

Polypropylene and the Future of the Bassoon

by

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ABSTRACT

The dearth of young bassoonists in America can be felt at every level of expertise, whether it be at professional levels where there are fewer qualified bassoonists compared to other woodwinds, or in local communities where interested pupils cannot find a teacher to guide them. In order to alleviate this scarcity, we must solve the problem at its root: young bassoonists. There have been many attempts to provide better instructional material for beginner-level bassoonists and to produce better reeds to entice more students to study the bassoon and to sustain their playing beyond the first few years. These attempts, however, fail to address another critical issue: the cost and availability of the bassoon itself.

Most bassoonists in America begin their journey in public school; however, many school music programs cannot afford to purchase bassoons due to their cost. To combat this obstacle, Fox Products produced their first bassoon made of polypropylene—a synthetic material—in 1961 at a relatively low price point. This is an innovation that no other bassoon manufacturer has accomplished. An analysis of sales numbers from major instrument suppliers indicate that these bassoons have been very successful. Their availability has allowed schools to purchase instruments to educate more young bassoonists and, as a result, participant numbers of students in Texas (where public music programs are known for their strength) competing at regional and state competitions have increased over the past fifty years. Fox, through their focus on affordable student bassoons, is revitalizing young students' interest in playing the bassoon and thus is a major factor in the reversal of the decline of bassoonists in America.

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Chapter 1

Introduction

The dearth of young bassoonists across the United States can be found at the earliest levels where beginning musicians choosing their first instruments often do not know about or have the opportunity to select the bassoon. In 1947, noted music educator George Waln stated that “The bassoon situation in the schools of America . . . is not as bright as we wish it were. Why do we find such a scarcity of players?”¹ This problem can be attributed to the fact that bassoons, even at the student level, are prohibitively expensive and thus many public schools do not have any in their inventory. The instrument often confounds even professional educators—as college students, music educators often must choose whether they want to study the bassoon or the oboe in their instrumental methods class and at some universities even those that do get to study bassoon may not get the amount of time necessary to gain a good grasp on the instrument’s technique.

Bassoonists face many difficulties not found by players of other woodwind instruments. Beginner-level bassoons are more expensive than any other beginner-level woodwind instruments. Furthermore, bassoons, like oboes, require the use of an often-fickle reed that must be handmade by a professional. To further compound the problem, the reed is a principal part of the bassoonist’s tone quality and ease of playing; having a bad reed can greatly hinder a student’s development on the instrument. To add to the problem, the bassoon itself is an extremely difficult instrument to learn to play, mostly

¹ G.E. Waln, “The Bassoon,” *Instrumentalist*, (May-June 1947): 11-13.

due to its complex fingering system that features techniques such as flicking and covering only half of a tone hole (instead of fully covering the hole) that is not found on other woodwind instruments. These various factors cause many students to not choose the bassoon as a starting instrument and those that do often quit out of frustration either from the difficulty of the instrument or the uninteresting parts in beginner level music that the bassoon often plays.

In this paper, I will discuss how Fox Products, a prominent maker of double-reed instruments since 1949, through their introduction of an affordable plastic student bassoon is helping to revitalize the bassoon population in America. I will explore the myriad benefits of constructing student instruments from plastic as opposed to wood. In addition, I will demonstrate how the number of young bassoonists have grown since Fox's plastic bassoons were introduced by comparing the number of students competing at regional and state level competitions in the state of Texas (where music programs are renowned for their strength) from the 1960s to the number competing in the twenty-first century. Finally, I will extrapolate the future impact of Fox's plastic bassoons by comparing what other makers' advancements in plastic instruments have done for the oboe and clarinet to what can be reasonably expected for the bassoon.

Chapter 2

The Lack of Bassoonists

Several factors contribute to why the bassoon is an unpopular pick for starting instrumentalists. Primarily, the cost of the instrument is often prohibitive for either the school to provide the instruments for their students or for the students to purchase for their own personal use. Table 1 presents a list of various student model bassoons, flutes, oboes, clarinets, and saxophones. Furthermore, bassoonists require high quality reeds that must be handmade and, if possible, tailored to the student's specific needs. These reeds cost at minimum \$15 each, and, if used in a four-reed rotation, could only last for roughly one month each.² Beyond that, the potential bassoonist faces a very steep learning curve that often requires additional outside tutoring via a private instructor to properly develop a solid playing foundation. This requires that the student devote additional time and money towards lessons for an instrument that is already prohibitively expensive.

Table 1. Cost of student bassoons versus other student woodwinds in United States Dollars

Instrument	Model	Woodwind- Brasswind	Musician's Friend	Music 123
Bassoon	Fox Renard 240	\$8,899.50	\$8,899.50	\$8,899.50
Flute	Gemeinhardt 2SP	\$479.00	\$479.00	\$479.00
Oboe	Fox Renard 333	\$2,999.00	\$2,999.00	\$2,999.00
B-flat Clarinet	Selmer CL711	\$399.00	\$399.00	\$399.00
Alto Saxophone	Bundy BAS-300	\$1,049.00	\$1,049.00	\$1,049.00

Source: Data obtained from websites of respective companies, prices are current as of March 29, 2017.

Note: Prices are consistent across distributors likely due to these distributors having an agreement with the manufacturers to use a standardized price. Prices do not include any bundle pricing or school discounts.

² Leigh Muñoz, "Finished Bassoon Reed," GoBassoon, accessed April 17, 2017, http://www.gobassoon.com/store/p2/Finished_Bassoon_Reed.html

A current survey of public school band programs shows that fewer students study the bassoon than the other woodwind instruments. This leads to poor instrumentation in many ensembles, from small band programs to large, well-funded bands. The Texas Music Educators Association 5A Concert Band, in which membership is awarded by juried audition, has seven positions each year for the bassoon. While this may seem like a large number, it is dwarfed by the twenty-seven spots available for B-flat clarinet alone.³ One could easily argue that there should be proportionately more B-flat clarinets than bassoons in any given wind band; however, how would one justify the fact that there are six spots for bass clarinet and four more spots for contrabass clarinet? In a typical wind band instrumentation, there are six different B-flat clarinet parts, one bass clarinet, and, occasionally, one contrabass clarinet part, compared to two bassoon parts. The expected instrumentation balance should therefore be equal number low clarinets and bassoons. However, in the TMEA 5A Concert Band it is ten-to-seven in favor of low clarinets. If the instrumentation does not require more low clarinets than bassoons, this discrepancy could be explained by there simply being more students who audition on low clarinet versus bassoon and the Association's desire to allow the same proportion of students from both instrument groups to advance to the 5A Concert Band.⁴

Solving the problem of the lack of bassoonists must begin, then, with the youngest students when they first start studying the instrument. Most bassoonists in America receive initial instruction through public school music programs. Unfortunately,

³ "All-State History Rosters," Texas Music Educators Association, accessed November 30, 2015, <http://www.tmea.org/programs/all-state/history>.

⁴ Ibid.

many schools cannot afford to purchase bassoons simply due to their cost relative to other instruments. For example, a new student bassoon by a reputable company such as Bernd-Moosmann GmbH costs \$7,995.00.⁵ Compared to a Yamaha Corporation student flute priced at \$923.00, this price difference could prevent many music programs from purchasing bassoons for their students.⁶ Furthermore, many student bassoon models, such as those made by Bernd-Moosmann, are made of wood like their professional counterparts. This may seem desirable at first but oftentimes younger students need smaller or less complex instruments from those that a symphony musician would play. Furthermore, wooden instruments require more careful maintenance than plastic instruments. Plastic instruments are more durable and can withstand the higher demand and subsequent abuse that a school-owned instrument might have to endure.

Fox Products, self-entitled “The American Bassoon Company,” has produced a solution to both the cost and the quality level of student bassoons. With the Renard student line Models 41 and 51, Fox introduced their first plastic bassoon made of polypropylene. Today, these instruments are priced competitively at a relatively low \$4,949.50 and are resistant to the cracking and water damage that threaten wooden models.⁷ Furthermore, these bassoons are made to accommodate the smaller hands of younger players, thus making the instrument a more viable choice for a larger number of

⁵ “M Bassoon,” Miller Marketing, last modified February 16, 2017, accessed March 29, 2017, <http://www.millermarketing.com/m%20bassoon/>.

⁶ “Yamaha YFL-221 Student Flute Standard,” Woodwind & Brasswind, accessed November 10, 2015, <http://www.wwbw.com/Yamaha-YFL-221-Student-Flute-461420-i1142848.wwbw>.

⁷ Ibid.

students. Fox, through their focus on affordable student bassoons, is a major factor in the reversal of the scarcity of bassoonists in America.

Chapter 3

Fox Products: The American Bassoon Company

Although Hugo Fox's legacy is largely (and rightfully) tied to Fox Products, which he founded, his tenure as a successful bassoonist cannot be ignored. Born in 1897, Fox was the principal bassoonist of the Chicago Symphony from 1922 to 1949 for a total of twenty-seven years. This alone is exceptional; however, that he was one of the few *American-born* bassoonists to do so is even more extraordinary.⁸ Prior to the turn of the century, European musicians filled many bassoon positions in American symphonies. Fox opposed this trend and served as a model for others to do the same. His professional playing career afforded him the ability to experience the growing demands on symphonic musicians and, in particular, bassoonists. Orchestras were asked to produce more sound and more colors than in previous generations. Fox noted that the bassoons he and his colleagues were playing, manufactured by the German company Wilhem Heckel GmbH, had difficulty meeting these new demands.⁹

Fox also had a long career as an educator, teaching bassoon at Northwestern University in Evanston, Illinois, for fourteen years (1936-1950), concurrently with his appointment with the Chicago Symphony.¹⁰ One of Fox's most successful students, Wilbur Simpson, eventually joined him in the Chicago Symphony as second

⁸ Karen Mercedes Crews, "Hugo Fox: A Biography of a Prominent American Bassoonist," (DMA diss., The Ohio State University, 2001), 1, accessed November 29, 2015, ProQuest Dissertations & Theses.

⁹ *Ibid.*, 33.

¹⁰ *Ibid.*, 34.

bassoonist/contrabassoonist in 1946 shortly before Fox retired. His students, who were interviewed by Karen Mercedes Crews, report that Fox “made efforts to keep his teaching career and his performing career separate from one another” and even went as far as to recommend his students not pursue professional playing careers because such careers were unstable and limiting.¹¹ Perhaps this disillusionment with his performing career eventually led him to investigate other careers in music that included selling reeds and eventually, bassoons.

Fox began manufacturing and selling bassoon reeds in the 1930’s in an effort to improve his own bassoon playing and the playing of those who bought his reeds. Fox is noted for having a large sound uncharacteristic for bassoonists at the time, which can be attributed in part to his personal reed style.¹² At the height of his reed making business, he had a drawer twelve feet tall filled with reeds ready to be sold at any time.¹³ Fox eventually concluded that selling reeds alone was not enough to advance bassoonists to higher levels of virtuosity—other limiting factors with the instrument itself sparked Fox’s interest in the construction of bassoons, and these eventually led to the creation of his own line of instruments.

Fox’s distaste for an orchestral musician’s life, despite his high-profile job, led to his founding Fox Products in 1949 when he retired from performing with the Chicago Symphony. Fox Products evolved from Hugo Fox’s reed-making business and from his dissatisfaction with the German Heckel bassoons he (and the clear majority of his

¹¹ Ibid., 40.

¹² Ibid., 40.

¹³ Ibid., 41.

American colleagues) were playing.¹⁴ Wilhelm Heckel GmbH, located in Wiesbaden, Germany and founded in 1831, was the dominant bassoon maker for most of the world outside of France and their instruments were the only acceptable choice for professional musicians at the time. Fox often felt that the bassoon had trouble projecting through the orchestra due to a lack of resonance and that the scale was uneven and thus difficult to play in tune.¹⁵ He sought to solve these issues by producing his own instruments on his family farm in South Whitley, Indiana where the company is still located today.¹⁶

Fox consulted with a number of repair technicians and engineers in order to start producing his own instruments. While at Northwestern University, he met Goldbeck¹⁷, a respected instrument technician in Chicago. By watching him work on bassoons, Fox learned the basics of the instrument's construction. Fox's colleague in the Chicago Symphony, Reynold Schilke, a trumpet player, was also a machinist. Schilke taught Fox the principles of machining that would eventually allow Fox to design the various machines he would need to mass produce bassoons. Schilke eventually became a major manufacturer of trumpets and the friendship and working relationship he and Fox built over the years continued to help both in their endeavors to improve their respective instruments.¹⁸

¹⁴ Ibid., 40.

¹⁵ Ibid., 44.

¹⁶ "History," Fox Products, accessed November 10, 2015, <http://www.foxproducts.com/history/>.

¹⁷ "Goldebeck" was mentioned both by Alan Fox and Mark Fink in an article in *The Double Reed*, "The Renaming of the Gillet Young Artist Competition" (2000), however, further information on Goldbeck has not been found.

¹⁸ Crews, "Hugo Fox: A Biography of a Prominent American Bassoonist," 45.

Ronald Klimko, former professor of bassoon at the University of Idaho, remarked that “world class, beautifully built bassoons . . . being turned out on a daily basis in this tiny town . . . borders on a miracle.”¹⁹ South Whitley is indeed a small, unassuming town in Northeastern Indiana with no other remarkable landmarks. Today, it is the headquarters of the largest bassoon maker in America. The company’s base has humble beginnings despite Fox’s illustrious career. Fox converted one of the chicken coops on the family farm into the original factory building for the company, which served as the center for operations until the company grew too large and had to be moved to a nearby barn.²⁰ Various other parts of the farm were repurposed into a multitude of wood drying shelters, offices and factories. After a fire that devastated his entire stock of wood, Fox began storing wood that was in the process of drying (which were intended to become joints of bassoons) in multiple locations across the farm in order to minimize future potential losses.

Alan Fox, Hugo Fox’s son, joined the company in 1960 when his father’s failing health reduced his capacity to tend to the day-to-day business of the company. Unlike his father, Alan Fox was not a bassoonist but rather a chemical engineer. Thus, he had to rely on hiring professional bassoonists to assist him in tuning the instruments when he officially took over the company in 1964.²¹ Alan Fox successfully transitioned the company from a small business to a prominent bassoon making company through the

¹⁹ Robert Klimko, “A Visit to the Fox Bassoon Factory,” *Double Reed* 29, no. 4 (2006): 99-103.

²⁰ Crews, “Hugo Fox: A Biography of a Prominent American Bassoonist,” 46.

²¹ *Ibid.*, 48.

careful hiring of bassoonists and craftsmen and a focus on the Renard student line of instruments after his father's death in 1969.²²

Alan Fox pushed the company to create the Renard student line as a way to maintain the company's profitability, which would in turn support its ability to develop better professional models. Chip Owen, one of the head instrument makers at Fox Products, revealed that the Renard name originated from Fox Products's student oboe line as a pseudonym used when the company stenciled oboes as a means of expanding the company beyond bassoon production in 1968.²³ Stenciling is a process by which a company purchases instruments made by someone else but claims them as their own by branding them with the company's insignia. This practice was in common use by many instrument manufacturers at the time. Alan Fox, however, did not feel comfortable putting his name on the instruments and instead used Renard, which is French for 'fox.' This endeavor did not turn out to be fruitful and Fox retired the Renard oboe line. It was not until nearly a decade later that Fox applied the Renard name to a student bassoon line. These instruments were produced in-house, and Fox was proud to add the Fox branding in addition to the Renard name on the instruments.

In 1999, businessman Rod King interviewed employees the company and likens Fox's business model to a company that creates both racecars and car engines. The engine business may be a bit more mundane yet profitable and this profitability allows the company to develop better racecars. Alan Fox wisely saw that while there are only so

²² "History," Fox Products.

²³ Chip Owen, phone interviewed by author, Tempe, Arizona, March 29, 2017.

many professional orchestras around the country, there are over 25,000 high schools filled with students who could potentially become bassoonists. Of the roughly 2,000 bassoons produced in 1999, only 800 of them are wooden professional models with the rest consisting entirely of polypropylene plastic student models.²⁴ The number of student bassoons Fox Products produced yearly easily dwarfs the total production of every other bassoon maker's output, many of which produce only a few hundred bassoons annually.²⁵ This is achieved through the advanced machines Hugo Fox developed to hasten bassoon construction, although much of the work is still done by hand.

Fox Products's plan to advance the bassoon differs from those of many other companies. Among competitors, none focuses such a large portion of its production on student models. Instead, most are trying to push the boundaries of their professional line in hopes of easing the various technical and acoustical deficiencies of the bassoon.²⁶ That is not to say that the end goals of Fox Products are not the same as those of other companies, but that Fox instead realized that even with the best professional bassoons, if there are not more students that are able to play the instrument in the first place, there will not be a healthy market for professional bassoons. Thus, Fox's focus on their Renard student line is their solution to not only the problems of the bassoon but also the solution to the lack of bassoonists across the United States.

²⁴ Rod King, "Instrumental in Making Beautiful Music," *Business People* 12, no. 11 (December 01, 1999): 40.

²⁵ *Ibid.*, 40.

²⁶ *Ibid.*, 40.

Chapter 4

Properties of Polypropylene

Polypropylene was first commercially produced in the 1950s in response to the need for a low cost yet high performance and flexible material with which to make consumer products. It is a type of plastic that is a resultant byproduct of turning crude oil into natural gas. Polypropylene is used for a variety of commercial products that range from flooring to textiles or even packaging materials.²⁷ The plastic's popularization during the late 1950s coincided with the transfer of Fox Products's leadership to Alan Fox. It is plausible that as a chemical engineer, Alan Fox would have had knowledge of the new polymer and its various properties and how it could be applied to bassoon construction. Alan Fox, a graduate of Purdue University, consulted with many of his friends and colleagues at the University in order to determine that polypropylene was the best wood-substitute to use for bassoon construction.²⁸

Polypropylene exhibits many qualities that make it desirable for bassoon construction. It has a high melting point that allows the plastic to retain its shape and physical qualities thus allowing instruments made of polypropylene to be stored and used in a larger variety of temperatures than their wooden counterparts. However, once the melting point is reached, polypropylene is highly elastic and viscous which allows it to be used in injection molding. This property allows Fox Products to shape the plastic to the highly specific measurements needed for the joints of the bassoon. Much of their

²⁷ Harutan G. Karian, ed., *Handbook of Polypropylene and Polypropylene Composites*, (New York: CRC Press, 1999), accessed November 29, 2015, ProQuest Ebrary.

²⁸ Owen, interview.

innovation in bassoon construction comes from the adjustment of the tone holes' size and position along with the diameter of the bore.²⁹ The bore and tone holes of Fox's polypropylene bassoons are drilled using the same machines as their wooden professional models except for the boot joint, which is too complex for machine work and is thus still drilled by hand.³⁰ The fact that polypropylene can be mass produced similarly to how Fox constructs their wooden bassoons was a major factor in its selection as the material for their student models.

According to Mike Trentacosti, a retired employee of Fox Products who was responsible for the final tuning of instruments, the polypropylene plastic student models "don't resonate quite like a professional horn, but have a very fine tone quality. In fact, many professionals have one of our student models for use in outdoor performances where humidity and temperature could damage their wooden instruments."³¹ This durability is a major benefit of their student line versus their professional line, and indeed even allows them to surpass other companies' student lines since no other bassoon maker uses polypropylene for the body of their student instruments. Since no other bassoon maker has been able to mass produce a relatively inexpensive student bassoon, the Renard line has been at the forefront of the production of student bassoons since the introduction of polypropylene Models 41 and 51 in 1964.

Renard Models 41 and 51 are both nearly identical instruments. Their primary focus is for younger students to use in school band and orchestra settings. As such, they

²⁹ King, "Instrumental in Making Beautiful Music."

³⁰ Owen, interview.

³¹ King, "Instrumental in Making Beautiful Music."

do not have some of the more advanced key work that professional models employ to keep the costs down. The only difference between the two models is that the 51 uses a “short reach” fingering system that brings some of the tone holes and keys closer together to accommodate the smaller hands of younger students with minimal impact on the overall tone quality of the instruments. They can withstand a fair amount of physical abuse and are not threatened by water damage or fluctuations in humidity levels.

Renard Models 41 and 51 derive much of their durability due to the polypropylene polymer from which they are constructed. Polypropylene is heavier than the maple used in bassoons.³² However, since student bassoons tend to have fewer keys than their professional counterparts, the difference in weight becomes negligible.³³ Polypropylene is relatively stiff and resistant to impact but perhaps even more important is that these attributes can be changed relatively easily to suit the specific needs of musical instruments. Indeed, polypropylene can range from sticky and gummy, which is useful for products such as sealants and caulks, to firm with a low density, which is the type used for bassoons.³⁴ This low density allows the instrument to resonate and produce the characteristic tone qualities associated with wooden bassoons.³⁵

According to physicist Arthur H. Benade, a professor at the Case Institute of Technology/Case Western Reserve University, Cleveland Ohio, from 1952 to his death in 1987, the material that from which a woodwind instrument is made does not perceptibly

³² Owen, interview.

³³ Ibid.

³⁴ Karian, *Handbook of Polypropylene and Polypropylene Composites*.

³⁵ Owen, interview.

change the tone quality of the instrument more than the two percent which most musicians can discern.³⁶ Benade argues that the differences resulting from the alignment and size of the tone holes far outweighs the difference caused by a change in actual material. Benade, however, also notes that if an instrument that is typically made of wood (such as the bassoon) is then made of plastic, the different methods and tools by which a bore reamer works on wood versus plastic can change the tone quality of the instrument.³⁷ Thin-walled instruments like the bassoon have vibrations that can be felt by the player. Therefore, it is important that polypropylene exhibits a porosity and rigidity as close to maple as possible so that the player is not influenced by the different “feel” of the instrument even if the tone quality is the same. This also explains why acrylonitrile butadiene styrene, which is a type of polymer that aligns more with the grenadilla wood used in other woodwinds, cannot be used for the bassoon.

Lastly, polypropylene is relatively environmentally clean and safe. Polypropylene is a natural byproduct of crude oil. Although the processing of crude oil itself can have a negative impact on the environment, polypropylene does not create extra environmental stress in its synthetization. This contrasts with Fox’s wooden bassoons which must be farmed from various types of maple throughout the world. Polypropylene can also be easily recycled and retains much of its desirable physical qualities in the process. This also means that bassoons can be made from primarily recycled materials further

³⁶ Arthur H. Benade, *Fundamentals of Musical Acoustics* (New York: Oxford University Press, 1976), 510-511.

³⁷ *Ibid.*, 510.

minimizing its environmental impact. When it needs to be permanently discarded, it can be safely incinerated without worry of excessive harmful byproducts.³⁸

³⁸ Karian, Handbook of Polypropylene and Polypropylene Composites.

Chapter 5

Fox Products's Polypropylene Instruments and Their Influence in American Public Schools

Due to being the first mass produced student bassoon made by an actual bassoon maker, the Renard student bassoon line has been well received since its inception. Prior to the introduction of the Models 41 and 51 in 1964, student bassoons were made by companies such as French company Conn-Selmer, Inc., which originally specialized in clarinets. Early in the development of the Renard bassoon line, Alan Fox requested input from many prominent bassoonists at the time. Bernard Garfield, (retired) principal bassoon of the Philadelphia orchestra, is credited with pushing for more default key work and rollers to be added so that “his students would have better instruments to play.”³⁹ After Fox made these changes, the Renard name was officially designated as the student line of Fox's bassoons in 1977.

The creation of Fox's plastic bassoons has had a positive effect on the number of students who play the bassoon in public schools. Schools saw that Fox made these instruments locally in America and thus could be easily purchased for reasonable prices without having to be added to long wait lists for European-made instruments. Fox worked closely with their dealers to ensure that they received any support necessary from Fox Products to popularize their new student bassoons.⁴⁰ The influx of Fox Products's bassoons into public schools during the 1960s and '70s helped make the possibility of playing the bassoon a reality for more and more students.

³⁹ Owen, interview.

⁴⁰ Ibid.

Since the introduction of Fox Models 41 and 51, the number of bassoonists competing at regional and state level contests has grown in the state of Texas, for example. Texas is widely known for their prolific public school band programs, which consistently produce high quality musicians. Students in Texas are encouraged to participate in a number of school ensembles including marching bands, concert bands, orchestras and choirs. Each student is also highly encouraged (or sometimes even required in the case of bassoonists) to enroll in outside private lessons in addition to the instruction they receive in class. Almost every student participates in some form of juried competition throughout the year and school music programs are judged almost entirely on the success of their students in these competitions. This level of dedication by the average student makes Texas a strong case study for music education in the United States.

At the Texas State Solo and Ensemble Contest, which hosts student competitions annually, students can compete by performing a solo work from a prescribed list of pieces for a comparative rating between I and IV with I being the highest rating.⁴¹ Although students are not ranked against one another, exceptional performances are acknowledged with an “Outstanding Soloist” award. In 1978, the first year of the competition, only one bassoonist was awarded this honor. Twelve years later, in 1990, five bassoonists were awarded “Outstanding Soloist” with the number of students competing also growing. Since then, nearly every year has had multiple bassoonists win the award, usually between five and seven.⁴²

⁴¹ “PML,” University Interscholastic League, accessed April 17, 2017, <http://wwwdev.uiltexas.org/pml/>.

⁴² “TSSEC Outstanding Performers,” University Interscholastic League, last edited 2009, accessed November 30, 2015, <http://uil100.org/archives/music/tssec-event.php?event=Bassoon>.

The Texas Music Educators Association hosts an annual convention and clinic in which the performances of its All-State Ensembles draw a large number of spectators. Students are selected for these ensembles through a rigorous audition process. In 2015, five students advanced from each region to the area level audition and then three of those students from each area advanced to the state level. Because there are twenty-eight regions in the State of Texas, a minimum of 140 bassoonists compete at the area level each year. With eight areas, twenty-four bassoonists compete at the final state level. Historically, 25% of participants at the region level competition advance to the area level and thus an estimate of twenty bassoonists would compete at each region for a total of 560 students annually.⁴³ In contrast to 1964, only four bassoonists made it to the final state level which means that there were only twelve bassoonists at area, and therefore only 60 bassoonists at the regional level. Extrapolating the same 25% passing rate, there were only 240 bassoonists competing in 1964.

These data show that the number of bassoonists competing in the State of Texas grew 215% since the 1960s. This is an extraordinary number on its own but when compared to the growth of a more historically popular instrument such as the flute, the number is even more indicative of the extreme growth in the number of bassoonists. In 1964, twenty-five flutists were accepted into the Texas All-State band. Extrapolating from the advancement numbers and estimating the same 25% passing rate from region to area used for bassoonists, there were roughly 1,625 flutists competing that year. In 2015, there were thirty-five flutists at the All-State level and thus an estimated 1,680 flutists

⁴³ "Region Alignment," Texas Music Educators Association, accessed November 30, 2015, <http://www.tmea.org/divisions-regions/regions/alignment>.

competing that year.⁴⁴ This 140% growth is much smaller than the 215% growth seen by bassoonists.

Although the number of bassoonists has increased dramatically since 1964, other factors may have contributed to this growth other than Fox’s polypropylene bassoons. An overall increase in the quality of music education and number of music teachers may have contributed to the growth and success of students studying music in public schools; however, that does not explain why the bassoon has become comparatively more popular versus the flute. A possible explanation is that the flute has not had a major development in student models and therefore has maintained a growth rate roughly equal to the population growth of the United States from 1964 to 2015 which is 168%.⁴⁵

Table 2. Bassoon, flute, and US population change from 1964 to 2015

	1964			2015			% Growth
	Area	State	Total	Area	State	Total	
Bassoon	12	4	260	140	24	560	215
Flute	75	25	1,625	105	35	2,275	140
US Population	N/A	N/A	191,888,791	N/A	N/A	321,418,820	168

Source: United States Census Bureau, accessed March 31, 2017, <http://www.census.gov/>

The increase in the number of bassoon students competing in the State of Texas and thus the overall increase in the number of students studying the bassoon in general can thus be linked to the introduction of Fox’s polypropylene bassoons in 1964. Prior to their introduction, many schools could not afford to purchase bassoons for student use and even when they could, the instruments were usually of lower quality in order to be affordable and difficult to maintain once purchased. Models 41 and 51, both made of

⁴⁴ Ibid.

⁴⁵ United States Census Bureau, accessed November 30, 2015, <http://www.census.gov/>.

polypropylene, became the first plastic student bassoons aimed at public school programs. Local availability allowed schools to purchase quality instruments at relatively cheap prices and thus allow more students to study the bassoon.

Chapter 6

Other Plastic Woodwinds: Clarinet and Oboe

Other instrument manufacturers have also turned to plastic as an alternative material to wood. In this section, I will discuss the physical properties of the plastics used in the clarinet and oboe families and their effects on the overall development of these instruments in modern times. I will discuss in particular the use of synthetic materials in professional models in addition to the student models that many schools employ.

Both plastic student clarinets and oboes are made of acrylonitrile butadiene styrene, hereafter abbreviated as ABS. ABS is highly resistant to scratches and abrasion and is therefore desirable for student model instruments. Furthermore, ABS is relatively lightweight and water resistant. These qualities combine to create a material that can withstand prolonged use in public schools.⁴⁶ Like polypropylene, ABS has a high melting point and can be injection molded to the specific measurements of clarinets and oboes. Wooden variants of these instruments are constructed from grenadilla and thus their plastic counterparts use ABS, which is a much stiffer plastic than polypropylene, that lends itself more to the porosity and rigidity levels of clarinets and oboes. Oboes in particular are likely to crack at least once in their lifetime (due to their relatively smaller bore size) therefore making plastic a logical and perhaps necessary component in their construction.

⁴⁶ Norbert Niessner and Daniel Wagner, *Practical Guide to Structures, Properties and Applications of Styrenic Polymers*, (Shrewsbury, Great Britain: Smithers Rapra, 2013), accessed November 30, 2015, ProQuest Ebrary.

Recent developments by the company Buffet-Crampon, which makes popular student and professional clarinets, to incorporate plastic into their professional models have managed to produce instruments which sound just as good as their wooden counterparts and advance the environmental sustainability of the company. Traditionally, wooden professional clarinets are made of grenadilla (also known as African blackwood or mpingo) which is a rare tree that grows primarily in Tanzania and Mozambique. It is a small, heavily branched tree that takes between 80 to 120 years from the time a seedling is planted until it can be harvested for commercial purposes. Furthermore, grenadilla that is used to create clarinets must exhibit no physical flaws and thus only select trees can be used for instrument construction. During the process of machining the joints of a clarinet, much of the wood is wasted. This scarcity has motivated Buffet-Crampon to innovate with its Greenline professional clarinets. This specialized version of their R13 and other model professional clarinet is created from a mixture of pulverized grenadilla and a secret plastic resin suspected to be at least in part ABS (Buffet-Crampon has refused to release the specific components of their Greenline clarinets to prevent competition). Therefore, physically flawed grenadilla can be used, minimizing waste. Since the Greenline clarinets are still 95% grenadilla, Buffet-Crampon can use identical processes to machine the bore and tone holes as their fully-wooden instruments and thus Greenline clarinets sound just as good as their other professional models.⁴⁷

⁴⁷ Stephane Hascoet, "Crossing the Green Line," African Blackwood Conservation Project, accessed November 30, 2015, <http://www.blackwoodconservation.org/greenline.html>.

As for oboes, Fox Products makes the most popular student plastic model, the Renard Model 330 Artist.⁴⁸ Wooden oboes, also made of grenadilla, have major durability issues that include not only cracking, which occurs more often in oboes than any other woodwind due to its smaller bore size, but also have a required break-in period of roughly six months to one year for the instrument to settle acoustically. During this time period, the oboe is difficult to play in tune, projects poorly and is in most danger of cracking. Further complicating the matter is that the expected lifespan of a professional oboe is only four to six years after the break-in period. Plastic instruments do not have a break-in period and thus, coupled with the lower cost of plastic versus wood, student oboes are almost always made from plastic.

Due to the extreme durability constraints of wooden oboes, some professional models have begun to implement plastic in their instruments. Unlike clarinets, oboes have opted to use entirely plastic joints instead of a complex blend of wood and plastic like the Greenline clarinet series (made by Buffet-Crampon). The top joint comprises roughly half of the overall instrument and is where cracking is most likely to occur since it is the thinnest joint on the instrument. A number of manufacturers have taken steps in order to combat this problem. French oboe maker F. Lorée, whose instruments are popular in America, along with Fox Products have both introduced professional model instruments with a plastic top joint. Howarth of London, another major professional oboe manufacturer, makes the top joint of their oboes entirely from ebonite, a type of hard rubber. Japanese instrument maker Yamaha includes a synthetic insert that lines the top

⁴⁸ “Renard Artist Model Oboes,” Fox Products, accessed November 30, 2015, <http://www.foxproducts.com/renard-artist-model-330/>.

joint of one of their professional models as opposed to using a fully plastic joint. The added durability has made these instruments a popular choice amongst oboists.

Both plastic clarinets and oboes developed due to the need for durable and cost efficient student models; this same desire pushed Fox to create their polypropylene bassoons. Whereas plastic bassoons have been limited to only student models, clarinets and oboes have extended the use of synthetic materials to their professional models with great success. Unlike wooden clarinets and oboes, which are generally made of grenadilla, bassoons use a variety of different maple from across the globe. There is constant experimentation in this area and perhaps once a consensus on the best type of wood is reached, professional bassoon makers will also experiment with making the joints of the instruments from synthetic materials. This innovation could bring the cost down dramatically for professional bassoon models and allow even more players to pursue playing the bassoon beyond a hobbyist level.

Chapter 7

Conclusion and Extrapolation

Hugo Fox and his son Alan Fox have made great strides in the advancement of bassoonists in the United States. Although the instrument itself still has quite a few technical and acoustical quirks, the number of students playing the instrument has increased exponentially since Fox Products introduced their polypropylene Renard Models 41 and 51 in 1964. Alan Fox chose polypropylene specifically because it has a density similar to maple and can still be molded and machined like a wooden instrument. Alan's background as a chemical engineer helped him to create the best student bassoons available today.

Whereas others have tried to reverse the low number of bassoonists through developing new instructional methods or attempting to change the fingering mechanisms to create less daunting instruments, Fox Products has chosen to make the bassoon more accessible by making it financially more feasible and available for schools to purchase. Renard Models 41 and provide a more economical and functional bassoon option for schools. These instruments can withstand the rigors of constant use through multiple generations of students and require less maintenance, whether it be in daily swabbing of the instrument or annual oiling of the bore. They are designed for younger students, moving tone holes and keys closer together where possible to accommodate smaller hands.

Gareth Newman, bassoonist with the London Philharmonic, performed a survey of professional bassoonists on which brand of instrument they prefer. At the professional

level, a great variety of responses means no consensus can be reached, unlike in the past when Wilhelm Heckel GmbH dominated the professional market. However, Newman notes that almost everyone interviewed stated that they prefer Fox Products's student bassoons to other manufacturers. They cite the cost, tone quality, and durability as major factors in their decisions.⁴⁹

Fox Products's student line has afforded the company the ability to further innovate with their professional instruments. The Fox Professional Model 680, released in 2014, demonstrates Fox's latest advancements in tone hole size and positioning along with expanding the size of the walls in the left half of the instrument to create a powerful low octave with better intonation while maintaining the clarity and tonal qualities of the upper ranges for which their other instruments are known. The Model 680 is quickly gaining recognition among professionals across the country, with several high-profile bassoonists already converting from other brands. The number of Fox Products sponsored artists is steadily increasing as more and more professionals choose to play Fox Products's instruments as opposed to the Heckels of yesteryear. Amongst them is Kristen Wolfe Jensen, professor of bassoon at The University of Texas at Austin, formerly a major proponent of Heckel bassoons. Without Fox's investment in their student line, however, the company likely would not have the funds and stability to innovate in their professional models to create an instrument like the 680.

Fox's rise to prominence is noted by Robert M. Stein, former Professor of Bassoon at the University of California, Los Angeles, in his article for *The Double Reed*,

⁴⁹ Gareth Newman, "What Bassoon? Thoughts and Advice on Choosing a Bassoon," *The Double Reed* 15, no. 3 (Winter 1992): 43-48.

the scholarly journal for oboes and bassoons. Stein states that several prominent bassoonists have converted to Fox instruments. Among them are famed artist-teachers such as Charles McCracken (principal bassoonist of the American Symphony Orchestra) and Kim Walker (famed bassoonist and former professor of bassoon at Indiana University) who are then influencing their own students and admirers to explore Fox Products's instruments.⁵⁰

Fox's development of their professional line of bassoons has also indirectly benefitted the number of bassoonists in America. Fox's professional bassoons, like their student-level counterparts, cost far less than the competition. A Fox Model 680 costs on average \$27,000 while a German-made Heckel bassoon can cost upwards of \$50,000. Due to the availability and relatively low cost of Fox's professional models such as the 680, 660, 601, and 201, more and more American bassoonists can play on a high-quality instrument. These professionals are then able to teach a younger generation who are also playing on relatively inexpensive but still high-quality polypropylene instruments made by Fox Products. The increased number of students playing on Fox's student instruments may eventually create more professionals and thus the cycle feeds unto itself to result in a noticeable increase in the number of bassoonists overall.

Given that Fox Products has strived innovate in bassoon construction since the company's inception, it is safe to project that they will continue to seek advancements for the instrument. As occurred with the clarinet and the oboe, Fox may one day experiment with using synthetic materials in construction of the joints in their professional

⁵⁰ Robert M. Stein, "To Heckel or Not To Heckel, That is the Question," *The Double Reed* 28, no. 4 (2005): 95-96.

instruments. Although bassoons are not threatened by cracking to the extent that other woodwinds face, they could benefit from being less expensive and easier to mass produce. Bassoons are far more expensive than the other woodwinds except for top of the line flutes made of precious metals. While a professional Fox Model 680 can cost upwards of \$27,000, a comparable professional Buffet-Crampon Greenline clarinet costs \$7,849.⁵¹ Incorporating some type of plastic into the professional line, if it is done without negatively affecting the tone quality of the instrument, could push costs down and make owning a professional level bassoon more feasible.

If plastic can be incorporated into a less expensive, sturdier bassoon, the instrument may finally find a place in the marching band. Student participation in marching bands, both at the secondary school and college level, is increasing at a large rate. Health experts are beginning to recognize marching band as a physical activity equal to traditional sports and oftentimes bassoonists are excluded from these ensembles unless they choose to perform on another instrument. Now that there are more bassoonists in general, if Fox can find a way to make the instrument a feasible part of marching ensembles, students will benefit from the ability to play their primary instrument in one of the quickest growing musical ensembles and the bassoon would gain great exposure with the public.

Alan Fox, by focusing Fox Products's efforts into making the best possible student bassoons by innovating with the use of polypropylene in their construction has created a company that now has the financial stability to experiment with and hopefully

⁵¹ "Tosca," Buffet-Crampon accessed April 17, 2017, <http://www.buffet-crampon.com/en/instruments/clarinets/tosca/>.

improve professional bassoons. Fox is solving the lack of bassoonists by focusing on first the students and then the professionals rather than the other way around. Their polypropylene Models 41 and 51 have made the bassoon more accessible than ever before and are a large reason why the instrument has seen tremendous growth in the number of players both student and professional.

Bibliography

- Benade, Arthur H. *Fundamentals of Musical Acoustics*. New York: Oxford University Press, 1976.
- Crews, Karen Mercedes. "Hugo Fox: A Biography of a Prominent American Bassoonist." DMA diss., The Ohio State University, 2001. Accessed October 6, 2015. ProQuest.
- Gainacopulos, Gretchen Schaeffer. "A Self-Instructional Method Book for Students Transferring to the Bassoon." DMA diss., The University of Wisconsin – Madison, 1988. Accessed October 6, 2015. ProQuest.
- Hascoet, Stephane. "Crossing the Green Line." Accessed November 30, 2015. <http://www.blackwoodconservation.org/greenline.html>.
- Karian, Harutan G., ed. *Handbook of Polypropylene and Polypropylene Composites*. New York: CRC Press, 1999. Accessed November 29, 2015. ProQuest Ebrary.
- King, Rod. "Instrumental in Making Beautiful Music." *Business People* 12, no. 11 (December 01, 1999): 40.
- Klimko, Ronald. "A Visit to the Fox Bassoon Factory." *The Double Reed* 29, no. 4 (2006): 99-103.
- Miller Marketing. "M Bassoon." Miller Marketing. Last modified February 16, 2017. Accessed March 29, 2017. <http://millermarketing.com/m%20bassoon/>.
- Muñoz, Leigh. 2017. "Finished Bassoon Reed." GoBassoon. Accessed April 17, 2017. http://http://www.gobassoon.com/store/p2/Finished_Bassoon_Reed.html.
- Newman, Gareth. "What Bassoon? Thoughts and Advice on Choosing a Bassoon." *The Double Reed* 15, no. 3 (Winter 1992): 43-48.
- Niessner, Norbert and Daniel Wagner. *Practical Guide to Structures, Properties and Applications of Styrenic Polymers*. Shrewsbury, Great Britain: Smithers Rapra, 2013. Accessed November 30, 2013. ProQuest Ebrary.

Stein, Robert M. "To Heckel or Not To Heckel, That is the Question." *The Double Reed* 28, no. 4 (2005): 95-96.

TMEA. "All-State History Rosters." Texas Music Educators Association. Accessed November 9, 2015. <http://www.tmea.org/programs/all-state/history>.

Woodwind & Brasswind. "Buffet Crampon R13 Greenline Professional Clarinet with Nickel-Plated Keys." Woodwind and Brasswind. Accessed March 30, 2017. <http://www.wwbw.com/Buffer-Crampon-R13-Greenline-Professional-Bb-Clarinet-with-Nickel-Plated-Keys-462807.wwbw>.

Woodwind & Brasswind. "Yamaha YFL-221 Student Flute Standard." Woodwind & Brasswind. Accessed November 10, 2015. <http://www.wwbw.com/Yamaha-YFL-221-Student-Flute-461420-i1142848.wwbw>.

University Interscholastic League. "PML." University Interscholastic League. Accessed April 17, 2017. <http://wwwdev.uiltexas.org/pml/>.