
Nordic IPA - a remarkable fusion and blending of ancient farmhouse brewing traditions and modern craft beer innovation.

Henning Sejer Jakobsen*

Aarhus University, Technical Science, Department of Biological & Chemical Engineering, Gustav Wieds vej 10, 8000 Aarhus C., Denmark
E-mail: sejer@bce.au.dk

Frank Gertsen

Aalborg University, Faculty of Engineering & Science, Department of Materials & Production, Fibigerstraede 16, 9220 Aalborg, Denmark
E-mail fgertsen@mp.aau.dk

* Corresponding author

Abstract:

In recent decades, the world of beer brewing has undergone a remarkable and unprecedented transformation, witnessing the emergence of a myriad of new breweries, particularly micro- and craft breweries (e.g., Jackson, 1998; Wülfing, 2014). This innovative trend extends beyond the boundaries of existing brewing companies and includes a diverse spectrum of start-ups that meet the new demands of consumers also related to the experience economy and pleasure economy (e.g., Boswijk, 2017; Garavaglia, 2018; Cabras, 2023). At the same time, there has been a trend for providing new beer types and flavours, rooted in old traditions combined with new knowledge, research, development of new species and varieties, and access to adapted process equipment (Oliver, 2011; Wülfing, 2014; Alworth, 2021). This article illuminates and explores the interplay between traditional beer styles and their place in a contemporary era at the time of creation based on the possibilities that existed. This interplay is combined into a contemporary description of the Nordic IPA as a fusion of Nordic tradition (Glamann, 2005; Andersen, 2014; Garshol 2020), Nordic crops (Juul, 2016; Bjørn, 2017; Caruse, 2020) with ingredients, processes, and raw materials (Skaarup, 2018; Laitinen, 2019). In summary, the defined Nordic IPA beer style is a testament to the creativity and innovation of the enduring heritage of Nordic cuisine (Juul, 2006; Neumann, 2018) and Nordic brewing tradition, intertwining centuries-old techniques with farmhouse brewing as an almost forgotten style (Phil, 2004; Mallett, 2014), related to contemporary craft- and microbreweries. This article highlights the historical, cultural, technological, and sensory dimensions of this defined beer style, compared to other Danish and Nordic beers to demonstrate Nordic IPA as an innovative creation, and arranged in our developed periodic beer system of 139 unique beer styles from the world.

Keywords: Innovation, beer styles, craft brewing, blending theory, evolution, Nordic Cuisine, Farmhouse beer, Nordic brewing tradition

1: The background and the purpose

Brewing beer is a several-thousand-year-old tradition and has been known since the cultivation of cereals. Today, beer is the world's fourth largest beverage after water, tea, and coffee (however, there is some dispute regarding whether the amounts of soft drinks and juice are bigger than beer) and the world's most sold and consumed alcoholic beverage, ahead of e.g., wine and spirits. Throughout history, beer has been one of the most popular alcoholic beverages with a significant spread in almost all parts of the world and with huge differences in type, style, taste, and variety. Although beer today is consumed for enjoyment and pleasure, historically beer has indeed also been considered as food (liquid bread) and a liquid safer for the health than water.

Between 2002 and 2008, Denmark went from a nation with 19 breweries to a country with more than 100 breweries (Bentzen, 2018). And again - the number of registered microbreweries in Denmark increased from 100 in 2013 to 180 in 2019. The local microbreweries in Denmark are strongly innovative and produce a wide variety of beer styles, and there has been tremendous growth in beer variants with more than 150 different beer styles, types, and hybrids in the last 20-30 years.

In the rich tapestry of human ingenuity, few domains showcase innovation and entrepreneurship as vividly as the realm of beer production and breweries (Jackson, 1998; Wülfing, 2014). Over the past few decades, the landscape of brewing, especially in the burgeoning world of microbreweries, has undergone a transformative evolution both related to brewery forms and equipment, types, and varieties of beer as well as marketing and branding of specialties. The development has had three tracks:

1. A reintroduction of discovered old and often almost forgotten styles, reproduced as close to what one assumes the old-style content as well as with strong marketing of the history. This is, among other things, initiated by Michael Jackson in his description of the concept of styles (Jackson, 1977), and is also seen in prehistoric styles introduced by breweries in collaboration with local museums.
2. A development based on a knowledge of historical styles and production methods but reinterpreted in a new and blended approach with local raw materials, research, innovation, and experimentation. This development follows Theory U (Scharmer, 2007, 2018) with a basis in a strong tradition and defined style, then downloading rooted in the style, presenting a peculiarity that has sometimes created a new style, a new market, other times has been a failure. This can be seen e.g., from American microbreweries, but also from Australian, Japanese, and partly around the year 1900 in Scandinavian breweries, and again from 2000 in the Nordic Cuisine also called the New Nordic Kitchen (Neuman, 2018).
3. Creation of copies of the above with subsequent branding and profiling with labels, marketing, and storytelling (Jackson, 1998). This is, among other things, reinforced by distribution channels with a focus on sales numbers as well as various beer evaluation systems that focus on being able to make the best brew as the almost identical version of the original, and

since the measurement method affects the result, originality is made difficult (Jakobsen, 2008).

Amidst this surge of creativity, it is imperative to undertake an analysis of the unexplored opportunities and lurking threats that have been instrumental in shaping the industry and have the potential to impede its progress. The rise of many companies addressing a new market has also created a more competitive market, where price, quality, and originality are constantly under pressure and can lead brewers into the pitfall of relying on what appears to be the safest choices, what is known, and what sells the best. This research strives to shed light on potential opportunities for continued advancement of the microbrewery landscape, having also in mind the latent pitfall.

2: Research design and methodology

Beer drinking and beer have been known in the Nordics at least since the Viking Age (Grammaticus, 1200) but definite brewery activity like today's practices has been known since the Middle Ages. Even though there are minimal written sources from Nordic breweries, we create an interdisciplinary "picture" by combining literature studies, old traditions e.g., handed down by sagas, and archaeological excavations. These old styles have been passed down over generations, and by combining these different sources we can produce a description of the Danish and Nordic beer styles.

The study takes its starting point from a literature survey of sources and descriptions of beer brewing since the Middle Ages, which is supported by sources of various archaeological excavations to indicate ingredients for beer production. This is supplemented by tales of brewing handed down in songs, later by labels and written tax rules and approvals. Brewing methods for farmhouse beer have been passed down through traditions, which is why written sources appear later in history from labels, descriptions of quantity, and brewing methods. Even though many of the traditions of historical Nordic brewing died out at the end of the 20th century, an overview of brewing has been preserved in several descriptions and at museums, such as classic Nordic brewing traditions have survived as a style in isolated areas in the Nordics such as NV Norwegian valleys, Finnish forests, and the Swedish islands Gotland. From this, a picture can be drawn of Nordic tradition and styles despite local variations, where old texts and contemporary insight into practices that otherwise appear unclear can be built.

Thus, the paper will explore and identify the nature of traditional Nordic beer styles, including their location and distinctive characteristics, and map the styles in relation to other beer styles in the world.

Methodology

This methodology for describing Nordic beer styles takes a holistic approach to the historical development of beer styles in the Nordic region, considering the influence of contemporary factors on their evolution over time.

By comparing the contemporaneity of the time with brewing tradition, a development in Nordic beers is styled as an evolution that unfolds in a line-up. This line-up is compared with a literature analysis of all the world's beer styles based on previous

definitions of styles, hereby the definition by Michael Jackson (Jackson, 1977), the Geographic Indicator System (WIPO), and UNESCO. This is supplemented by an in-depth analysis of Nordic brewing tradition with styles that are often overlooked due to minimal written source material. Here this material rooted mainly to farmhouse brewing is based on sparse written sources but strong handovers, and descriptions by preserving tradition in isolated locations as well as archaeological excavations with knowledge of both process and ingredients. This contributes new knowledge to historical styles not only in the Nordics but also elsewhere in the world, despite these often being of more recent date. By blending (Fauconnier, 2008) historical knowledge of processes and knowledge of ingredients from the Nordics, an interpretation of a new style is created with reference to known counterparts standing out with roots in Nordic traditions, -cuisine, and -nature, which for the individual brewer creates meaning for the development of the brewer's own imprint (Scharmer, 2018).

This article is based on two conducted and composed analyses:

1. Analysis of the history of Nordic beer brewing based on literature study, including a description of contemporary major developments in relation to trends, movements, and inventions that created fertile ground and the need for the creation of new beer styles.
The results of this analysis are summarized for the definition of natural evolutionary Nordic innovative beer style by blending the knowledge from the styles (Fauconnier, 2008) with strong synergies to Nordic Kitchen (Neuman, 2018), and its location in the periodic beer system, here also including the other historic Nordic beer styles.
2. Analysis based on a literature review of all beer styles in the world and their history including the reason for origin covering the entire world arranged in a periodic arrangement, based on literature revived to create a conceptual overview. In the classic description of beer styles (Jackson, 1977, 1984) there has been a tendency to focus on Belgian, German, and English brewing tradition and history, which produces a simplified picture of a much more complex and worldwide tradition of practice. Brewing culture, and here especially beer brewing culture, thus partly has a tradition of several thousand years, several hundred years of evolution with region-specific productions as well as new styles that arose because of systematic breeding work and technological possibilities. The setup of all beer types in the world is explored and arranged in our own development periodic beer system of 139 unique beer styles from the whole world. The placement of each beer style in the periodic system is based on the knowledge and background of the authors of the article as experienced brewers.

This arrangement, as a system of categorization of beer types having a distinctive character and a peculiarity, has been created by an analysis of historical data on beer types as well as a view of existing and newly emerging beer types, organized in the

system according to everyone's preferred preference. Therefore, the system also appears without styles that appear so close to another style that it is considered largely identical, as well as hybrids are omitted.

3 Defining styles and referencing

The definition of 'style' and the arrangement and placement of beers from all over the world in a systematic and periodic arrangement is based on the logic described by the English beer writer Michael James Jackson's seminal book: "The World Guide to Beer" (Jackson, 1977), concerning the arrangement of 75 different types of beer, each with its own unique characteristics and flavour profile. Jackson saw beer as part of the culture, where style is defined by appearance, aroma, taste, and mouthfeel composed in its cultural context. Others such as Fred Eckhardt in his book "The Essentials of Beer Style" (Eckhart, 1989) have followed up on Jackson's statement by adding subclasses. Regional organizations also define their own beer styles almost following Jackson's definition of judging beer or categorization, such as the Campaign for Real Ale's (CAMRA), Champion Beer of Britain, Beer Judge Certification Program (BJCP), Brewers Association's World Beer Cup and Brewing Industry International Awards. There is an equivalent system of the Danish Beer Judges Association ("Danske Øldommere") including an annual national championship for "hand brewers" (with links to some other Nordic ones), a locally developed periodic system (by Peter Fly) also using the term beer style and all with listings inspired by Michael Jackson (Jackson, 1984), where the categories can vary covering processes or ingredients not normally considered to define beer styles in themselves.

Since then, however, many new assessment criteria have been added, such as the system introduced in 1992 for the protection of products that have a specific geographical origin and possess qualities or a reputation that can be related to their origin (WIPO). The system is called Geographical Indicators (GI) primarily dealing with three different protections with a description of origin and distinctive character (Johnson, 2017), each with its own easily recognizable symbol:

- Protected Designation of Origin (PDO). PDO products are essentially or exclusively due to a particular geographical environment with its inherent natural factors.
- Protected Geographical Indication (PGI). The quality or characteristics of PGI products are linked to the geographical area, but not necessarily due to the geographical environment.
- Traditional Specialty Guaranteed (TSG). TSG is a form of geographical protection that ensures that a product has a traditional character or composition but is not necessarily linked to a specific geographical origin such as PDO or PGI.

These have given impetus to the development of beer styles as well as hops variants and -areas, which are not only based on the assessment of others but have largely opened the way for regions and areas to proactively gain recognition for their specialties. At the same time, UNESCO, and local systems such as the French certification approval

Appellation d'Origine Contrôlée (AOC) - usually best known for wines, also played a role in spotting distinctive beer styles.

By reviewing these combined with regional descriptions, our new beer periodic system Anno 2023 (figure 3) for beer styles has emerged knowing that this is not future-proof or a definitive truth: There will of course appear more historical styles that we have not yet considered, which through careful analysis and application obtain protection as proof of their style uniqueness, just as new styles will also appear in the future due to new developments, new knowledge and new technological possibilities in creative blends. Brewery activity and beer styles have been one of the most innovative areas within beverage and food in history, which must be expected to continue.

Each individual beer style is carefully described with its original name and with a description of the preferred story of origin, the characteristics of the style, the preferred fermented sugars defined by interval percent alcohol including original gravity and final gravity, preferred interval in hop bitterness described with the style's IBU (International Bitterness Unit) and the style's colour range described with the EBC (European Brewing Convention) scale. These are then analysed for overlap in the styles' unique character as well as the styles' preference for placement in the correct column. Vertically, the styles in the same column thus have common features, where users with a preference or aversion to a style in one column typically also have it for the rest. Conversely, there is no relationship horizontally, however, each column typically starts with a strong interpretation of the column's "DNA" with increasing strength or colour the further down one goes.

4: The tradition in Nordic brewing

Farmhouse ale is an old tradition primarily rooted in Northern Europe and to a particular extent Scandinavia and the Nordics (Thomsen, 2020) and therefore also sometimes called Nordic Brewing (Garshol, 2020). Many of the types have roots back in the Middle Ages (the year 1000 - 1536), especially the Nordic ones (Viklund, 2011), as this area outside the capital primarily was based on larger farms, villages, settlements, and later smaller market towns (Mallett, 2014), where they brewed with local ingredients and used the ingredients to their fullest (Thomsen, 2020; Juul, 2016). Farmhouse beer is usually brewed in small batches using small and more primitive facilities, which allows for greater experimentation with flavours and ingredients but also offers several opportunities to vary brews in relation to what the farm could contribute with raw materials depending on soil conditions, weather conditions, and tradition. Following a tradition from the Viking Age and the Viking female God Freja, beer was brewed by women on the farms, a tradition that has continued until recent times (Laitinen, 2019). Virtually the entire rural population was illiterate, which is why recipes and brewing methods were neither written down nor read, whereas knowledge of brewing at the time also comes from archaeological excavations and foreign accounts (Wise, 2022).

It is a peculiar coincidence that "brewing has come home". Homebrewing has become popular in contemporary times, and one could argue that it represents a return to the roots of brewing, which was traditionally done at home on farms and domestic houses in ancient times. No figures were found about the amount of home – or "hand brew" - in

the Nordic Region, but the New American Homebrewers Association estimated in 2013 that there were 1,2 million homebrewers in the USA.

Brewery in the middle age in Germany, England, France, and Belgium/Netherlands was organized and described quite differently (Alsleben, 2007). The development happened mainly in or in connection with monasteries, often with written recipes and process descriptions, partly with productions on a completely different scale to the larger cities here. Northern Europe also had monasteries, but here the influence from the monasteries was quite different, moderate to primarily deal with the introduction of hops and new herbs (Juul, 2021; Caruse, 2022). All things being equal, this must be seen in relation to the fact that the church and the monasteries with the Pope did not have the same power in Northern Europe among other things because there were strong pagan traditions especially in the Nordic, as well as northern Europe early before the 30 years' war became Protestant, and most monasteries became closed and decommissioned at the Reformation. Farmhouse beer therefore has a very special history and development centralized around northern Europe and in particular the Nordic region (Kjersgaard, 1978), based on traditions from the Middle Ages that have a hold right up to the turn of the 19th century (Wise, 2022).

We have defined four factors as particularly important in the creation and development of Nordic and Danish beer traditions:

1. The trend and the movement in the society of the time in the Nordic region, where the countries developed together but also individually with key events that spawned new beer styles.
2. The diseases and ravaging epidemics of the time, which derived needs such as clean water (or boiled water), food but also famine, and herbs for conservation and disease healing, which ultimately led to knowledge of the importance and effect of yeast and bacteria in beer (e.g. Pasteur's 'Études sur le vin' from 1866 concerning Pasteur's studies of wine fermentation and the effect of bacterial infections on wine, as well as his 'Études sur la bière' from 1876, where Pasteur described the principles of beer fermentation which was the basis for Emil Christians Hansen's purification of beer yeast cells).
3. The importance of the church with monks who brought knowledge of brewing as well as hops and herbs, the church's days with fasting days without solid food but preferable beer. This was abolished after the Reformation and replaced by strong Holiday drinks for celebrations and not fasting, but the new church continued to agitate for the limitation of beer and alcohol consumption despite its own significant consumption. The monasteries, the church, faiths and beliefs had a great influence on beer and especially alcohol consumption.
4. Technological breakthroughs that made growing crops more efficient, milling grains better and faster, transporting goods easier, controlling processes possible even on a huge scale, and understanding the mechanisms in the chemistry and physics of brewing.

Table 1 highlights the development of Nordic and Danish beer styles as a consequence and symbiosis with these supporting factors.

Table 1 Line-up of the dominant factors that over time have had a decisive influence on the creation of Nordic and Danish beer styles

Name of ages in Scandinavia (differences to European ages)	Time period	Danish (and Nordic) beer types and traditions, that occur during the period	The big trend of the time in the Nordic countries and hereby Denmark	Rampant diseases/ epidemics	Christianity and faith ('I believe in') development	Some of the great inventions of the time and/or their breakthroughs
Viking Age (or 'age of the Vikings' or 'last part of the Late Iron Age')	793 - 1066	Seasonal beer and 'to drink Christmas', Mead, Beer for parties and celebrations. Kviek yeast	Densification and urban formations, sails on ships, iron to steel. The Nordics are one cultural area	Many outbreaks, but not epidemics or pandemics. Increasing population	The Danes become (slowly) Christians, but still many pagan traditions	Double-Edged Swords, Longships, Herb Gardens, Mole Plow, Water Mill
High Middle Ages ('and Early Middle Ages' or 'Romanesque Period')	1066 – 1340	Rye bread beer. Everyday beer. Inn woman, beer stalls, and beer-woman. The farmhouse beer tradition is born	Creation of borough, Knights Templar, Jutland law, the first 'universities'	Leprosy	Monasteries are created, monks bring beer culture with them including hops and herbs	Watermills, windmills, the reversible plough, glasses, gears, crossbow
Late Middle Ages ('the Gothic period')	1340 – 1536	Gammelo! and 'Gemmeol' / good (no.1), 'Middeløl' / Everyday beer (no.2) and 'Sketøl' / The Tiny beer (no.3)	The Hanseatic League, the Kalmar Union (Nordic Union). Guilds, distillation becomes widespread (brandy)	Plague (Black Death), leprosy	The power of bishops increases, monasteries become strong/rich, hops become normal in beer	The wheel plough, churches with tall towers, mechanical clocks, caravel ships, book pressure, gunpowder, paper
The Renaissance (the 'Nordic Renaissance' or 'Reformation')	1536 – 1660	Skibso! (Ship's) beer, plenty of smoked malt and lot of hops, suitable for the people of the sea on ships	End of Kalmar union. Huge Danish-Norwegian fleet, cultural and scientific revolutions (human as creator: creativity). Denmark lost Scania area to Sweden	Scurvy, cholera, plague, Syphilis	The Reformation, the Danes become Protestants (<i>happens over several years</i>), Gregorian calendar	The thermometer, telescope, microscope, binoculars, pendulum clock, barometer, knowledge of anatomy
Absolute monarchy (or 'royal monopoly' or 'one king's rule')	1660-1849	Bitter Beer - well hopped, smoke malted, and aged; Rye Porter; 'Hvidtøl's' breweries (in the cities)	The colonial period in the Caribbean, Africa and Asia, state bankruptcy, the golden age, Danish Law, industrial revolution	Smallpox, Plague, Typhus, Syphilis	Church power still great, but much power now moved to the king and the autocracy	The beer bottle, swing plough, bicycle, electromagnet, battery, steam engine, calculator
The modern era (cradle and challenge of democracy)	1849 - 1917	Under-fermented beer, breweries arise in the province. 'Hvidtøl' as an underfermented low-alcohol beer (law). Seasonal beer as Salvator type and strong style	Lost Schleswig and Holstein to Germany, Urbanisation, the co-operative movement, change in alcohol habits. The 19th century is also called the "Century of Inventions"	Tuberculosis, awareness of Malaria (<i>chill fever, Dutch disease</i>), measles described (<i>Panum</i>)	Freedom of religion is introduced, new religious interpretations are seen (<i>Indre Mission, the Pentecostal movement, Jehovah's Witnesses, etc.</i>)	Wine yeast and beer yeast, the ph scale, the beer cap, the patent stopper, the periodic table, dynamite, airplane, refrigeration technology
	1917 - 1945	Breweries consolidate in the cities as industrial units. 'Beer have to be cheap'	North Schleswig back, Depression, nationalism and war again. Research into hop plants	The Spanish flu pandemic	The new religious currents are gaining ground	Machine gun, fission energy, stainless steel, wristwatch, penicillin, radar
	1946 - 1989	Brewery mergers - focus on price, many breweries die. Danish Bock (Christmas and Easter brew) makes their breakthrough	The Cold War and dictators in the world, the nuclear family, gender role confrontation, youth rebellion, new educations, new wave of urbanization	Polio	New religious currents are again gaining ground as sects (<i>scientology, the Moon movement, etc.</i>)	Electronic data processing, computer, PLC control, transistors, internet, the pill
	1990 -	Huge breweries. But also craft, nano, hand and micro breweries. Nordic cuisine and Nordic IPA arise as a concept	The world is globalizing, but so are nationalist forces. Identity struggles and focus on health and climate. The UN sets 17 global goals	SARS, Ebola, COVID-19	New "religious" movements (folk religion) not based on a God but a belief	Smartphones, AI, more nuanced use of biotechnology, satellite/space travel taking off, surveillance society

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Source: Own line-up in cooperation with the experimental craft brewery Humleporten

The old Nordic farmhouse styles have their roots in the Viking Age with the development of decidedly styles from the Middle Ages. One of the oldest testimonies of these farmhouse styles even in the cities was found in 2014 in a burned-down brewery in Odense, Denmark from the second half of the 14th century, which testifies to brewing with ingredients from that time (Feijen, 2017). The brewery was established during several phases and grew bigger and bigger over the years, but of course, only brewed for use by the house's own residents and perhaps for sale in beer stalls, and there were large quantities of barley malt and oat malt. In the same way, on a hill near Gødved Church north of Silkeborg, Denmark archaeologists have found an oven with almost 10 liters of charred oats, which have been shown to have germinated before charring. The grain originates from approximately year 1130 (carbon-14 dating) (Feijen, 2017). In the Middle Ages, barley, rye, and oats, often covered with chaff, were the most common cereals for cooking in the Nordics and probably also for brewing beer, which these new excavations confirm (Kjersgaard, 1978; Skaarup, 2018).

Calling it the Nordic brewing tradition comes from the fact that the Nordic countries, including Northern Germany (Alsleben, 2007) as well as periodically the Baltics, in both

the Viking Age (793 - 1066) and the Middle Ages were largely one kingdom with strong overlapping traditions (Kjersgaard, 1977). The Kalmar Union was the strongest Nordic community ever existed from 1397 to 1523. It was a personal union between Denmark, Norway, and Sweden, which was established with the aim of uniting the three countries under a common king and ensuring peace and stability in the region as well as cooperation on trade. Sweden also included Finland, Norway included Iceland, Greenland, the Faroe Islands, the Orkney Islands, and the Shetland Islands, and Denmark included the duchies of Schleswig, Holstein, and Lauenburg as well as the Gotland and Scanian lands (Halland, Scania, and Blekinge). The Kalmar Union had its centre of power in Copenhagen, but with decentralized governance in Norway and Sweden, and during the period the traditions developed in parallel. Therefore, the correct designation is "Nordic style" for brewing in this area.

Farmhouse beer as a term was almost forgotten when beer writer Michael Jackson in 1980 encouraged Don Feinberg, owner of the Belgian export company Vanberg & DeWulf as well as he was known as the original founder of Brewery Ommegang, to look at the Belgian beer Saison. Feinberg imported Brasserie Dupont's Saison to the United States from Belgium, and he defined Saison as a 'farmhouse ale', which was further cemented when Phil Markowskis in his book 'Farmhouse ales' (Markowskis, 2014), defined Saison in line with Biere de Garde as farmhouse beer. Perhaps these styles are truly Scandinavian, as Normandy was strongly inspired by the Vikings and their brewing traditions. These farmhouse beers are in the same way as the largely disappeared original styles Stone Beer (Stein Bier) from Austria and the Russian Chuvash (sora) beer, not a part of this description despite having a long and old tradition as farmhouse beer.

4: Result of the analysis of the Danish and Nordic beer styles

The Nordic classic farmhouse style was based on brewing with extractions up to three times, sometimes even a fourth extraction is seen (Garshol, 2020). The first draft called no1 (Old beer, Good beer or Beer for Storage), created in the Middle Age, was a strong and good hoppy beer intended for guests and for celebrations, a tradition handed down from the Vikings. This easy extraction without completely washing out is also known from the production of Port Wine (Carvalho, 1995) and Liqueur Wine, where the pressing is limited to create particularly good wort, where the remainder raw material is then pressed out and used for the second extract for a new production, which is distilled for addition to the first extraction as a natural fermentation stop. In the Nordic tradition, hot water was added to the mash again to create a new brew based on the same raw material called no2 (Everyday- or Household beer), primarily for women, servants, and workers. This second extract provided a milder beer in terms of taste, alcohol, and bitterness, which was not suitable for storing for a long time. Often this Everyday beer as a no2 was brewed as a no1 with a smaller amount of raw materials, as it was clearly the type that was consumed the most (Juul, 2016). Finally, hot water was added again for the next production of the same raw material called no3 or 'Slet' beer as "the tiny beer" which was in every way a thin beer for the children and beggars. As the water consisted largely of surface water everywhere - even in the wells, water was downright poisonous

to drink, and even children drank beer largely as the only liquid, this tertiary extract was admittedly thin, but the wort was still boiled and therefore not toxic.

This brewing tradition survived for approx. 800 years, first as farmhouse style in the Middle Age from approximately 1200, then in cities and market towns as industrial beer types from the 16th century based on the same tradition, but here typically only two extractions as no1 - called Prime, and no2 - called Almuen ('the common people'). Despite the fact that the city breweries were based on Farmhouse traditions and brewing methods, these breweries were called 'Hvidtøl' breweries (White beers breweries), probably inspired by the popular bright North German wheat/light barley beers, perhaps based on the white sprigs of the white-malt. The beer was collectively called 'Hvidtøl', and both 'Hvidtøl'beer and 'Hvidtøls' breweries became a strong characteristic, especially for Danish beer and breweries.

As a special version of the Everyday beer, a special beer called Skibsøl (Ships-beer) arose in the 17th century based on Denmark-Norway's colonial times and strong merchant navy (Garshol, 2023). As a result of failed dispositions during and after the Thirty Years' War, Denmark-Norway had lost large land holdings in Scania, and 'what is lost inwardly must be gained outwardly'. This resulted in colonial activity in the East Indies, Asia, on the Gold Coast of Africa, and in the Caribbean. This merchant fleet required large quantities of beer. Brewed with even extremely large amounts of smoked malt and nicely hopped, particularly suitable for creating durability for long sailing. This was later followed with a beer that was stronger in percentage and hops and aged in casks, called Bitter beer. Here, these counterparts to the hoppy IPA styles are similarly well hopped, intended for shipping, but the Danish versions were heavily smoked and opposite Skibsøl (Ships beer) suitable for storage.

The use of rye has always been a central part of Nordic food culture, where bread was baked based on rye. Rye flour has a high gliadin content but is low in glutenin, which is why rye bread rises but not as well as wheat bread and appears heavier. In contrast, barley flour and oat flour do not rise at all, which is why these were primarily used for animal feed and beer production. However, wheat has traditionally been more difficult to grow in Scandinavia, which is why rye often was preferred, as it can grow on almost all soils. In the Viking Age and the Middle Ages, it was common to make beer based on dry rye bread that was sliced and soaked in water. Due to the sourdough and the presence of lactic acid bacteria, this beer becomes sour but fresh contributing to the fact that even older and dry bread could be used in beer. From the Viking Age, beer has been brewed based on the classic Nordic bread, rye bread (Kjersgaard, 1978), but it has mainly been common in the Viking Age and Viking Age, and other beer types such as Kvasir or Kvass in the Slavic countries, who certainly learned this style from the hearing Vikings in the early Viking Age (Grimm, 2018).

Rye was also a central part of Nordic beers and was for a period largely as widespread as barley however with a large geographical spread, there was a surplus of rye for bread production (Skaarup, 2018). Then rye was used directly in Rye beer, and as rye was cheaper than barley it was possible to make a stronger beer still reasonably cheap. Finally, with the arrival of the porter especially on the Danish market, a special Danish version of porter was brewed using malted rye to create deep aromas, which

appeared as a special Danish variant of the English porter. Rye was prohibited from use in England due to the English Purity Act of 1816.

By collecting the historical Danish beer styles, twelve unique Danish styles appear (see figure 1), where the styles above the dividing line approximately dated to 1880 deal with farmhouse styles. These have deep roots in the rest of the Nordic region, and although they largely disappeared outside of museums in Denmark, they have survived in other more desolate areas of the Nordic region. Below the line, the newer Danish styles emerged in connection with the transition to bottom fermentation, typically following the Bavarian example, which largely outcompeted the old styles - but also created some newer types with widespread and varied distribution.

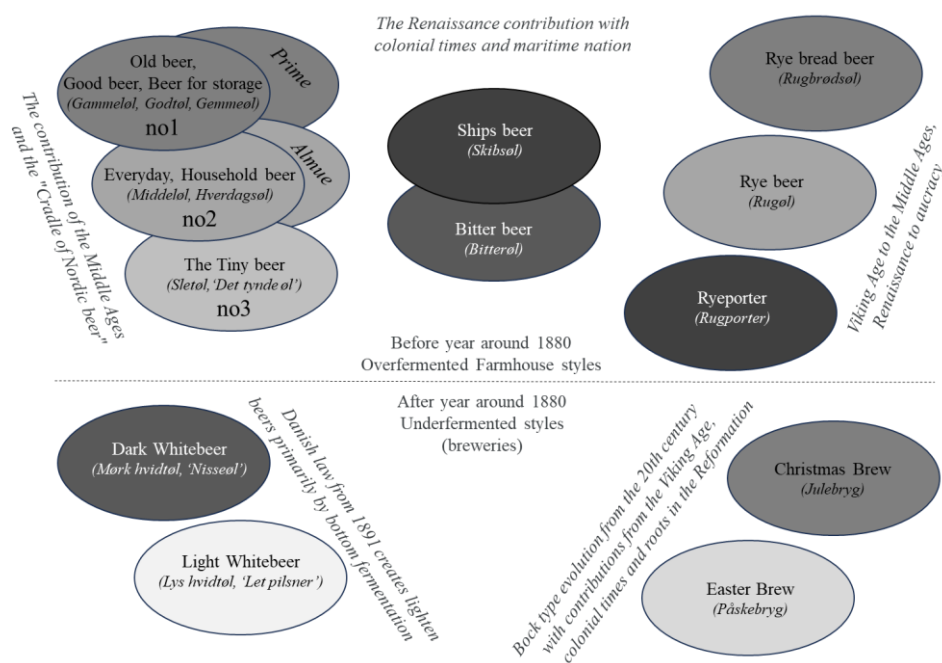


Figure 1: The Danish hereby the Nordic beer styles with the old classic Nordic styles over the line and the more recent originated from the end of the 19th century in Denmark as under-fermented beer types below the line

Throughout the Nordic countries as well as in the Baltic countries, clear traces of the Nordic beer tradition of brewing Farmhouse beer can be seen, surviving in small, isolated settlements, valleys, and islands where the late 19th and 20th-century major trends, wars, and changing state formations did not destroy the old tradition. This can be seen, for example:

- In western Norway also called mountain Norway, where the settlements have been isolated by the large fjords surrounded by even remarkably high mountains and with harsh winters, a special farmhouse beer called Kornøl (Malt-beer) could

survive. Kornøl is brewed with barley malt and oat malt – later also spelled wheat, some hops, and juniper berries. Large parts of the malt and hops came from Denmark since Denmark and Norway were one kingdom until 1814 (the Twin Kingdoms). Korn (Malt) beer is brewed without boiling which was possible in the mountains with cleaner water from the sources here, contrary to what is known from Denmark with polluted surface water. The special Kveik yeast is used (Catello, 2020), which, as is tradition throughout the Nordics as a purified *Brettanomyces* yeast cultivated by recycling in every brewery over several years, why the yeast develops differently from farmhouse to farmhouse, from region to region (Garshol, 2016). The word Kveik has its origins in the old common Nordic language Norse "kvikk" which means "vigorous and fast" in the meaning of healthy and lively, and today Kveik is a dialect word for "yeast" in Norwegian. Kveik yeast – a recently very successful widely used re-discovered yeast known from Norwegian farmhouse brewing - is tolerant of high alcohol percentages and high temperatures, fast-acting, and, depending on the strain, it is typically ester-driven (contributing with a fruity or floral flavour) and less pronounced phenolic (taste like smoke, which is why smoked malt can be included in large quantities) (Stange, 2021). In 1857, Norway, which had now become a union with Sweden, introduced the Purity Act based on the Bavarian model, which should have eliminated Kornøl, but Kornøl survived as a farmhouse beer in the isolated settlements (Garshol, 2016).

- On the island of Gotland, one of the most authentic farmhouse beers from the north is called Gotlandsdricka (Salomonsson, 1979). Until recently, Gotland has been a trading center at the crossroads of the Baltic Sea between Sweden and the Baltics, between Russia and the Hanseatic cities, and Gotland has been a hotspot for trade since the Viking Age, where the Gotland traders in the Viking Age had trading offices in London and Novgorod. Also, in the Middle Age the capital of Gotland Visby was a Hanseatic city with an impressive city wall, and Visby has been on UNESCO's World Heritage List since 1995. Until 1645, Gotland had primarily been part of Denmark, then Gotland intermittently became part of Sweden, and Gotland is today the place in Sweden that is richest in ancient monuments. Gotlandsdricka is brewed on smoked malt, most often barley, oats, and rye, but could also be wheat. Seasoned with Juniper berries and *Myrica Gale* – often also hops, where there was significant hop production on Gotland. Often the beer was supplemented with honey, and the yeast is typically the classic Nordic Kveik-like yeast, alternatively baker's yeast. In the 19th century, the island's importance as a trading center died out, and Gotland became more isolated, which probably is why the old classic farmhouse style has been able to survive on the islands.
- In the deep forests of southwest Finland, a similar Farmhouse style called Sahti survived (Laitinen, 2019). In the 15th and 16th centuries, Finland was an eastern province of the Kingdom of Sweden, and before that part of Scandinavia's Kalmar Union. Although Sahti has been known for centuries, Sahti brewing has been official through written sources since 1792, and Sahti has today obtained TSG protection. Sahti is brewed with a combination of malted

barley, rye, and occasionally wheat or oats depending on what is available. Mashing starts at approx. 40 degrees, after which part of the herb is removed, boiled, and added to the main mash as a kind of RIMS system, but the mash and the herb are not actually cooked. The moss and the herb of juniper and hops are filtered through juniper twigs, which in addition to the filter act as a flavouring agent. Sahti is fermented with baker's yeast.

- The Baltic countries were also strongly influenced by the Nordic brewing styles and the influx from here, where these countries for long periods have been part of or associated with changing Nordic kingdoms, hereby also trade with the Nordic countries, including trade with the Hanseatic cities. In Estonia, the local Koduõlu was a traditional Farmhouse beer, and Koduõlu means 'home brew'. Although Koduõlu is also brewed on the mainland, this

style has primarily survived on the more isolated Estonian islands Saaremaa, Hiiumaa, and Muhu. Koduõlu is brewed with malt as is known from Nordic beers, but here the spices such as hops, juniper berries, and porcini are boiled in water and not in the wort, and added to the mash at the end. As in Finland, baker's yeast was usually used. In Latvia, there has been a similar farmhouse beer called Miezītis, which means little boy or little grain. However, this has not been preserved or described, and the name is used today just for an ordinary lager beer. Similarly, in central-northern Lithuania, there is the farmhouse beer Kaimiškas Jovary alus, a beer brewed from local ingredients and spices and hops boiled in water and added to the mash. Kaimiškas Jovary alus is special and unique partly due to the water from a local well, but also due to the very special pure-grown yeast that has been passed down for generations among brewers and families in the region for 130 years. Kaimiškas literally means "from the countryside", and the style has survived even the Soviet era due to the isolated location with dedicated production on each farm outside the cities. Therefore, Kaimiškas Jovary alus has also obtained PGI protection.



Figure 2: The farmhouse beer (ale) in North Europe

There are other farmhouse styles in Europe such as Biere de Garde (France), Saison (Belgium), Chuvash (Russia), and Stone beer (Austria) – and it can be argued that Chicha de Jora from South America and Umqombothi from Africa actually is farmhouse beers, but in this line up we focus on the northern types rooted in the Viking age. These described Nordic styles - including strong connections to the historic Baltic beer styles, are today only made as 1st production (no1) for use at celebrations and special occasions and are usually no longer made as a 2nd or 3rd extract from the mash for everyday use.

In contemporary times, several revolutionary inventions appeared in Denmark, especially in connection with Carlsberg, which have since been defining factors for beer production all over the world:

- In 1875, the Danish researcher in fermentation physiology Emil Christian Hansen at Carlsberg's research laboratory in Valby examined the diseased yeast in a production the brewery had made. Here Emil found different strands of yeast in the beer, two of which he found interesting to work with further - with only one strand of yeast you are sure of uniformity. He was thus able to create a pure yeast culture for brewing beer, and the microscopic battle of fermentation was over. The first yeast strain was named *Saccharomyces Carlsbergensis*, and the second less stable strain was called *Saccharomyces Pastorianus*, the name in honor of Louis Pasteur, the godfather able to isolate and purify yeast strains. This work and these strands of yeast have since been the basis for virtually all beer production.
- *Brettanomyces* yeast strains are a different yeast strain than the typical *Saccharomyces* yeast strains normally used in brewing beer. Beer brewed with *Brettanomyces* yeast is often shortly called "Brett". In nature, *Brettanomyces* feeds on fruit skin, which is why it is found on virtually all fruit (including many berries), in brewery environments, e.g., in oak barrels used to store beer during the secondary conditioning phase as well as in the root systems of certain plants, known as the "rhizosphere". Thus, *Brettanomyces* is a type of yeast more commonly found in wineries, where often not welcome, same as it has the potential to cause significant spoilage in beer through the production of volatile phenolic compounds but can also give exciting flavour profiles. The old classic yeast types used were based on *Brettanomyces* yeast strains, and many beer styles had this aftertaste of *Brettanomyces* yeast strains, including many English porters. In 1889, Seyffert from Kalinkin succeeded - a brewery in St. Petersburg to isolate this off-flavours yeast and create a pure English beer, and 10 years later in 1899, JW Tullo of Guinness described the corresponding two types of "secondary yeast". But it was Danish N. Hjelte Claussen at the Carlsberg brewery who patented the yeast in 1903 as the first patented microorganism in history and who was the first to publish a description in 1904. Claussen named the genus *Brettanomyces*, after the Greek word for bacteria or after the French province of Brittany (Wikipedia). The Nordic Kveik yeast is a cultivated *Brettanomyces* yeast, and it make therefore sense that it was Clausen who first patented and described Brett.

- The pH scale was invented by biochemist Søren Peter Lauritz Sørensen in 1909 when he came up with a way to measure how much acid (hydrogen ions) there was in a solution at Carlsberg's chemical laboratory.

The new discoveries in beer brewing totally changed the image of beer production in the Nordics and many other places from top-fermented to bottom-fermented (lager). However, this was not the picture everywhere, e.g., in England, Scotland, and Belgium they maintained the tradition of top-fermenting its beer as the preferred method.

From the middle of the 19th century, a minor revolution took place in the Nordic region, when the old Danish top-fermented beer and ale-based breweries switched to bottom-fermenting according to lager and pilsner principles, and the old styles largely died out. This can also be seen with the old English Imperial Stout, which around the countries of the Baltic Sea due to the blockade due to the Napoleonic wars had started production of Baltic Porter, which gradually became more and more bottom-fermented with cold fermentation and storage in the colder north, and Baltic Porter is even today the only bottom-fermented Porter.

Here, Denmark was special not only in relation to the creation of new and region-specific beer specialties but also in relation to particularly great inventiveness (Wrisberg, 2019). Some special variants emerged due to the Danish legislation called the 'Hvidtølsdirektiv' (White beer regulation) from 1891, which enforced that beer with a percentage below 2,25 was tax-free. This resulted in two types of beer:

- A dark malt beer called Dark White Beer, also called Santa Beer then sold at Christmas time, not to be confused with the stronger Christmas Brew (Wrisberg, 2019), often added dark sugar and colour.
- A Light White beer, also called Light Pilsner as a very seasonally friendly beer, often added sugar (raw fruit).

The law did not differentiate between bottom-fermented and top-fermented beer, and initially, they co-existed but eventually, it ended up with mainly bottom-fermented beer. Also, there is no obstacle to the addition of anything other than malt, hops, and yeast, in the Danish styles which are why many Dark White Beers have added sugar (raw fruit) and the colorant ammoniated caramel (E-150), etc.

At the same time, two types inspired by German Paulaner Salvator emerged as Bock types, full-bodied beer with a fairly high alcohol percentage and a distinct malt character, but with added exotic spices, and as styles became popular after several years of evolution:

- Christmas brew, first seen in 1891, but with Christmas, spices added typically from distant areas such as cinnamon, cloves, cardamom, liquorice, orange, etc. (Wrisberg, 2019). The Christmas brew has since 1990 been released on the first Friday in November, also today known as 'J-day' in Denmark (J stands for 'Jul' as the Scandinavian name for Christmas).
- Easter brew is a lighter-in-colour version with freshness from hops with fruit and floral nuances, as well as there is often significant ester production. There are added fresh spices such as elderflower, fruit, and/or sugar. The day when the Easter brew is released is called 'P-day', and this tradition dates all

the way back to 1952 (P stands for Påske as the Scandinavian name for Easter). Over time, Easter Brew has both become lighter in colour and milder in alcohol.

Christmas brew and Easter brew may only be sold for a limited period, and are classically under-fermented bock-styles, but as the only Bock-beer as well as Danish brews having exotic spices added (other Danish beers usually local herbs) as known from these holidays' cakes and cookies just as they are also sweeter than other beers both related to malt and added raw fruit. Easter and Christmas beer in Denmark is called "brew" ("bryg" in Danish) and not "beer" ("øl" in Danish) or ale, as the term "brew" is often used to describe a specific type of beer, such as a seasonal or specialty beer due to its unique ingredients and brewing techniques. In addition to these two retained church traditions in Denmark, many other beers intended for this season are also seen, which are even sold outside the period when Christmas brew is released or is based on other traditions from other countries, hereby Belgian-inspired top-fermented beer types or German Maizen beer types.

These new styles can be seen below the line in Figure 1, and despite the styles being more than 100 years old, they describe a newer era in Danish brewing tradition, which now differs from the other Nordic countries and from other seasonal beers.

5: Revelation of a new Nordic style

Since the 1980s, there has been a small revolution globally in the innovation of beer types and styles, often based on historical traditions, but also with deep roots in technological possibilities and agricultural research (Oliver, 2011). This concerns both technologies e.g., as inspired by space research such as Brutus Ten systems (Steinmeyer, 2019) allowing small units for brewing, obtaining sources of historical brewing styles and methods, the Geographic Indicators system as well as UNESCO's views of beer on an equal footing with wine, research into malt, hops, and yeast types and much more. Beer is no longer just 'as cheap as possible' but micro- and craft breweries have sprung up around the world to an extent that exceeds most other establishments and entrepreneurial activities.

As described, the Nordic region has an old and strong food and beer tradition (Juul, 2016; Skaarup, 2018), which, however, has been partially overlooked due to a lack of writing traditions or skills. Even in the Nordic countries these traditional brewing methods and use of local raw materials have been overlooked (Glamann, 2005), but this is not a particularly Nordic phenomenon but a global phenomenon. Most of the beer styles we today describe as unique have been almost forgotten for several years.

The same is seen with Nordic cuisine, which for many years was replaced by foreign trends such as pizza, Chinese food, French gourmet, etc., where classic old Danish and Nordic dishes were more or less forgotten or relegated to museums (Juul, 2016). But as with beer, a total overhaul is seen here, and then in relation to national specialties (Kjaersgaard, 1978). The New Nordic Cuisine has gained both popularity and recognition in recent years due to its unique characteristics and the efforts of Nordic chefs to create a common culinary identity inspired by the excellence of their raw materials as a

movement that is earthy and refined, ancient and modern, both playful and deeply serious (Neuman, 2018). As a result of the long, dark winters, traditional Nordic cuisine has developed remarkable methods of conserving food (Neuman, 2018). On the other hand, the rather short and hectic growing season has encouraged a celebration of fresh fish, wild berries, mushrooms, etc., focusing on the use of seasonal produced ingredients such as new potatoes, strawberries, and asparagus in the summer, and baked goods and seasoned meats during the Christmas period etc. (Skaarup, 2018). The Nordic Kitchen Manifesto, conceived and formulated in 2004, summarizes the vision of the New Nordic Cuisine in ten points on purity, season, ethics, health, sustainability, and quality. It aims to transform every link in the long chain of how food is produced and consumed, from the dirt up to the dinner table (Neuman, 2018).

New Nordic Cuisine has also created a demand for special beers to accompany these experiences, where Nordic breweries have provided specialties but not to the same extent as food based on Nordic tradition, heritage, and ingredients. When combining the general trends in Nordic brewing, several characteristics emerge, and the Nordic countries, especially Denmark-Norway, have always been maritime nations, and special smoky and hop-intense beers have been created here for this (Garshol, 2020). This was even before Indian pale Ale arose in England precisely with the title of a beer 'for shipping', although this was not the case. India has very little to do with IPA, Pale is an allusion as it was simply lighter than Stouts, and cf. old English designation it was not an ale, as the English classically called hopped beer is 'beer' and un-hopped beer used to be 'ale'. Despite this, the designation IPA persists as a style designation, also in our setup.

By blending (Oakley, 2017) the historic Nordic beers, a potential new beer style has emerged as a blend from 1000 years of evolution in the Nordics with “must be” and “can” following the dominant and carrying trend in the Nordic countries when this area was defined by common characteristics regarding the brewing of farmhouse ale. This new beer style Nordic IPA is hereby defined as a product that has a specific geographical origin in the Nordic possesses qualities or a reputation that are due to that origin. The defined qualities, characteristics, or reputation of the product are essential due to the place of origin as Nordic countries, and there is a clear link between the Nordic IPA and its original place of brewing which follows the criteria for Geographical Indications (WIPO) as:

- Based on barley malt, more than one type, and typically a touch of distinctive notes of smoked malt. Barley and barley malt has really been the main ingredients for brewing Nordic style and in particular Denmark (Mallett, 2014). Even to this day, Denmark has a particularly large production of barley, of which 20% is barley for beer production, and despite large in-house production, 80% is exported. Scandinavia, especially Denmark and southern Sweden, is known for Norway's production of the world's best barley malt, just as there is extensive research in the area to create this position, e.g., by Nordic Seed A/S.
- Most often, a little to significant part of oat malt is added to create a velvety, creamy consistency, which helps to stabilize the smoke taste. Sometimes also unmalted oats where more character was desired in the frothy and unclear appearance (“hazy”).

- Most often a little to some rye malt is added to create fullness in the malt character, which makes the beer more crisp, refreshing, and subtle (Thomsen, 2020). Sometimes un-malted rye is also added to create more spicy nuances almost earthy grain flavour with a dry character, just as the foam becomes creamier. Rye has been cultivated and used for bread as well as for brewing, as it is a rare, good crop, especially on the lean soils that are seen in many places in the Nordics.
- Sometimes wheat malt might be added to create more body in the foam.
- Nordic IPA is well-hopped with +50 IBU. Since the Middle Ages, hops have been a staple in the Nordic brewing tradition, and successive kings have forced the cultivation of hops. Already in 1447, King Christian I ordered Funen farmers to plant 60 hop plants annually (under the Kalmar Union), and in 1558 King Christian III decided that all the country's farmers should plant at least five hop plants annually (Norway, Denmark, Scania, and Schleswig/Holstein), plant three grafted fruit trees and ten willow trees. Again in 1683, by Danish law of King Christian V, was passed by law that all farms should plant five hop cones annually. Hops have since largely disappeared in the Nordics as a home-grown ingredient in beer, but in the 1940s and 1950s, however, professor at Carlsberg Laboratory Øjvind Winge initiated experiments with the breeding and cultivation of hops at northern latitudes. Here they succeeded in establishing 16 hop lines with an increased content of the bitter hop oil. Today, this work has resumed at the Carlsberg Laboratory (Braumann, 2019), just as there is research with old Nordic as well as new hop species at Gammel Estrup – The Danish Manor & Estate Museum, the National Museum of Denmark, Aarhus University and the Aarhus School of Architecture (Bjørn, 2017) in the same way as many craft- and microbrewers in Denmark in particular base their production on Danish grown hops based on existing variants suitable for the Danish climate (Hieronymus, 2012; Healey, 2021). Currently, however, Nordic IPA is primarily based on imported hops, but this can actually be due to the research being a different situation.
- Most often, the hops are supplemented with other spices from the Nordic flora such as Myrica Gale, but many others such as Elderflower, Juniper branches, Heather, St. John's Wort, Angelica, Sweet fern, Achillea Millefolium, Caraway, Tansy, Mugwort, and Chamomile are some of the herbs, that can be included to create a spicier character (Caruse, 2022). The use of Nordic herbs, spices, and berries is also a central part of Nordic Cuisine.
- Berries are always included in Nordic IPA, such as Juniper Berry to provide a resinous flavour (Laitinen, 2019), but can also be other berries like Sea Buckthorn, Lingonberry, Cloudberry, Wild strawberry, Blueberry, Cranberry, etc. as well as fruits is used to a limited extent (Thomsen, 2020). The berries contribute fructose and sweetness, flavour, and a slight acidity to balance the smoke malt and the bitterness of the hops (Garshol, 2021). Berries are also a central part of Nordic Cuisine and are seen in several old and new dishes both as

pickled, as jam, and as dried. Similarly, the Nordic region is very berry-rich, and berries such as juniper are largely included in all Nordic first extractions.

- Right from the Viking Age, it has been known how to use honey to create extra sweetness in the beer, stabilize the smoky flavour, and as a contributor to make stronger beer. Both in the Viking Age and later, this has been called Mead, but at the same time, various combinations have been made depending on the availability of honey. Within the Nordic flora with berry bushes and flowering areas, honey has been an essential ingredient for both cooking and beer in summer and autumn. Later, during the Renaissance and the Monarchy, cane sugar and molasses became available from the colonies in the Caribbean, and since the mid-20th century, sugar cane molasses was replaced by sugar and molasses from sugar beets for the production of alcohol as well as raw fruit in beer, which mainly has been an ingrediency in cheaper beer. Nordic IPA will therefore often have a hint of honey reflecting the local flora, which for the Nordic region often contributes with distinctively flavoured honey such as heather honey, porcini honey, buckwheat honey, etc.
- Nordic IPA is usually brewed with Kveik yeast or Kveik yeast together with other yeast (Garshol, 2016) – or added Brett, which adds a bit funkier flavour and a bit drier finish to the beer, and the beer can have a little hazy appearance and sometimes a citrusy flavour (Catallo, 2020).
- The usual Nordic IPA is a strong beer like no1 and the bock types with strength at 6% to 7.5% ABV.

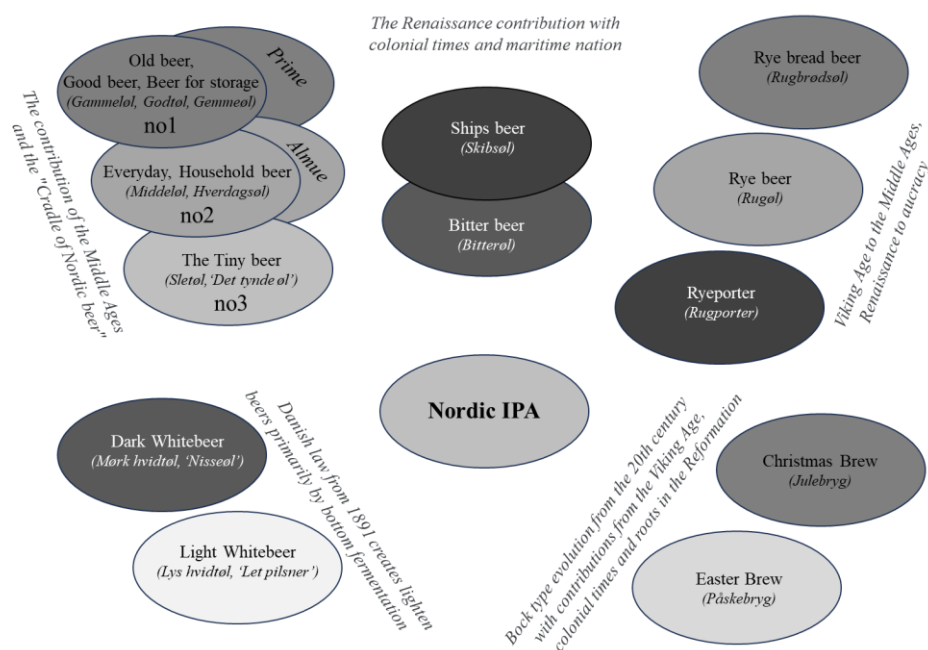


Figure 3: The Nordic IPA placed in the middle as a blending of the traditional Danish styles.

Nordic IPA ranks as a no1 extraction of a stronger beer even if it's not brewed as a no1, brewed with barley malt and mostly also with oat- and rye malt, heavily hopped with a hint of smoked malt Nordic IPA is well-malted as known for light beers, and at the same time seasoned with spices known from Danish bock types, but Nordic herbs. Juniper berries or other berries as known from the northern regions, are always included, just as the classic and old now primarily known from Norway Kveik yeast is used or combined with other east to stabilise the sweetness. The Nordic region is a huge area with very large climatic differences, and the style really offers opportunities for variations.

6: The Periodic system of all beer including the Nordic beer styles

Based on (Jackson, 1977) style definition compared to others (e.g., Eckhart, 1989), Geographic Indicators, etc. a picture emerges of a nuanced and widely branched beer landscape, containing brewing traditions in terms of ingredients, process, and storage. This set off an innovative and entrepreneurial avalanche with new breweries more or less experimental, new more or less experimental types of beer, and new ways of thinking about sales, distribution, and packaging.

Under fermented beer				Over fermented beer									Different
Light lager	Dark lager	Pilsner	Bock (strong)	Light ales	Dark ales	Belgian Ales	IPA	Strong ales	Porters and Stouts	Scottish ale	Farmhouse ale	Wheat beer	Sour
Light lager	Wiener	Czech pilsner (svetle)	Einbecker Bock / Ur-Bock	Kölsch	Altbiere	Belgian blond	English IPA	Old (Strong) Ale	Brown Porter	Scottish Light 60/-	Saison (Gristette)	Weizenbier, weisse	Lambic
Mündner hellas (Hell)	Munich Dunkel	Bohemian pilsner	Hellas Bock/maibock	Pale Ale	Irish Red (ale)	Belgian Golden/Strong ale	American IPA	Kentish Strong Ale	Robust Porter	Scottish Heavy 70/-	Biere de Garde	Belgian Wit	Gueuze
Schankbier	American Dark lager	German Pilsner	Märzen	American Pale Ale	Amber Ale	Belgian Pale Ale	New England IPA (NEIPA)	English Barley Wine	Dry (Irish) Stout	Scottish Export 80/-	Gammelgl/ Gemmepl (no1)	Keute (Keut, Broyhan)	Faro
Dortmunder	Roggen	Lys Hvítöl (Light pilsner)	Octoberfest Bier	Cream ale	Rugel (Rye beer)	Trappist Single	Fruit IPA	American BarleyWine	American Porter	Scotch ale /Wee Heavy	Middelöl (no2)	Gose / Leipziger Gose	Krieg
Kellerbier	Märk Hvítöl (Nisseöl)	European/ continental pilsner	Plskebryg (Easter)	Chicha de Jora	Kentucky Common	Tripel	White IPA	Mumme	Rug (rye) porter	Outmeal Stout	Sletöl (no3)	Lichtenhainer	Fruit beer
Zwickelbier / Ungespundet	Rauchbier	American pilsner	Julebryg (Christmas)	Kentish ale	English Brown Ale	Belgian Strong Dark Ale (abbey)	Wabi-Sabi beer	Foreign Extra Stout (FES)	Smoked Porter		Kornöl/Maltöl	Grodziskie (Grätzer)	Flanders Red Ale
Zoigl	Rotbier	Champagne Velvet	Doppelbock	Australian Sparkling Ale	English Mild	Dubbel / Bruin	Session IPA	Imperial Stout	Milk stout (Cream/Sweet Stout)		Sahti	American Wheat	Oud Bruin/ Flamsk Brun
International lager	Braunbier	Dark Czech pilsner (Tmave, Ceme)	Eisbock	Rutland Bitter	American Brown Ale	Quadrupel (Quad)	Brut IPA	Russian Imperial Stout	Pastry stout		Gottlandsdricka	Wheat Wine	Berliner Weisse
American lite	Schwartzbier		Baltic porter	Golden bitter/ Summer ale	Irish Brown Ale		Imperial (Double) IPA		Tropical stout		Kaimiskas Jovary alus	Dunkelweizen	Rugbrödsöl (Rye bread) / Kvasir
American standard				Ordinary bitter (session)	Skiböl (Ship)		Nordic IPA		Oyster Stout		Koduöl	Weizenbock	Umqombothi
American Premium				Best/Premium bitter	Malta (Vitamalz)		Bitter-pl		Flavored Porter		Chuvash (sara)		Gruit (Gruit)
California/Common Steam				Extra special/strong bitter (ESB)			Indian Dark Ale (Black IPA)				Stein (stone) bier		Brett (-anomyces)

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Figure 4: The Periodic Beer system of 139 beer styles (own line-up)

Few industries have experienced a similar boom in new initiatives as breweries. Especially in the USA, from the 1980s, a myriad of type variants emerged, strongly inspired by German, English, or Belgian brewing traditions, but recast for an American context with American ingredients such as 6-row barley, rice, corn, and American hops.

But the view defined as an epicentre around central Europe is too narrow and contains unnecessary limitations. For example, in the north of Europe around Scotland, northern

Germany, the Baltics, and in particular the Nordic region, there has been a similar and even older tradition of beer brewing, which is less based on monasteries and recognition but more on agriculture and farm production, apparently beer as nutrition and for entertainment also outside the lordships as well as having beer for a large merchant fleet. In the same way, there are - not with the same history and tradition, but with largely the same authenticity in relation to local opportunities - emerging exciting initiatives in virtually every corner of the world, which are implemented in the new Periodic Beer System.

The defined extended version of the periodic beer system involves 139 unique beer styles from all over the world. The record covers 14 classes or columns of styles knowing that many beers have ingredients from other columns. E.g. - many beers have wheat without being categorized as wheat beers, many use bacteria combined with traditional yeast without being special beers, some are Belgian styles even though they are not categorized as Belgium, etc. Each beer is categorized in columns according to the preferred characteristic based on the assumption, that if one has a liking or aversion to one in the column this liking or aversion probably also relate to all other in the column.

The periodic beer system is certainly not perfect, as there may be areas in the world that have a yet unrecognized unique beer style, process, or ingredient. Likewise, this line-up has also shown that, throughout history, new unique beer styles, variants, and hybrids have been discovered or created, which must be assumed to be a trend that will not end. The Nordic and Danish beer style does not belong to a general class but belongs to many classes.

7: Summary and conclusion

In recent years, the development of new breweries and new types of beer has had an expansive development in Denmark and the other Nordic countries, as well as in many other parts of the world. This has happened even in a market with decreased demand for beer at approximately 1,3% decrease every year in Denmark (Conway, 2023), a market that has been bound by tradition (in many years dominated by lager beer), and a market based on one of the world's oldest professions. Thirty years ago, common sense would have suggested that this market is dominated by price and volume alone. The (r)evolution of beer is a school example for viewing possibilities and limitations of innovation in a red market. On the one hand, the creation of beer by micro-, nano-, craft breweries, etc. has evidently shown that there are unimagined possibilities, particularly where there are traditions (strong history), where raw materials are available, where there is an environment (research, access to knowledge and vertical network opportunities) and new opportunities for marketing such as digital media and SoMe (Cabras, 2023). In Hallertau in Germany, in Kent in England, in Cascade in the USA, in Chuvash in Russia, etc., the research institutes for hop production are breeding disease-resistant species, species adapted to local climates, etc., all of which help to stimulate beer production from the very small to the very large. This has created new and exciting beer styles, and refinement work by Carlsberg (Braumann, 2019) and Gl. Estrup (Aarhus University) (Bjørn, 2017) has given the possibilities for the development of Nordic IPA with the use

of Nordic-bred hops. Already now, many dog brewers, especially in Denmark, base their production wholly or partly on their own production of hops.

Contrariwise, there has also been an opposite trend for new brewers with the start-up of production based on what is known, what is already selling, and what is established, e.g., among Danish microbrewers. This trend is partly driven by a conservative distribution system in the supermarket chains as well as consumers' preferences for larger quantities, but also by rating and assessing systems focusing on brews that have the best match to existing recognized types. Thus, since 'one gets what one measure's (Jakobsen, 2008) the Nordic brew has been dominated by copies even local copies of Pilsner, lager, IPA, Porter, etc. from other regions as popular styles, but often the origin is both cheaper and better than the copy. Even taste contests are most often based on the ability to copy as accurately as possible or examine what most people prefer rather than the ability to innovate (which, by the way, seems opposite to the prestige that Nordic Cuisine has achieved in recent years).

Down the columns of the periodic system (Figure 5), there is a fairly consistent shape in that the beers become stronger or more distinctive the further down you go (a few exceptions though). Otherwise, there is no relationship between columns and rows since it is a layout, not a matrix.

Under fermented beer				Over fermented beer								Different	
Light lager	Dark lager	Pilsner	Bock (strong)	Light ales	Dark ales	Belgian Ales	IPA	Strong ales	Porters and Stouts	Scottish ale	Farmhouse ale	Wheat beer	Sour
Light lager	Wiener	Czech pilsner (svetle)	Einbecker Bock / Ur-Bock	Kölsch	Altbier	Belgian blond	English IPA	Old (Strong) Ale	Brown Porter	Scottish Light 60/-	Saison (Grisette)	Weizenbier, weisse	Lambic
Münchner hellas (Hell)	Munich Dunkel	Bohemian pilsner	Hellas Bock/maibock	Pale Ale	Irish Red (ale)	Belgian Golden/Strong ale	American IPA	Kentish Strong Ale	Robust Porter	Scottish Heavy 70/-	Biere de Garde	Belgian Wit	Gueuze
Shankbier	American Dark lager	German Pilsner	Märzen	American Pale Ale	Amber Ale	Belgian Pale Ale	New England IPA (NEIPA)	English Barley Wine	Dry (Irish) Stout	Scottish Export 80/-	Gammelale/Gemmeal (no1)	Kout (Keut, Broghnan)	Faro
Dortmunder	Roggen	Lys Hvítall (Light pilsner)	Oktoberfest Bier	Cream ale	Rugall (Rye beer)	Trappist Single	Fruit IPA	American Barley Wine	American Porter	Scottish ale / Wee Heavy	Middelale (no2)	Gose / Leipziger Gose	Krieg
Kellerbier	Merk Hvítall (Nisseal)	European/continental pilsner	Pilskebyrg (Easter)	Chicha de Jora	Kentucky Common	Tripel	White IPA	Mumme	Rug (rye) porter	Outmeal Stout	Sletal (no3)	Lichtenhainer	Fruit beer
Zwickelbier / Ungespundetes	Rauchbier	American pilsner	Julebyrg (Christmas)	Kentish ale	English Brown Ale	Belgian Strong Dark Ale (abbey)	Wabi-Sabi beer	Foreign Extra Stout (FES)	Smoked Porter		Kornel/Maltal	Grodziskie (Grätzer)	Flanders Red Ale
Zoigl	Rotbier	Champagne Velvet	Doppelbock	Australian Sparkling Ale	English Mild	Dubbel / Bruin	Session IPA	Imperial Stout	Milk stout (Cream/Sweet Stout)		Sahti	American Wheat	Oud Bruin/Flamsk Brun
International lager	Braunbier	Dark Czech pilsner (Tmave, Ceme)	Eisbock	Rutland Bitter	American Brown Ale	Quadrupel	Brut IPA	Russian Imperial Stout	Pastry stout		Gotlandsdricka	Wheat Wine	Berliner Weisse
American lite	Schwartzbier		Baltic porter	Golden bitter/Summer ale	Irish Brown Ale		Imperial (Double) IPA		Tropical stout		Kaimikas Jovary alus	Dunkelweizen	Rugbradale (Rye bread) / Kvassir
American standard				Ordinary bitter (session)	Skibøl (Ship)		Nordic IPA		Oyster Stout		Koduolu	Weizenbock	Umqombothi
American Premium				Best/Premium bitter	Malta (Vitamins)		Bitter-ol		Flavored Porter		Chuvash (sara)		Gruit (Gruit)
California/Common Steam				Extra special/strong bitter (ESB)			Indian Dark Ale (Black IPA)				Stein (stone) bier		Brett (anomyces)

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Alcohol (avg.): 7,7 %
Variation in %: 6,0 - 8,0
OG: 1055 - 1065 OE
FG: 1010 - 1015 OE

Nordic IPA

Bitterness: 60 - 80 IBU → Lot of bitterness
Colour: 15 - 30 EBC → Light copper

Based on Nordic beer tradition created by Nordic craft brewers
Strong, hoppy beer with smoked barley, oat- and rye malt.
Berries and herbs from the Nordic nature, added kviek yeast

Figure 5: The periodic system with the Danish styles placed in the system (including an example of a more detailed description of each style).

However, the exploration of classic Danish and Nordic beer styles has given rise to an intriguing and innovative development in the form of the Nordic IPA, strongly inspired by the Nordic Cuisine. This style represents more than just a blend of traditional elements; it embodies a fusion of history, culture, and craftsmanship, creating a unique identity in the world of brewing, and some Nordic breweries (and even Scottish ones) have shown the first move to Nordic IPA in their portfolio. By infusing Nordic influences into the tradition, ingredients, and brewing techniques, the Nordic IPA stands as a testament to the dynamic nature of the beer industry and the adaptability of age-old traditions in contemporary contexts. One of the key strengths of the Nordic IPA lies in its ability to offer a distinctive Nordic touch while contributing to the global landscape of historically inspired reintroductions and reinterpretations, which is in line with the definition defined by Geographic Indicator (WIPO).

This Nordic IPA style not only pays homage to the rich brewing heritage of the region but also serves as a catalyst for creativity and experimentation among brewers in the area. By embracing the essence of Nordic ingredients and techniques, breweries have the opportunity to brew beers that tell stories of the area and the cultural heritage, engaging consumers in a sensory journey that transcends borders. Moreover, the emergence of the Nordic IPA paves the way for a diverse range of beer brands originating from Nordic, Scandinavian, and Danish breweries, but not limited to these areas as e.g., the Baltic countries and partly also Scotland share the same beer-related heritage. Unlike imitations, these old styles as well as this Nordic IPA style are born out of a genuine exploration of local traditions, which enables breweries to establish their unique identities in the competitive global marketplace. This authenticity not only appeals to connoisseurs seeking novelty and depth in their beer experiences but also fosters a sense of pride and connection within the local communities.

This article contributes to:

- Despite the fact that the beer market is price sensitive, there is a rare large supply of exciting new beer varieties, most often rooted in classic and often even very old traditions blended with new knowledge and research into hops, grains, technology, and equipment.
- Despite the fact that the beer market is characterized by a few very large corporations, of which the three largest (InBev, Heineken, and Carlsberg) together have approx. half of the market, there is a rare drive for new enterprising entrepreneurs such as micro, nano, and craft brewers, who seek to disrupt the incumbent (Christensen, 2013) by introducing new varieties and styles to the market with new forms of production (brew-pubs, festivals, etc.) and marketing strongly inspired by for experience economy. The Incumbent companies have of course followed this movement and also entered the market for special beers, often by creating a new division focused solely on the growth opportunities that arise from the disruption (Christensen, 2013) or by acquisitions.
- New entrepreneurial brewers typically have a background as conventional brewers (breaking out) or home brewers (leveraging hobby) and from this a

strong empirical knowledge and skills, which often is a driving factor (Jakobsen, 2022).

- Research institutions have been important for the development of beer styles. Classically, water quality (Palmer, 2013) has determined many beer types, but this has been extended to all ingredients (DiSorbo, 2010; Hieronymus, 2012). The research centre in Hull in Hallertau, Germany has placed German hops as the world's largest supplier of hops, the research centre in Cascade in the USA has created special hops for American cultivation, which form the main component in the special American style descriptions, and the research in grain varieties has given Denmark a strong position on special barley malt with large malthouses (Mallett, 2014).
- Nordic styles as farmhouse styles have to a certain extent been forgotten in the global internationalization of beer styles from the end of the 20th century. But these have been decisive for the development of the Nordic region and part of the Nordic cuisine, through archaeological finds, handover including description on labels as well as subsistence from preserved traditions of remote areas, 8 classic Nordic beer styles, and 4 newer Danish-based beer styles are re-established here.
- As a result of the analysis of the Nordic styles and food traditions defined in 'The Nordic Kitchen', this has been reinterpreted by setting up a Nordic IPA beer style. The name Nordisk IPA is seen by some Nordic craft- and microbrewers, and a contribution in the article is a description and provision of the style.
- The international scene for beer styles has correspondingly gained renewed recognition, and here a corresponding picture of the international scene is gathered with a definition of all found global beer styles that the literature search has been able to demonstrate. Finally, the Nordic and Danish styles are placed in this overview of the Periodic Beer System.
- The article's last conclusion concerns the descriptions in the Geographic Indicator system's variations, where it is our conclusion that Nordic IPA as described herein should be able to be subject to TSG protection, with the introduction of Danish hops even a PDO protection and recognition.

As the beer hereby also the craft beer movement continues to thrive, the Nordic IPA exemplifies the spirit of innovation, collaboration, and cultural preservation. It underscores the importance of embracing the past while daring to experiment and redefine boundaries, ultimately shaping the future of brewing. In essence, the Nordic IPA stands as a symbol of the harmonious coexistence of tradition and innovation, demonstrating that the world of beer is not static but ever-evolving not only in the direction of more optimized and streamlined production methods but also for a market that constantly demands something new, exciting, and often authentic.

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