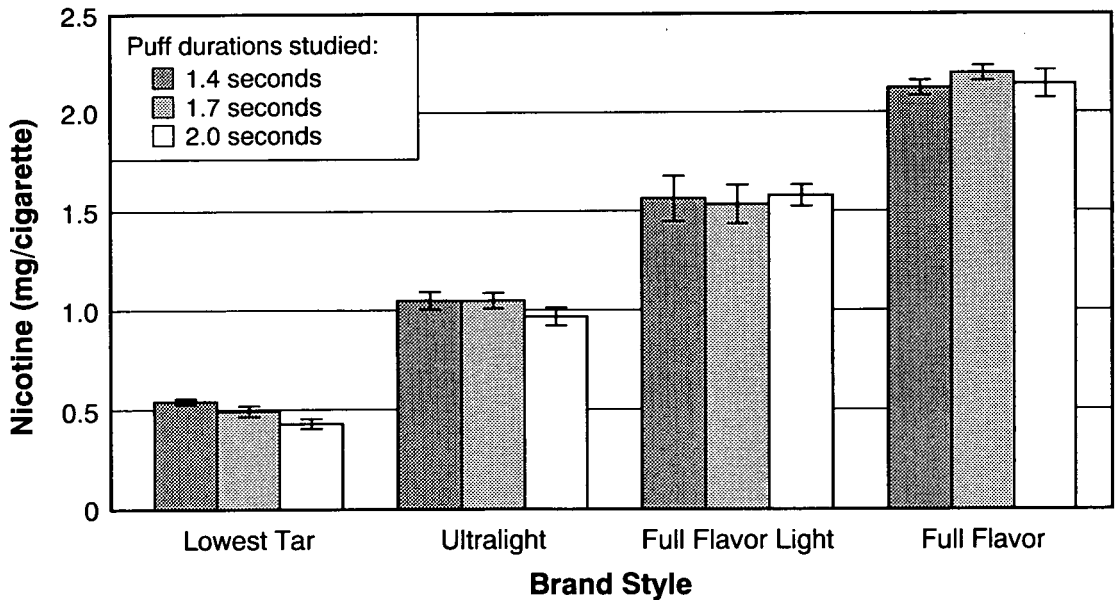
Note: The puff duration for this experiment was 2 seconds; the puff frequency was one every 60 seconds.

Figure 7
Effect of puff frequency on observed nicotine yields



Note: The puff volume for this experiment was 45 cc; the puff duration was 1.7 seconds.

Figure 8
Effect of puff duration on observed nicotine yields



Note: The puff volume for this experiment was 45 cc; the puff frequency was one every 30 seconds.

QUESTION-AND-ANSWER SESSION

DR. BENOWITZ: How do you reconcile the differences between your data and other data that show when you get down to very low yields of nicotine, you are getting to a cotinine level of 225 vs. maybe 325 or so at the higher levels, in over 2,000 people. Do you think that is less accurate than your data in 33 subjects?

DR. DEBETHIZY: I think that the method of measuring plasma cotinine is a less accurate measure of nicotine uptake.

DR. BENOWITZ: What bias do you think there is in cotinine that could explain the tremendous difference in findings?

DR. DEBETHIZY: I do believe the data that we have. And I am surprised at them, based on what I know about the cotinine data in the field studies. Now, that does not mean that the data we have are wrong; it may be that at lower yielding products, that what people do over the course of an entire 24-hour period is different from what would be measured, say, at either 9:00 o'clock in the morning or 3:00 o'clock in the afternoon, depending on where people are measuring those plasma samples. So, I would say that, yes, the number is much larger for those plasma cotinine studies. But the point is that, even with those studies, compensation is incomplete. People smoking lower yielding cigarettes absorb less nicotine. Now, I would conclude the same thing from both data sets.

DR. BENOWITZ: I want to go back to your statement when you said the FTC method is accurately reflecting intake, because I think that is patently wrong. It is not whether there is some reduction; it is whether you can look at those cotinine levels, which would indicate that, when you get below 1 mg nicotine, that the FTC method is underestimating consistently based on cotinine levels in a couple of thousand people.

What I am arguing about is, is it reasonable to generalize from your 33 subjects and say that is more valid than the 2,000?

Cotinine levels, as you know, vary throughout the day, but not more than 10 or 15 percent if you are smoking regularly. So, there is no way that 10 or 15 percent can explain the difference, even if there were the worst bias that you can imagine.

DR. DEBETHIZY: I think that we can generalize from the data. I do not think we can give those data the weight that 10 years of analysis has provided us with. But I think that if we look at the plasma cotinine data, people smoking lower yielding cigarettes absorb less nicotine. Those data clearly show that.

They do not show that people get the same amount of material from all the wide range of nicotine-yielding cigarettes; would you agree with that?

DR. BENOWITZ: There is a slope such that there is not 100 percent compensation, although it may be close in some studies. But I would agree that there is a slope.

DR. DEBETHIZY: And I think that what we have done is taken things to the next step, what Dr. Henningfield called for earlier in his talk, which is to apply a technique that is used for other materials.

If you were asking what the amount absorbed of a pharmaceutical product in a 24-hour period would be, you would measure the total amount excreted and sum it up. That is all we have done, and I think that the data deserve consideration. I think that additional work will determine whether that slope will stay as steep as it is now.

I think you will notice that there were people above and below that, so there is wide variation. But the point is that people smoking lower yielding products are absorbing less. How much less, I do not know, and I suspect, even with our own data, we see some evidence that at the lowest yields, they are absorbing more than FTC would predict.

DR. RICKERT: First of all, in looking at your data on the FTC yield and the nicotine, one is impressed by the fact that it looks like there are basically two points on that regression. One is at the very low .1 mg and the other one is up at 1.4.

It seems to me that, for the bulk of the data, there is no relationship, that it is really a two-pronged display, with one at the bottom and one at the top and in the middle.

DR. DEBETHIZY: And I think that what you are looking at is the fact that the two center groupings are very close in nicotine and tar yield, but of course there is a full range of products out there on the market, and that is what we wanted to address with that.

DR. RICKERT: In reading the industry documents, it has been stated time and time again that consumers understand the FTC tar numbers. And my reading of the literature and what I have heard today suggest that is not so. And I was wondering whether there is industry information that supports the hypothesis that consumers, indeed, understand FTC numbers of tar and nicotine?

DR. TOWNSEND: How could the industry have changed so dramatically over the years and people traded taste, if tar levels were not a consideration in their choice?

People tell us, in focus groups and in other ways, "Yes, I am concerned about what I believe are health risks in smoking." They have been told that for 40 years, and they respond by looking at the tar levels of the products that they choose in the marketplace.

DR. RICKERT: I guess the question I am asking is, How do you reconcile that point of view with the information that has been provided here today, which suggests that the majority of smokers do not understand FTC numbers?

DR. TOWNSEND: I am convinced that they understand tar ratings as a relative comparison, the same as I think we understand EPA gas mileage. When you go buy a new car, EPA gas mileage estimates are determined by a number of factors, including the type of engine, how you drive, how properly you inflate the tires, how well you maintain it, how good your mechanic is, and even maybe the region of the country in which you live, because gasoline engines are more efficient in certain climates than others.

I do not take EPA gas mileage ratings to mean that is what I am going to get. The same as I was referring to earlier, I do not think I am necessarily getting the same efficiency on my hot water heater as it is rated.

I think these ratings are for comparison purposes. And I think that is what most consumers look for in the marketplace, and I think that is the way they interpret the FTC numbers.

DR. RICKERT: Let's assume for a moment that the FTC numbers are a perfect predictor of the amount of nicotine that is obtained from a cigarette. How do you think that relates to the other components that may be of concern? There are a whole host of chemicals that are related to various disease phenomena. How do you think the blood nicotine levels will act as a predictor of the absorption of these other constituents?

DR. DEBETHIZY: I think that one of the things about nicotine as a marker is that nicotine represents probably the upper limit for a particular phase for constituents. But one thing that I want to remind everybody is that the FTC method was never intended to measure or assist people with the actual uptake. It is to provide a relative ranking of cigarettes. And I think it has reliably done that for a long time.

It also gives us a way that we can standardize the analysis of cigarette smoking, so that we can compare work done in our laboratory with work done in your laboratory. And it has done that very well for a long time.

DR. HARRIS: I wondered if you could show, once again, one of your slides showing the trends in the sales-weighted tar and nicotine averages over time. And also, you might put up the one of unfiltered Camels also, if you have it. It is not essential which one, and I think Dr. Hoffmann even had one.

Dr. Hoffmann showed a similar slide, although the axes were labeled somewhat differently. And I have also looked at data on sales-weighted average nicotine, using the FTC numbers, at least those that were provided at various times to the Federal Trade Commission.

And I have been led to the general conclusion that, while the FTC-based numbers declined substantially during the 1950's and continued to decline,

to some degree, during the 1960's, in the last 10 years, there has been basically no change in the sales-weighted average, whether you measure it by the distribution of tars with a percentage of brands under 15 mg or by the sales-weighted average nicotine.

And in fact, data for 1992, and what I can estimate myself from 1993 and 1994, are a slight upturn in the sales-weighted average nicotine.

If you show your slide on Camel nonfilters, the graph ends in 1982 at a tar level of 20.6. It would be interesting to have the data for after 1982.

DR. TOWNSEND: The tar delivery for Camel nonfilter is virtually flat from 1982 to the present. This is a chart that I prepared for something else, not this.

DR. HARRIS: And my question is really, What, if any, observations you might want to make about what appears to be progress in the decline in FTC yields during the last 30 years, a progress of which is really confined to the preceding two decades, with no change in the last decade?

If this had been a meeting on mileage in the car industry, somebody would be waving a finger and saying, "What have you guys done in the last 10 years with your car model?"

DR. TOWNSEND: My response to your question, first, is that I believe this clearly points out to me the need for the industry to respond with low-tar products that have improved taste characteristics. Clearly that is what consumers have told me: "I trade in tar for what I perceive as a possible benefit, and what I get is less taste." The concept of low tar, great taste, does not wash with consumers.

There are taste deficiencies in the lowest end. Some people choose to make that trade because, again, they weigh both factors in the marketplace: taste and tar levels.

But I think both factors are important in their choice, because there are many, many smokers who do buy products in the lowest category; again, back to the need for some useful and valid comparative information on tar levels, and that is already in the market. The FTC test method provides valid and reliable information.

First, beginning in 1981 or 1982, the price of cigarettes in the United States began to rise much faster than the rate of inflation. And at the same time, we saw a dramatic increase in generic and branded discount cigarettes.

To some degree, the apparent stagnation in tar and nicotine levels may reflect smokers choosing to go from branded to discount and generic cigarettes. In fact, from what data I have seen, the major source of brand switching in the last 10 years has been to the discount and generic segment of the market, which, as you know, is about 35 percent of the market in 1993.

Another possibility that has been raised by some is whether some brands have had their nicotine levels and tar levels actually reconstituted upward slightly.

A third is the changing demographics of the market. As some people quit and other people start, the average smoker is a different person who would intend, on average, to smoke a higher tar or higher nicotine cigarette.

Finally, there is the question of whether or not, in fact, there is a limit that smokers are willing to tolerate, given the current cigarette array of choices.

How does your hypothesis relate to the question at hand: What is the meaningfulness of the FTC test, and is it useful in the market?

DR. HARRIS: There are several points you make. One is whether the test is useful, but also whether the industry has accomplished anything in reducing tar and nicotine levels. And I think that, since that was a preamble of both talks and it is certainly an issue that I have been puzzling over, I thought it was important to wrestle with the question of why have tar and nicotine levels not fallen in the last 10 years, and is there anything that can be done about it.

DR. SHIFFMAN: You have very much emphasized the issue of consumer choice and consumers making a choice based on accurate information. I take it, then, that if consumers could be provided with better, more accurate information about yields, that is something that you would favor.

DR. TOWNSEND: I believe that what the consumer needs is there. The FTC method provides reliable comparative information.

DR. SHIFFMAN: You do not want them to have better information?

DR. TOWNSEND: Convince me that there is better information. I am not convinced that there is.

DR. SHIFFMAN: I am asking it as a hypothetical question.

DR. TOWNSEND: If there is important information that the consumer needs to make choices in the marketplace, then I want to know it.

DR. SHIFFMAN: We have seen individual variability around the trend line, and if we were able to provide individuals with information about where they stood on that, then would that be an improvement that you might be able to support?

DR. DEBETHIZY: That is a tall order for any sort of standardized method.

DR. PETITTI: Your talk, Dr. deBethizy, referenced the historical context of the development of the FTC measures. And the historical context was the claim that these measures would significantly reduce the risk of disease. Do you think that the data so far support a claim that these FTC measures predict or are meaningfully related to disease risk?

DR. DEBETHIZY: Personally, I do not know. But what I would say is that the data that I saw Dr. Samet present today, which were largely taken from the 1981 Surgeon General's report, their conclusion was that people smoking lower yielding products have reduced relative risk for lung cancer.

DR. PETITTI: I think that you saw the quotes from Dr. Wynder and some of the earlier commentators. They mentioned 40-percent reductions in tar might lead to large reductions in lung cancer. I just want to get a sense of the magnitude in the reduction of disease risk with differences in tar levels over the range we are talking about.

I just want to make the point that adjustment is the problem; when you adjust, you assume people smoke the same number of cigarettes, whether they smoke high yield or low yield. And it is very difficult to handle statistically and is, I think, one of the problems in the original data that were published in the 1981 report.

DR. DEBETHIZY: But you know, on average, that people smoking lower yielding products do not smoke more cigarettes.

DR. BOCK: I am having a little bit of a problem. You had mentioned some observations with staining of saliva regarding ventilation and hole blockage. It seems to be the opposite from what was reported. Can you give me some details of how you know you got saliva on the area covered by the lips in every case, or most cases?

DR. TOWNSEND: What I can do is give you detailed information on the whole experiment. And I will have to do that privately, because I don't have the information with me today.

What I said earlier is the case. We saw infrequent hole blockage, but there was hole blockage in some cases, and we determined that by an inhydrin staining process. And I cannot recall the details and the numbers, because I really was not responsible for that experiment. I would be happy to follow up with you on that, if you are interested.

DR. COHEN: Let me quickly state what I think the premises are of your presentation, Dr. Townsend, and see if you disagree with where I disagree.

Suppose we accept the premise that the FTC system provides useful ranking information, everyone understanding the difference between ranking and other kinds of information. Let's say the system does that. Suppose we also accept the premise that truly individual smoking characteristics are beyond the scope of such a rating system.

Now, you have established that there are product design features—type of paper, type of tobacco, etc., that lead to different yields because of smoking parameters that vary with such product design elements, such as puff rate, puff volume, etc.

Doesn't this mean that a numerical scale—say, from 1 to 27—is necessarily misleading and that a categorical rating system would be a more valid way to report such information? You had four categories, I believe, and you showed variance. What I am saying is, I was following that, and it looked to me like you were about to recommend a four-category system.

DR. TOWNSEND: The whole idea of a categorical system, or so-called banded system, has been put on the table by a number of people in the past.

Conceivably, that accomplishes the same endpoint with one exception, I believe. The same endpoint, of course, is that it provides a comparative ranking for consumers. The flaw in that approach, if that is the only ranking, and discrete numbers are not also included, is that, of course, you would expect products to come up against the ceiling of each band.

DR. COHEN: I thought you established, with your own analysis, that individual numbers were inherently misleading?

DR. TOWNSEND: I did not say that individual numbers were misleading. In fact, I believe individual numbers—a numerical rating system—is, in fact, the best and that is what the FTC test method is.

With those data, then, manufacturers have advertised their products as light or ultralight, to fit some range of tar numbers.

DR. COHEN: I think you missed my point.

DR. TOWNSEND: The FTC method is the method that provides the useful comparative information for the smoker.

DR. COHEN: I thought you established with your charts that there was variance due to what is technically an interaction between product design characteristics and smokers' adaptations to them. Is that correct?

DR. TOWNSEND: Okay, you are confusing me. Let me put the chart back up. Standard deviation for replicate measures of that particular product. Different particular puff frequencies. Puff frequency of 60 seconds happens to be blue bars, 45 seconds is the red bars, 30 seconds is the yellow bars. So, the ultralight product that was smoked at 30-second frequency—in fact, this is the variability we saw in 10 replicate measures of that one cigarette.

DR. COHEN: Okay, then I did misunderstand that, but a lot of the presentations today have essentially suggested that smokers respond to product design characteristics by modifying behavior. And I am not talking about idiosyncratic behavior, but standard ways that you put up—puff frequencies, puff duration, number of puffs.

That creates variance around a point estimate. And would it not be more valid to acknowledge that those variances exist when you provide this information to consumers? Ranking is the least informative scale.

DR. TOWNSEND: You are talking about something like the EPA gas mileage ranking, where you have highway and city.

DR. COHEN: Ranking information has only an ordinal property. The absolute numbers have no significance, nor do the units of measurements between—like 16, 17, 18, 19. In a ranking system, you never assume those units are equal.

In this system, presented to consumers, consumers have a right to assume equal appearing units—16, 17, 18, 19. It goes beyond a ranking system. If you just want a ranking system, then there are ways to do that, to build on this kind of variance.

So, if all you want is a ranking system, the one that is in place now attempts to do more than that, and I thought your evidence indicated that it did not do it with great validity.

DR. TOWNSEND: What variance are you speaking of?

DR. COHEN: The interaction of human smoking topography and cigarettes having different design features.

DR. TOWNSEND: Have you quantified that?

DR. COHEN: I have not done it. I think we have discussed it today. I am not a technical expert on it. I am asking from the standpoint of consumer usefulness.

If a ranking system could be preserved to meet your objectives that you set out and, at the same time, it would have more validity because it wouldn't represent units that do not exist because there is too much variance around them; it is only a ranking system.

DR. DEBETHIZY: It sounds like you have put a proposal on the table, and my impression is that is what we will do tomorrow.

DR. COHEN: It sounded like you were saying, "Well, if it achieves its purpose as a ranking system and leaves consumers to know which brands are lower and which are higher, and that is fine."

DR. DEBETHIZY: And we think that the current method does that. So, I will be looking forward to the discussion tomorrow about alternative methods.

DR. HENNINGFIELD: This is actually a nice introduction to my point. Compensation is one of the reasons that you get a good correlation with machines and a lousy correlation with humans. It is not validated that the FTC method predicts what humans get.

But you have seemed concerned that compensation was not perfect, as though the fact that it was not imperfect rejected the notion of compensation.

DR. DEBETHIZY: I think what I was doing was challenging the notion that people get the same amount from every cigarette on the market.

DR. HENNINGFIELD: Do you know of any drug study with humans with addictive drugs where you do get perfect compensation?

DR. DEBETHIZY: I just do not even see a reason to address that question because smoking is a habit that people engage in, and people enjoy smoking. I think we have a situation where people enjoy smoking; they have a wide range of products to choose from; they can choose lower yielding products. The data—whether it is plasma cotinine or total urinary uptake—show that they get, when they smoke lower yielding cigarettes, less material, on average.

Now, the FTC method was never intended to address that question. It was intended to address the relative ranking of cigarettes.

DR. SHIFFMAN: Actually, what your data show is that within the broad range in which sales are actually concentrated—let's say from .4 to about 1.0, 1.2, FTC nicotine—people are getting, on average, the same, regardless of the nominal yield. So, in fact, your own data, as Dr. Rickert pointed out earlier, suggest that, in fact, the numbers do not track.

DR. SHIFFMAN: What your data show is that people who smoke cigarettes of .1 are very much lower than people smoking 1.4. But if you look at the middle range, we could probably compute the correlation by tomorrow, but I would warrant that it is close to zero.

DR. DEBETHIZY: And the middle range is a very narrow range of tar and nicotine yield.

DR. HENNINGFIELD: Let me just bring closure to my point, because what I see—and I think Dr. Shiffman is pointing out, too—is that what you see with humans with other addictive drugs, and what you see in animals, is compensation that is partial. And that seems to be what we are seeing here: another case of an addictive drug that controls behavior, and you do get compensation, although it is not perfect. That seems to be the biological process going on.

DR. TOWNSEND: And I think you and I fundamentally disagree about that, because it is like coffee drinking. I do not see myself as being, if I drink 1 cup of coffee 1 day and 10 cups of coffee the next day, I do not see that as compensation. I just see that as responding to different situations and choosing to drink coffee under those different environmental conditions. And I see smoking as a very similar activity that people engage in.

DR. KOZLOWSKI: This is a supplement to Fred Bock's question and point. Years ago, in Toronto, we tried to do a saliva test, I think similar to the one you did. We collaborated with the forensic laboratory for the Province of Ontario, and a Ph.D. student in pharmacology worked on it.

And we never published it because we did not find it useful, in part because the lips, in general, were too dry and were not depositing that much saliva and were doing it in a very soggy manner.

We found that a much more straightforward technique would be to take chapstick or lip gloss, and that would stain the filter overwrap. You could

then dissect the cigarette and count the holes that have been blocked by that. We tried that technique and abandoned it as unsuccessful.

Just months ago, we published in *Pharmacology, Biochemistry and Behavior* a validation of the stain pattern technique using Marlboro Lights, Winston Lights, Marlboro Ultralights—I am not sure about the four or five other brands. They worked just fine.

Even with ventilated filter cigarettes, which may be ventilated in the 20- to 30-percent range rather than 80 or 90, you can get a team of raters to do reliable judgment.

DR. DEBETHIZY: I think what is important is that some individuals may block holes when they smoke cigarettes. What is important is what happens over the course of their entire smoking day and what happens, on average, with people. And I think there has been an incredible emphasis placed on blocking holes here today, and I think that Dr. Townsend's talk clearly showed that there are many, many other techniques used to lower tar and nicotine, techniques that could not be overcome by the smoking behavior of the individual.

DR. FREEMAN: What I am going to do is say to cut this at this point and maybe we can continue it tomorrow. We were due to be finished about 20 minutes ago. It may be a little hard on these two gentlemen, who have been very gracious in answering these questions. We do not want to put them under too much, but we would like to bring you back tomorrow, if you do not mind, for further discussion. But let's have these two questions.

DR. BENOWITZ: There has been some suggestion about providing the consumer with more information, such as making ventilation holes visible so that people can see them and not block them, and give them information about what intense smoking would do, which you could simulate by machines. Are there any negative aspects about doing those things, from your perspective, and why not provide more information like that?

DR. DEBETHIZY: I think Dr. Townsend addressed it earlier when he responded that we would consider any reasonable proposal as long as there were some data to support that proposal.

And I am assuming that is what you all will do, and at least start the process. And you all may conclude that the FTC method is fine as it is, but I certainly do not have any problem with looking at reasonable proposals.

We have a motto at our company that we work for smokers. And if we can be convinced that it is meaningful for the consumer, that might warrant consideration.

DR. TOWNSEND: But you understand that we believe, today, that the FTC test method is useful for the consumer; that its presence has been beneficial for consumers making choices and also for driving the industry to reduce tar and nicotine levels to this great extent that we have.

Then the other point, too, ISO—the International Standards Organization—of course, adopted a standard test method that is used throughout the world, that is essentially the same. And they, in the investigations, particularly in Germany and the UK, had many of the same questions here.

DR. BENOWITZ: But there is no drawback for providing more information.

DR. TOWNSEND: Oh, absolutely. I think we always have to look at new information that is available, and look at it in depth, critique it, and see if anything is there.

DR. HOFFMANN: I am somewhat puzzled. I have seen the tobacco field for decades, and I always found the tobacco industry to be flexible. The pressure from the consumer and from the scientific community led to the industry changing the cigarette. And you have in *Science* the outstanding study by Dr. Benowitz.

We all agree that there is some compensation, and I find that you are inflexible. We have to work on it; there is a way. I am surprised. I have, in all the X years I have been working in this field, I have never seen such an inflexible thing as this, where you stick to the FTC method.

I think we can always improve, and U.S. scientists know this just as well as I.

DR. DEBETHIZY: Let me ask this question. Have you seen a proposal put on the table that seriously would improve on the current method?

DR. HOFFMANN: The advances in the research have been done by both sides—by industry as well as the scientific community. Suddenly, I find that you say, “No, the FTC method is the final word.”

DR. DEBETHIZY: I think that clearly what we have said is that, with 30 years in a standardized method that has been incredibly valuable to consumers, the industry, and the scientists that we have not seen any reason to walk away from that. I would just give it back to the group and say, let’s see a serious proposal.

DR. TOWNSEND: I am sorry that you are misreading this as being inflexible. I think the fact is that the FTC method has worked for a long time, and it continues to work.

But demonstrate what the proposal is, and how it adds to what we have now, to make things better, or to provide some more information. For example, one of the proposals that was floated this morning included a min and max level. Okay, let’s smoke a cigarette at FTC conditions, and then let’s go to a more intensive smoking condition, to report min and max.

What is going to happen from that is that you get exactly the same ranking; it is just more numbers, but it is the same ranking. And consumers are making their choices based on ranking.

DR. HOFFMANN: But you have shown here, in your paper, it is very detailed. It is for the low-yielding figure and compensation.

DR. DEBETHIZY: Yes, and you are right about that.

DR. HOFFMANN: So, this is not a reason that we should work together?

DR. DEBETHIZY: And we are quite willing to work with anybody, and that is why we are here today.

DR. FREEMAN: Dr. Townsend, I just want to ask one question, and it may be a little naive. Several times you have mentioned the value of tar in cigarettes because you say it is associated with taste. Even conceding that although it seems to be a thing that is killing people.

But what about nicotine? What is the value of nicotine and cigarettes, and why could it not be dramatically reduced?

DR. TOWNSEND: Nicotine, of course, is part of the smoking sensation. It does provide a sensation to the smoker. I think one of our competitors found that tobacco that had been treated to remove all the nicotine was not successful in the marketplace.

More than that, just as I cannot look into the components of tar and say, this is a very important, tasteful, and flavorful compound. You know, I am not equipped as a chemist to say nicotine is an important compound for this aspect of taste characteristics.

DR. FREEMAN: We will stop at this point.

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